



**Vattenfall Wind Power Ltd**

**Thanet Extension Offshore Wind Farm**

**Annex 6-1: Phase 1 Geo-environmental Desk  
Study**

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Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Annex 6-1: Phase 1 Geo-environmental Desk Study

June, 2018

Drafted By:	Amec Foster Wheeler
Approved By:	Helen Jameson
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Vattenfall Wind Power Ltd

# Thanet Extension Offshore Wind Farm

Phase 1 Geo-environmental Desk Study



25 May 2018

Amec Foster Wheeler  
Environment  
& Infrastructure UK Limited



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## Report for

Vattenfall Wind Power Ltd  
First Floor  
1 Tudor Street  
London  
EC4Y 0AH  
UK

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## Main contributors

Sarah Evans  
Derek Grange  
Elspeith Harris  
Vanessa Dahmoun  
Ben Smee  
Mike Sheard  
Shaun Salmon  
Matt Logan

---

## Issued by

  
.....  
Vanessa Dahmoun

---

## Approved by

  
.....  
Jennifer Stothert

---

## Amec Foster Wheeler

Floor 4, 60 London Wall  
London  
EC2M 5TQ  
United Kingdom  
Tel +44 (0) 203 215 1610

Doc Ref. 39080CR006i6

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# Executive Summary

## Background and Objectives

Amec Foster Wheeler Environment & Infrastructure UK Ltd (Amec Foster Wheeler) was commissioned by GoBe Consultants, on behalf of Vattenfall Wind Power Ltd (VWPL) (the Applicant) to prepare a Phase 1 Geo-environmental Desk Study on land contamination and geotechnical considerations to support the Environmental Impact Assessment (EIA) for the onshore elements in relation to the Development Consent Order (DCO) application for the Thanet Extension Offshore Wind Farm (Thanet Extension).

The purpose of this report is to support the EIA in providing a conceptual understanding of the geology and ground conditions of the onshore site and its surroundings and an identification of the key ground, groundwater and surface water constraints which may influence the proposed development. The objectives of this report are:

- ▶ To provide a desk study that includes a collation of existing information and site walkover findings into a concise report, and the development of a Conceptual Model (CM) and a Preliminary Risk Assessment (PRA);
- ▶ To identify information gaps relating to land contamination and any requirements for further assessment; and
- ▶ To provide a preliminary geotechnical assessment that identifies gaps in knowledge and geotechnical issues and constraints that would require further investigation and assessment.

## Site Description

The site comprises the Pegwell Bay onshore cable route and its associated onshore infrastructure, which includes jointing bays and construction areas for Horizontal Directional Drilling (HDD)/ trenchless techniques where appropriate, as well as an associated onshore substation which is to be located at Richborough Port and a tenant relocation area (replacement land for HMRC) located south of Richborough Port.

For the purpose of the Environmental Statement (ES), the onshore site covers an area of approximately 40 hectares. The elevation for the site varies between 1 and 7 m Above Ordnance Datum (AOD), with the higher elevations in the north of the site.

A site walkover was carried out by Amec Foster Wheeler on 5 and 6 April and 28 June 2017.

## Site History

The earliest maps for the site shows that it was largely undeveloped with the exception of Sandwich Road which is present from the earliest available maps (1872) until present day. From 1958 to 1962/ 3, Richborough Power Station was constructed in the south of the site. The power station operated up until 1996, initially coal fired but converted to burn oil in 1971. Following plant closure, demolition was carried out over a period of time between 1999 and 2017.

The land adjacent to the site is made up of a combination of agricultural, natural sand and mud flats (Sandwich Flats) and industrial land. The industrial land includes an historical



salt works (from 1931 to approximately 1999), laundry (1938), fireworks factory (1955—assumed 1987), waste paper merchants (1980-1981), motor vehicle (1999-2018), Richborough Port (approximately 1960 until present) and an industrial estate. There have also historically been a number of landfill areas on the site - eight off-site landfills have been included in the assessment.

Various railways including the Ashford, Canterbury and Ramsgate Branch and the Deal Branch lie within

1 km of the site. A mineral railway previously crossed the site and was active from 1931 until 1960, however there is still evidence of its presence on site up until the 2006 map.

### **Site Sensitivity**

The site and surrounding area is underlain by superficial deposits comprising beach and tidal flat deposits, together with head and storm beach deposits. The superficial deposits are classed as unproductive strata on-site and off-site to the west, and as a Secondary A and Secondary (undifferentiated) Aquifer immediately east of the route. The solid geology comprises the Thanet Formation, which unconformably overlies the Chalk Group. The Thanet Formation is classed as a Secondary A Aquifer. The underlying Chalk is a Principal Aquifer. Groundwater abstractions for agricultural and commercial uses are located within 1000 m of the site.

The River Stour lies immediately east of the proposed onshore substation area at Richborough Port. The watercourse flows eastward towards the North Sea. A network of land drains is located along the entire stretch of the site. The North Sea lies adjacent to the site at its closest point.

The following ecologically designated sites are in close proximity to the site: Special Protection Area (SPA), Special Area of Conservation (SAC), Thanet Coast and Sandwich Bay Ramsar site and Sandwich Bay to Hacklinge Marshes Site of Special Scientific Interest (SSSI).

### **Initial Conceptual Model and Preliminary Environmental Risk Assessment**

Potentially significant contamination risks associated with a number of on-site and off-site sources have been identified including: existing and historical tanks; petrol filling stations (PFSs); landfills, infilling and Made Ground; maintenance activities; a historical power station; a waste water treatment plant; a hoverport; transport supply and cargo handling; and a pyrotechnics manufacturing works.

### **Preliminary Geotechnical Assessment**

The data review and site walkover has enabled a broad interpretation of the ground and groundwater conditions to be carried out. A number of gaps in knowledge still exist, which must be addressed by carrying out intrusive site investigation (SI) that would be undertaken post-consent to identify geotechnical issues and constraints for consideration in detailed design and construction.

The identified ground conditions include: the potential for significant depths of compressible and/or collapsible material related to the former landfilling in Pegwell and Stonelees; the potential presence of filled ground containing colliery spoil material at the former Hoverport site in Pegwell Bay and Richborough Power Station; the presence of very soft and highly compressible intertidal deposits on the foreshore at Pegwell Bay; and





the presence of very soft and highly compressible alluvial and or estuarine deposits in the Richborough area. All of these factors could have deleterious effects on infrastructure placed within the affected materials.

## Conclusions

The initial CM has identified a number of potential contaminant linkages for receptors including future site users, controlled waters and property. The risk rating of the potential linkages range from very low to high. The highest risks are associated with maintenance personnel and property in relation to the landfills located on-site (and off-site) and asbestos from the pipeline and maintenance activities, should the cable route pass through these areas.

## Recommendations

This Phase 1 report constitutes a robust characterisation of the receiving environment to support the EIA. The site reconnaissance and desk-based assessment has identified a number of potential contaminant linkages and geo-environmental constraints associated with the proposed onshore development. In order to gain a more detailed understanding of these constraints, further SI and assessment would be required post-consent as part of the detailed design process, prior to construction.

Whilst geotechnical issues are not a material planning consideration, geotechnical data would be required to inform the detailed design of the proposed development. An intrusive SI is recommended to provide further characterisation of the site's ground and groundwater conditions as part of the detailed design process, prior to construction. A detailed Unexploded Ordnance (UXO) threat and risk assessment should be carried out prior to any intrusive works.



## Glossary

Amec Foster Wheeler

AOD  
AWQC  
BCA  
bgl  
BGS  
BTEX  
CH<sub>4</sub>  
CLEA  
CLR  
CM  
CO<sub>2</sub>  
DC  
DCO  
DDC  
DQRA  
EA  
EIA  
EPR  
GAC  
GRR  
HDD  
HVDC  
KCC  
LNAPL  
m  
MaCk  
mg/kg  
MTBE  
MRL  
MW  
NNR  
ng/l  
OEGB  
OS  
PAH  
PCB  
PEIR  
PFS

Amec Foster Wheeler Environment & Infrastructure  
UK Ltd

Above Ordnance Datum  
Ambient Water Quality Criteria  
British Car Auctions  
below ground level  
British Geological Survey  
Benzene, Toluene, Ethylbenzene, Xylene  
Methane  
Contaminated Land Exposure Assessment  
Contaminated Land Report  
Conceptual Model  
Carbon Dioxide  
Direct Current  
Development Consent Order  
Dover District Council  
Detailed Quantitative Risk Assessment  
Environment Agency  
Environmental Impact Assessment  
Environmental Permitting Regulations  
Generic Assessment Criteria  
Geotechnical Risk Register  
Horizontal Directional Drilling  
High Voltage Direct Current  
Kent County Council  
Light Non-Aqueous Phase Liquid  
metre  
Margate Chalk Member  
Milligram per kilogram  
Methyl tert-butyl ether  
Method Reporting Limit  
Megawatts  
National Nature Reserve  
Nanogram per litre  
Old Central Electricity Generating Board Site  
Ordnance Survey  
Polycyclic Aromatic Hydrocarbon  
Polychlorinated Biphenyls  
Preliminary Environmental Information Report  
Petrol filling station



PID	Photo Ionization Detector
ppm	parts per million
PRA	Preliminary Risk Assessment
RLB	Red Line Boundary
SAC	Special Area of Conservation
SECK	Seaford Chalk Formation
SGV	Soil Guideline Value
SI	Site Investigation
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SVOC	Semi-volatile Organic Compound
TAB	Thanet Formation
TDC	Thanet District Council
TEP	The Environment Partnership
Thanet Extension	Thanet Extension Offshore Wind Farm
TOWF	Thanet Offshore Wind Farm
TPH	Total Petroleum Hydrocarbons
UKDWS	UK Drinking Water Standards
US EPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
VWPL	Vattenfall Wind Power Ltd
WFD	Water Framework Directive
WHO	World Health Organisation
WWTW	Waste Water Treatment Works
µg/l	Microgram per litre



# 1. Introduction

## 1.1 Background and Objectives

Amec Foster Wheeler Environment & Infrastructure UK Ltd (Amec Foster Wheeler) was commissioned by GoBe Consultants, on behalf of Vattenfall Wind Power Ltd (VWPL) (the Applicant) to prepare a Phase 1 Geo-environmental Desk Study on land contamination and geotechnical considerations to support the Environmental Impact Assessment (EIA) for the onshore elements in relation to the Development Consent Order (DCO) application for the Thanet Extension Offshore Wind Farm (Thanet Extension).

The proposed location of the offshore site is, at its nearest point, approximately 8 km from the Isle of Thanet off the east Kent coast. The proposed offshore site covers an area of approximately 70 km<sup>2</sup> and comprises a maximum of 34 wind turbine generators of up to 15 megawatts (MW) encircling the existing Thanet Offshore Wind Farm (TOWF). The maximum capacity of Thanet Extension is expected to be up to 340 MW.

Associated development is proposed, including onshore infrastructure such as a substation and export cabling to connect the project to the National Grid. Two possible export cable systems have been identified – see section 2.1.3 Site area.

The purpose of this report is to support the EIA in providing a conceptual understanding of the geology and ground conditions of the onshore site and its surroundings and an identification of the key ground, groundwater and surface water constraints which may influence the proposed development.

## 1.2 Scope of Work

This report has been completed in line with Amec Foster Wheeler's proposal to the Applicant and the objectives comprise:

- ▶ To provide a desk study that includes a collation of existing information and site walkover findings into a concise report, and the development of a Conceptual Model (CM) and a Preliminary Risk Assessment (PRA);
- ▶ To identify information gaps relating to land contamination and any requirements for further assessment; and
- ▶ To provide a geotechnical assessment that identifies gaps in knowledge and potential hazards and constraints.

In order to achieve the above objectives, Amec Foster Wheeler has reviewed any available existing information, including information obtained from sources such as Landmark Information Group's Envirocheck report, and has also undertaken a site walkover survey of the onshore site area.

## 1.3 Limitations

The conclusions reached and advice given in this report are based in part upon information and/ or documents that have been prepared by third parties. In view of this, Amec Foster Wheeler accepts no responsibility or liability of any kind in relation to such



third party information and no representation, warranty or undertaking of any kind, express or implied, is made with respect to the completeness, accuracy or adequacy of such third party information.

The walkovers did not cover the Waste Water Treatment Works (WWTW) or the Ebbsfleet Lane Waste Treatment site. Due to limited access, the Richborough Port area was viewed from accessible locations. Only limited access to the St Augustine's Golf Club and Richborough Energy Park was possible. The replacement land for HMRC was not covered by the site walkovers as it was not included in the Proposed Development when the walkovers were carried out.

Searches for UXO or other military associated contaminants are excluded from the study.



## 2. Site Description and Environmental Setting

### 2.1 Site Location and Description

#### 2.1.1 Site address

Sandwich Road and Ebbsfleet Roundabout, Ramsgate, and Ramsgate Road (A256), Sandwich.

#### 2.1.2 Grid reference

Onshore cable route from south to north: 633840 161480; 634270 163770; 635510 163950 – refer to Envirocheck slices F, G, and H in Appendix A.

#### 2.1.3 Site area

The site comprises the onshore cable route and its associated infrastructure, including Transition Joint Bays (TJBs), jointing pits and construction areas for horizontal directional drilling (HDD)/trenchless techniques where appropriate, as well as an associated onshore substation that would be located at Richborough Port. The site boundary is presented in Figure 6.1.1.

The offshore cable would make landfall at Pegwell Bay Country Park within the historic Cliffsend Landfill either:

- ▶ Using HDD from the Pegwell Bay Country Park from the base of the TJBs and possibly partly within the the Cliffsend Landfill to the intertidal mudflats, or entirely within the superficial deposits and/or solid strata beneath the landfill, thereby avoiding the landfill itself (Landfall Option 1);
- ▶ Extending seawards the existing sea defence to allow the offshore cable to interface from burial within the intertidal mudflat and surface saltmarsh to a surface laid berm above ground within the Cliffsend Landfill (Landfall Option 2); or
- ▶ Open trenching through the existing sea defence and below ground within the Cliffsend Landfill (Landfall Option 3).

The cable would then run from the TJB either above ground through the Country Park, to avoid interaction with the underlying historic Cliffsend Landfill (Option 2) or below ground through the Country Park and the Cliffsend Landfill (Options 1 and 3). It would be trenched for the remaining section through Stonelees, Pfizer Sports Ground, the eastern edge of the British Car Auctions (Ambrosetti) depot and Richborough Port before connecting to the onshore substation which would be located at Richborough Port.

The cable route length is expected to be approximately 2.5 km from the landfall to the onshore substation and extend on a 30 m wide corridor, to be confirmed in the final project design.

The cable would connect the onshore substation located at Richborough Port to the National Grid substation located in Richborough Energy Park, via a route constructed



using HDD methods under the A256 and trenched along the current access roads within the Richborough Energy Park.

The operational onshore substation would cover an area of 41,000 m<sup>2</sup>.

An area of replacement land located to the south of the onshore substation area would be provided to HMRC. It was required during Section 42 consultation that this replacement land be operational prior to the start of any construction works for the substation. The total land area that may require resurfacing is 59,899 m<sup>2</sup>.

The site boundary for the onshore cable route is presented on Figure 6.1.1 and the following definitions have been used within the report:

- ▶ 'On-site' being located within the site red line boundary (RLB);
- ▶ 'Off-site' being located beyond the RLB; and
- ▶ 'Study site' being the site boundary plus a 500 m buffer.

#### 2.1.4 Proposed use

Onshore development for commercial use associated with Thanet Extension.

#### 2.1.5 Site description and current activities

The elevation for the site varies between 1 and 7 m AOD, with the higher elevations being towards the north of the site.

Site walkovers were carried out by Amec Foster Wheeler representatives on 5 and 6 April and 28 June 2017.

There are various land uses on-site including the Richborough Energy Park, Pegwell Bay Country Park, the Sandwich and Pegwell Bay National Natural Reserve (NNR), Pfizer Sports Ground, Sandwich and Ramsgate roads and British Car Auctions (BCA) depot. The observations from the site walkovers have been used to inform Section 2.6 of this report.

#### 2.1.6 Services

No detailed service plans have been obtained or reviewed as part of this report.

## 2.2 Environmental Setting

### 2.2.1 Geology and hydrogeology

Information obtained from the British Geological Survey (BGS) mapping website (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>) included borehole logs, BGS maps (geological map, sheet no. 274, Ramsgate and no. 290 Dover, 1:50,000, published 1980 and the Hydrogeological Map of the Chalk and Lower Greensand of Kent, sheet no. 3, 1:126,720, published 1970), and the Envirocheck report included in Appendix A.

The BGS borehole locations mentioned hereafter are displayed on Figure 6.1.2, and the borehole logs are included in Appendix B.

Due to the developed nature of areas with the site boundary, although Made Ground has not been identified on BGS logs, its presence throughout the site is likely.

Ground conditions from BGS logs and relevant site investigation (SI) data received from Thanet District Council (TDC) is summarised in Table 2.1. Further information on ground conditions encountered in the south of the site, on the former power station site, is provided in Section 2.5.

Table 2.1 Summary of Geology & Hydrogeology

<b>Strata</b>	<b>Brief description of typical constituents</b>	<b>Average depth encountered (m below ground level (bgl)) or thickness (m)</b>	<b>Aquifer and approximate water level if known</b>
<b>Made Ground</b>	Brick and concrete rubble, colliery spoil.  Brown sand and gravel with tarmac, reworked Chalk and brick.	Variable thickness of Made Ground encountered (up to a maximum of 6.3 m) at Richborough Power Station.  0.4 – 0.8 m of Made Ground at Sandwich Road, north of Petrol Filling Station (PFS).	Unproductive strata.
<b>Topsoil</b>	Brown silty topsoil with some roots.	Typical depth 0 is 2 m bgl (based on previous borehole records on the BGS website — TR36SW85).	Unproductive strata.
<b>Tidal Flat Deposits</b>	Clay, silt and soft to firm consolidated compressible silty clay.	Encountered in BGS borehole TR36SW63 near Sandwich Haven, Approximately 18 m in thickness.  Encountered in numerous boreholes on Weatherlees WWTW – thickness between 3.0 m and 7.3 m (mean thickness c. 5.0 m).  Up to a maximum of 8.5 m encountered in the former Richborough Power Station (URS SI).	Unproductive strata.



Strata	Brief description of typical constituents	Average depth encountered (m below ground level (bgl)) or thickness (m)	Aquifer and approximate water level if known
<b>Thanet Formation (TAB)</b>	Sand, silt and clay, glauconite-coated, with nodular flint at its base, overlain by pale yellow-brown, fine-grained sand that can be clayey and glauconitic.	Encountered in BGS borehole TR36SW65 Ebbsfleet Farm to 27.6 m bgl, and to approx. 33 m bgl (based on BGS borehole TR36SW63 Sandwich Haven). Encountered to depths of between 26 m and 28.3 m bgl at Weatherlees WTW (average thickness 22.0 m). Encountered to depths of 19.2 m bgl (thickness 18.0 m) and 19.8 m (thickness 16.7 m) in Pegwell Bay (BGS ref TR36SW42 and TR36SE2). Thickness range typically 0 to 30 m (BGS website).	Bedrock Aquifer (Secondary A); water at approximately 12.60 m bgl (in BGS borehole TR36SW76).
<b>Margate Chalk Member (MaCk)</b>	White Chalk with little flint.	Encountered at approximately 26 m bgl (BGS borehole – TR36SW27) and 33 m bgl (BGS borehole – TR36SW65 Ebbsfleet Farm). Thickness of up to 24 m at Isle of Thanet, Kent (BGS website).	Bedrock Aquifer (Principal Aquifer).
<b>Seaford Chalk Formation (SECK)</b>	Firm white Chalk nodular and tabular flint seams.	At approximately 141 m bgl (based on BGS borehole TR36SW63 Sandwich Haven). Thickness range 55 m to 60 m in Kent (BGS website).	Bedrock Aquifer (Principal Aquifer).

### 2.2.2 Hydrogeological summary

The site area is underlain by superficial deposits. Superficial deposits consist of head (clay and silt) in the far northern area of the site, whilst alluvium and storm beach deposits and beach and tidal flat deposits are predominantly present in the northern area of the site.



Deposits in the north have historically been referred to as brickearth. Beach and tidal flat deposits are predominant in the southern part of the site, and drift is largely absent in the middle section of site, which is the area around the sports ground roundabout. The superficial geology is underlain by bedrock geology comprised of the TAB and MaCK and SECK.

The superficial deposits are classed as unproductive strata on-site and off-site to the west, and as a Secondary A Aquifer off-site to the east<sup>1</sup>. The Thanet Formation underlying the site is classed as a Secondary A Aquifer. The underlying Chalk Group is a Principal Aquifer. A Secondary A Aquifer is described by the Environment Agency (EA) (2015<sup>2</sup>) as permeable layers capable of supporting water supplies at a local, rather than strategic, scale, and in some cases forms an important source of base flow to rivers. A Principal Aquifer is described as layers of rock or drift deposits that have high intergranular and/ or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/ or river base flow on a strategic scale.

Information from the boreholes nearest the shore indicate that the groundwater is tidally affected, which is confirmed by groundwater monitoring that was conducted on-site in 2009<sup>3</sup> and off-site in 2007<sup>4</sup>. Based on the Hydrogeological Map<sup>5</sup> (BGS website), the groundwater level is at 0 m AOD across the site and no flow direction predominates from the contours. However, groundwater flow is assumed to be from land to sea in a west to east direction, although likely to be subject to local influences in the form of abstractions, for example by the abstraction to the north of the site. Groundwater beneath the proposed onshore substation location flows towards the River Stour.

The site does not lie within a Source Protection Zone (SPZ), although there is a SPZ off-site adjacent to the northern section of the buffer area, related to the northern abstraction – refer to Envirocheck report, slice G in Appendix A.

There are no public water supply abstractions located on-site, but a number of private abstractions from groundwater or surface water are present off-site in the vicinity of the site. These abstractions are for agricultural, industrial/ commercial and private domestic uses.

The site lies within an area with Water Framework Directive (WFD) water bodies of good chemical quality, and moderate ecological status<sup>6</sup>.

The soils on and surrounding the site are classed as variably and highly permeable soils of high leaching potential. As soil information for restored mineral workings and urban areas is based on fewer observations, a worst case vulnerability classification is assumed until proved otherwise.

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<sup>1</sup> [http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=groundwater&layerGroups=default&lang=\\_e&ep=map&scale=5&x=531500&y=181500#x=631208&y=159553&lg=4,&scale=7](http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=groundwater&layerGroups=default&lang=_e&ep=map&scale=5&x=531500&y=181500#x=631208&y=159553&lg=4,&scale=7)

<sup>2</sup> [http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=634500.0&y=166500.0&topic=groundwater&ep=map&scale=9&location=Manston,Kent&lang=\\_e&layerGroups=default&distance=&textonly=off#x=633323&y=161444&lg=1,10,&scale=7](http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=634500.0&y=166500.0&topic=groundwater&ep=map&scale=9&location=Manston,Kent&lang=_e&layerGroups=default&distance=&textonly=off#x=633323&y=161444&lg=1,10,&scale=7)

<sup>3</sup> URS Corporation Ltd, 2009, Detailed Quantitative Risk Assessment

<sup>4</sup> RSK, 2012, National Grid, UK Belgium Interconnector Project (Project Nemo), Phase 1 Environmental Study

<sup>5</sup> <http://www.largeimages.bgs.ac.uk/iip/hydromaps.html?id=kent.jp2>

<sup>6</sup> <http://environment.data.gov.uk/catchment-planning/WaterBody/GB107040019621>



### 2.2.3 Hydrology

The River Stour lies immediately south and east of the proposed substation area and crosses the south eastern part of the site. The river flows eastward towards the North Sea. The River Stour is classified as moderate ecological quality status within the WFD assessment as issued on the EA website.<sup>7</sup>

A network of land drains is located along the entire stretch of the site. Pegwell Bay is located approximately 1.4 km to the east of the cable route at its furthest point and lies adjacent to the site at its closest point.

The North Sea lies adjacent to the site at its closest point. The coastal waters are a part of the Thanet Coast SAC and the Thanet Coast and Sandwich Bay SPA.

### 2.2.4 Sensitive land uses

The site is located within and adjacent to several sensitive land use areas, as listed below:<sup>8</sup>

- ▶ Sandwich and Pegwell Bay NNR;
- ▶ Thanet Coast and Sandwich Bay Ramsar Site;
- ▶ Sandwich Bay to Hacklinge Marshes SSSI; Sandwich Bay SAC;
- ▶ Thanet Coast and Sandwich Bay SPA; and
- ▶ Nitrate Vulnerable Zone.

## 2.3 Regulatory Database Information

Only regulatory data relating to on-site features within the onshore site boundary and off-site features outside of the RLB that were assessed as having the potential to impact the site have been detailed in Table 2.2; please refer to Appendix A for the complete regulatory data set within the Envirocheck.

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<sup>7</sup> <http://environment.data.gov.uk/catchment-planning/OperationalCatchment/3282/classification?item=106&status=all>

<sup>8</sup> [www.magic.gov.uk](http://www.magic.gov.uk)

Table 2.2 Summary of Regulatory Database Information

Activity	On-site	Off-site	Details
Car services (body repairs and dismantlers etc.)	1	1	Car body repairs (inactive) located on-site to the south-east at the car auction (one); Vehicle cleaning located off-site at the Pegwell Bay PFS (one).
Waste management / transfer / treatment facilities/ disposal	0 <sup>9</sup>	2	Historical biological treatment at Ebbsfleet Farm off-site(one); Stonelees waste transfer station located off-site (one).
Fuel stations	0	3	PFSs – active (three), namely Pegwell Bay, Esso PFS and Gulf PFS located off-site.
Mineral Site	0	1	Sand and gravel – dormant off-site to the west on the A256 (one).
Industrial Works	0	1	Unspecified in Envirocheck report, however due to its location this is likely to be the salt works observed on the historical maps (one).
Tanks	5	6	On-site (five): three tanks located on-site at the former Richborough Power Station, one tank located to the south of Richborough Port, one at the location of the proposed substation;  Off-site (six): One located adjacent north of the former Richborough Power Station, one located at the former Richborough Power Station adjacent to the site boundary, one located off-site to the north at the location of the Pegwell Bay PFS, one located to the north in Cliffsend, one located to the south at Richborough Port along the Sandwich/Ramsgate Road, and one located to the north of the motor vehicle deport and Richborough Port.
Landfills	1	8	On-site: historic Cliffsend Landfill (one). Off-site: Ebbsfleet Lane Registered Landfill and Ebbsfleet –Ovenden Historical Landfill, Sandwich Road Tip, historical landfill located off-site to the west at the location of the former Richborough Power Station, Stonelees inert soil transfer station, Richborough landfill, Old Central Electricity Generating Board Site (OEGB) Site at

<sup>9</sup> Note - historical WWTW were observed at the former Richborough Power Station during the June 2017 walkover, refer to section 2.6

Activity	On-site	Off-site	Details
			Richborough, and Back Sand Point landfill (eight).
Potentially infilled land pond, marsh, river, stream, dock, pit or quarry	7	18	See details in section 2.6 – Areas of Infilled Ground.

### 2.3.1 Local Authority Information

An environmental information request was submitted by email to TDC and Dover District Council (DDC) on 3 March 2017. DDC was not able to provide any environmental information due to the extent of the route. A new request was submitted on 2 October 2017 as the RLB had subsequently changed and the search was required for a smaller area. A data request was submitted to Kent County Council (KCC) on 8 August 2017.

#### 2.3.1.1 TDC Data

The TDC information received on 4 May 2017 – refer to Appendix C – includes:

- ▶ Planning application references for the demolition of the Richborough Power Station and for underground high voltage Direct Current (DC) cables from Pegwell Bay to the Richborough Power Station;
- ▶ A list of potentially contaminated sites that are located in the surroundings of the proposed cable route. These are:
  - ▶ An old military rifle range – located offshore in Pegwell Bay;
  - ▶ PFS sites;
  - ▶ An old KCC landfill site, historic Cliffsend Landfill, which has been used to receive inert, putrescible and difficult waste, and has subsequently been capped. It is currently Pegwell Country Park;
  - ▶ The Richborough Power Station, which closed in 1996 and is listed for its use as a power station and also for the potential presence of asbestos; and
  - ▶ The railway network – located north-west of the site.
- ▶ A list of the 2017 permitted installations.

TDC advises that an investigation has been conducted in liaison with the EA at the Pegwell Bay PFS i.e. the Jet PFS located off-site to the north of the site, to the south-east of Cliffsend. Based on the information gathered from previous reports supporting planning applications at the site and summarised in Section 2.5 in this report, intrusive and remediation works were carried out at the Pegwell Bay PFS following free-phase hydrocarbon products encountered in groundwater during an investigation conducted in an adjacent lay-by located on-site. According to the EA, remediation works were successful and the adjacent site did not show evidence of significant impact beyond the corner of the

site first identified. However, a remediation verification report had not been received by the EA.

A request for further information was sent by email by Amec Foster Wheeler to the EA on 5 May 2017 and the response was received on 22 May 2017. The EA confirmed that the PFS was investigated some years ago due to indications of limited hydrocarbons in groundwater the adjacent lay by. Further investigations and reporting showed no significant on-going issues and only limited historic impacts. The EA anticipates that unless there have been additional leaks, there should be no significant residual impacts. As advised by the EA, freedom-of-information requests were sent by email on 22 May 2017 to the EA and the KCC Trading Standards in order to be provided with the associated reports. The response received from the EA was that its retention of records schedule for this type of record is four years. KCC responded that it does not hold any information. Requests were then sent to the environmental consultancies (AECOM and SLR) which produced the reports. To date the reports have still not been provided to Amec Foster Wheeler for review – refer to section 2.3.2.

TDC has no record of other pollution incidents at the site or surrounding sites.

TDC has confirmed that there are no private water supplies in proximity to the site, and that Pegwell Bay has a number of designations, including status as SSSI and Ramsar site.

TDC is not intending to take action under Part 2A of the Environment Protection Act 1990 based on the information currently held.

Information regarding potential contamination of soil and groundwater at the hoverport has been requested from TDC by email on 4 May 2017. TDC response on 16 March 2018 was that the hoverport site is understood to be constructed from colliery spoil. As such there exists the potential for contamination to be present (polycyclic aromatic hydrocarbons (PAHs), fuel, / oil spills, etc). To TDC's knowledge it was never added as a landfill site to the Kent Landfill Atlas. TDC requested its Planning Department to verify whether there were any historic reports archived for the site – TDC advised that it would only respond if it was able to find anything of relevance. As no response has been received to date, it is anticipated that TDC's Planning Department does not hold information.

#### 2.3.1.2 DDC Data

Data from DDC were received on 18 October 2017– refer to Appendix D.

Authorisations under the Environmental Permitting Regulations (EPR) 2016 exist within 250 m of the site for:

- ▶ BCA Fleet Solutions 2 Limited – re-spraying of road vehicles (permit ref TDS/156/V3/P5);
- ▶ Rana petroleum – petrol vapour recovery stage 1 (permit ref PTL/004); and
- ▶ Richborough Service Petrol Station – petrol vapour recovery stage 1 (permit ref SH/247).

Seven sites that may potentially be contaminated have been identified by DDC:

- ▶ Port Richborough (site 1) – transport supply and cargo handling 1946;
- ▶ Port Richborough (site 2) – 1946;

- ▶ Depot 1960 (site 3) – currently BCA Fleet Solutions 2 Limited;
- ▶ Two petrol stations/petrol storages (sites 4 and 5);
- ▶ Richborough Power Station 1990 (site 6) – electricity production and distribution; and
- ▶ Areas of unknown filled ground 1874, 1908 (site 7).

At present there is no register of contaminated sites under Part 2A. The first five sites listed above are listed by the DDC as potentially contaminated sites and prioritised out of 398 sites.

Details of the data are provided in Section 2.6 Current and Historic Site Activities.

#### 2.3.1.3 KCC Data

KCC provided data about the historic Cliffsend Landfill on 14 August 2017 – refer to Appendix E -comprising:

- ▶ A one page document summarising information about tipping and Made Ground refuse;
- ▶ Logs of the boreholes located at the landfill site; and
- ▶ Its latest environmental monitoring report produced by Waterman Infrastructure & Environment<sup>10</sup>.

Details of the data are provided in Section 2.6.4 Landfills (On-site and Off-site) (S4).

#### 2.3.2 Environment Agency Information

An environmental information request was submitted via email to the EA on 3 March 2017. The information received on 3 April 2017 is included in Appendix E and summarised below:

- ▶ The EA holds no records of any contravention of licence or authorisation terms and any enforcement actions taken;
- ▶ There are no licences and authorisations for which application has been made but that have not yet been given;
- ▶ The EA has no boreholes in the area. The EA confirmed that the site is not in a SPZ and that superficial and bedrock Secondary Aquifer underlie the site – note that the northern part off-site adjacent to the buffer area does fall within a SPZ. The EA also confirmed that the abstraction wells in the area are for agricultural and/ or commercial purposes;
- ▶ The EA confirmed that there are permits for a radioactive waste treatment facility, a waste water treatment facility, and a combined heat and power biomass plant, all located at Sandwich, i.e. off-site to the south, outside the study area;

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<sup>10</sup> Kent County Council Waste Management Pegwell Bay Closed Landfill Site, Ramsgate, Environmental Monitoring Summary, Rev. 2, October 2016, Waterman Infrastructure & Environment.

- ▶ No planning liaison or development control issues have been reported by the EA; and
- ▶ The pollution incidents that are recorded by the EA are of category 4, i.e. no impact, or category 3, i.e. minor impact, on land and water.

Additional information regarding the Pegwell Bay PFS and a pollution incident that occurred at the Pfizer Sports Ground was requested per email on 5 May 2017, following the receipt of TDC information. The information was received on 22 May 2017. Information received regarding the Pegwell Bay PFS is detailed in the 2.3.1 Local Authority Information section above. Regarding the pollution incident that occurred at the Pfizer Sports Ground, the EA advised that this has been closed down, following relevant remedial works to the site and additional monitoring over time. There are limited residual contaminants, but these are stable and reducing.

As advised by the EA, a FoI request was sent per email on 22 May 2017 to the EA in order to be provided with the associated reports. The response received from the EA was that its retention of records schedule for this type of record is four years. They advised that Amec Foster Wheeler contact the consultancies (URS/AECOM and SLR) that carried out the investigation. A request was therefore sent on 4 July 2017, and AECOM's client response on 14 November 2017 was that they are not able to supply the report to third parties given that it no longer owns the property in question. No response has been received from SLR to date.

## 2.4 Site History

A summary of the historical development of the site from south to north, based on historical Ordnance Survey (OS) maps (1:10,000 and 1:2,500) is presented below. The historical maps can be found within the Envirocheck report in Appendix A.

### 2.4.1 Period 1872-1937

**On-site:** The earliest available map dates 1872 and shows the majority of the site as grassland and agricultural land. Sandwich Road is present from 1872 in the same location as is seen today. The 1877 map indicates the presence of a sheep dipping tank on the southern part of the Pegwell Bay route, which is labelled as 'sheep wash' on the maps from 1896 to 1907. A coastguard station is present on site from 1877 and is shown on maps up until 1901. The 1931 map shows the presence of a smaller railway line (mineral railway) crossing the location of the former Richborough Power Station area of the site and leading to various areas at the adjacent Salt works factory.

**Off-site:** Salt works factory buildings are present in the 1931 map. It is situated approximately 250 m to the west of the site between two branches of the River Stour. At the same time as the factory appears on the map, two tanks are shown adjacent to site boundary. The tanks are adjacent to railway lines that have also been built by 1931. The village of Cliffsend is present at the northern end of the buffer area. Between 1877 and 1937, the village undergoes little change, except for some development of houses on the land adjacent to the site. Beyond Cliffsend a railway line (Ashford, Canterbury and Ramsgate Branch) runs from the south-west to the north-east. The railway line is built on an embankment and sits higher than the surrounding land. A quarry lies to the north of this railway line. St Augustine's Golf course is shown on the maps from 1878. Saltings are located along Pegwell Bay adjacent east of the site. The 1931 map describes the area to



the west of the site (and to the south of Cliffsend) as St Augustine's Golf Links which is still present today. Another railway line (Deal Branch) runs in a north-west – south-east orientation to the east of the site (just within the 1 km data search buffer of the Envirocheck report – refer to Appendix A). Again, the railway line is on an embankment and sits higher than the surrounding land.

#### 2.4.2 Period 1938 – 1966

**On-site:** The mineral railway in the area of the former Richborough Power Station is marked as disused. There has been further development to the area surrounding the pre-1931 railway and the tanks. More buildings and an extension of the railway lines and railway sidings have been constructed by the 1938 map and extended up to the location of the replacement land for HMRC. The later 1960 - 1961 map describes the area of this development as Richborough Port. The railway is described as disused on the 1960 - 1961 map. Railway sidings are no longer visible at the location of the replacement land for HMRC to the south of Richborough Port – one drain was installed by 1955-56.

**Off-site:** Further buildings have been constructed in the village of Cliffsend which appear to be primarily residential. Progression of the coastline (and mean high water mark) eastwards is evident from 1960. A refuse tip located adjacent east of the site along Pegwell Bay is visible on the maps from 1958 - 1964.

#### 2.4.3 Period 1966 – 1998

**On-site:** The 1968 map shows that Richborough Power Station has been constructed on site. A leaflet for the power station indicates that the construction took place between 1958 and 1962/ 63<sup>11</sup>. The power station operated until 1996. The buildings comprise one main building and other smaller satellite buildings, three large cooling towers and two smaller tanks. By 1982, a further two large cooling towers and two smaller tanks have been constructed to the west of the original building. The tanks at Richborough Port are not shown in any maps after 1969. A sports ground has been designated in the south-eastern part of the site at Stonelees in the 1968 - 1969 map. The 1982 map shows a pipeline within the site. A fireworks factory is labelled for the first and only time on the maps from 1977 to 1987 at the location of the replacement land for HMRC to the south of Richborough Port. However, no buildings are visible on the maps, presumably because the fireworks factory was located off-site on the other side of Ramsgate road, as such it has been assessed as potential off-site source. From 1984 the maps show a motor vehicle depot on to the eastern part of the site, on the northern side of Richborough Port area, and then on the southern side at the location of the replacement land for HMRC from 1987.

**Off-site:** Seven buildings have been constructed adjacent to the western site boundary. A 'refuse destructor' has been built approximately 500 m to the south-west of the site, to the south of the salt works. Waste paper merchants are located adjacent south of the replacement land for HRMC in 1980-1981. A filling station is visible adjacent to the south-east of the site boundary on the 1987 map. A filling station is present to the south-west of the Sandwich Road on the 1993 map. A garage is located in the northern part of the site along Pegwell Bay on the maps from 1963 - 1990. A filling station is then present on the maps at the garage location from 1993. Further residential buildings have been built to the north-east of Cliffsend. On the 1973 map, Ramsgate International Hoverport and a car park have been built into Pegwell Bay on an area of reclaimed land. This area is identified

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<sup>11</sup> [http://ramsgatehistory.com/documents/richborough\\_power\\_station\\_print\\_version.pdf](http://ramsgatehistory.com/documents/richborough_power_station_print_version.pdf)

on the maps as a hoverport until the 2006 map. An electrical substation located north-west of the site is present on the maps from 1977 - 1990.

#### 2.4.4 Period 1999 — Present

On-site: Richborough Power Station underwent demolition during this period. The 1999 maps show a pond to the west of the power station. The 2006 maps show the demolition of the westernmost chimneys and tanks and the northern half of the main building. The 2017 map shows the demolition of the remaining three chimneys, tanks, and the remainder of the main building and many of the satellite buildings. One building remains to the south of the area. Richborough Way (the A256) has been constructed and runs in a north-south orientation on and up to south and the west of the site. It is shown only on the most recent 2017 map.

Off-site: A large area of the salt works has been demolished leaving two large buildings and a depot in the 1999 map. Since then two more buildings have been constructed, one shown on the 2006 map and the other present on the 2017 map. Since 1999 a motor vehicle depot has been located adjacent south of the replacement land for HRMC. Two WWTWs have been constructed and are present in the 1999 map – North Stonar WWTW and Weatherlees WWTW. Weatherlees WWTW is located adjacent to the western boundary of the site. Richborough Way (the A256) is shown on the 2017 map. The 2017 map also shows a solar farm located adjacent north of the disused Richborough Power Station.

## 2.5 Previous Reports

TDC advised that information and reports relating to the demolition of the Richborough Power Station and two previous underground high voltage DC cable applications that are located within the study area are available via UK Planning. The key findings from the existing related SIs and desk studies have been collated and summarised below (see sections 2.5.1. and 2.5.2). In addition, KCC provided two reports of intrusive investigations that were carried out at the historic Cliffsend Landfill in 1992 and 2000, and their key findings have also been collated and summarised below (see sections 2.5.3 and 2.5.4). Some pages were missing from the two reports provided by KCC, and KCC stated that it does not have the missing pages. It only has digital copies of these reports, and it would seem that they were not scanned along with the rest of the documents.

### 2.5.1 Planning Application Reference F/TH/13/0760 and Associated Information

Information has been obtained from planning application reference F/TH/13/0760 (granted) and F/TH/13/0144 (withdrawn): “Installation of 3.1 km underground high voltage direct current (HVDC) cable from Pegwell Bay to former Richborough Power Station, being part of a 130 km HVDC electrical interconnector with an approximate capacity of 1000 MW extending from Zeebrugge (Belgium) to the former Richborough Power Station site, together with outline application for the erection of converter station building (max. height 30.8 m), substation building (max. height 15 m) outdoor electrical equipment for substation (max. height 12.7 m) and for converter station (max. height 11.8 m), underground cables from substation and converter station and construction of internal roads, including access and landscaping together with associated temporary construction compounds. Former Richborough Power Station, Sandwich Road, Ramsgate.”

A Phase 1 report was prepared and several Phase 1 and Phase 2 reports were reviewed in connection with the power station demolition application:

RSK, 2012, National Grid, UK Belgium Interconnector Project (Project Nemo), Phase 1 Environmental Study

A Phase 1 desk based assessment was prepared for The Environment Partnership (TEP) on behalf of National Grid for Project Nemo. It comprised the review of publicly available and historical information, information provided by the statutory authorities and previous reports available for the site, a summary of the site walkover carried out in April 2012, and a qualitative risk assessment.

According to RSK, the decommissioning of the former Richborough Power Station included a programme of asbestos removal and partial demolition and was completed in 2000. The remaining above-ground buildings were demolished in 2012, however the steel frame of the former turbine hall with a basement beneath and some of the debris were reported by RSK to remain on-site.

Information received by RSK from the DDC revealed that five sites that may potentially be contaminated were located within 250 m of the southern end of the Nemo cable route and the proposed location of the substation. These were two services stations, a vehicle repairing facility, the former Richborough Power Station and the former footprint of Port Richborough, which includes the Pfizer Sports Ground.

Based on the information from the TDC and the EA, intrusive and remedial works were carried out at the Pegwell Bay PFS located north of the cable route, following the free-phase hydrocarbon products encountered in groundwater during an investigation conducted in 2007 by Royal Haskoning at a lay-by located along Sandwich Road, adjacent south-east of the PFS (see summary of the report below). According to the EA, remediation works were successful and the adjacent site did not show evidence of significant impact beyond the corner of the site first identified. The verification report has been requested from the EA but has not been received. The EA information revealed that a tank spill had occurred at the Pfizer Sports Ground and that the bulk of the contamination identified had been removed from the site. A remedial plan was being developed by Pfizer following hydrocarbon contamination encountered in shallow groundwater in 2011. The incident at the Pfizer Sports Ground is listed as a 'pipe failure' in the Envirocheck report<sup>12</sup>.

The preliminary risk assessment identified the following potential contamination sources:

- ▶ Former Richborough Power Station (in particular the long-lease area) – sulphates and potential ground gases;
- ▶ Historical landfill materials located through Pegwell Bay Country Park – landfill gases and leachate;
- ▶ Made Ground – unknown fill material, ground gases, leachate;
- ▶ PFS 20 m north of the Nemo cable landfall and 55 m and 60 m south of the section of the cable route that runs through the Pfizer Sports Ground – hydrocarbons, oil and waste oil, solvents, asbestos, sulphuric acid, metals;

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<sup>12</sup> Corresponds to a Category 2 incident, i.e. significant incident that occurred in 1999 at the Pfizer Sports Ground – see Envirocheck report in Appendix A, datasheet F, map ID no. 22.

- ▶ Free-phase hydrocarbon products encountered at the groundwater surface 40 m north of the cable landfall in a 2007 site investigation and considered to be associated with the Pegwell PFS — hydrocarbons; and
- ▶ Pollution incident to controlled waters associated with the tank spill or the pipe failure at the Pfizer Sports Ground (176 m south of the cable route) – hydrocarbons.

Low to moderate risks associated with the two pollution incidents north and south of the cable route were identified. The risks associated with the petrol filling stations and the historical landfill materials were assessed as being low. The risks associated with the former Richborough Power Station and the Made Ground were assessed as being negligible.

It was recommended that SI be carried out to determine the presence and extent of hydrocarbon contamination in the vicinity of the identified pollution incidents and to confirm the depth and nature of the capping materials within the Pegwell Bay Country Park Cliffsend Landfill.

The Phase 1 report included the review of the reports listed and summarised within the planning application F/TH/11/0727 above and also of the Royal Haskoning report below.

Royal Haskoning, 2007, Phase 1 and 2 Contaminated Land Site Assessment Report, Lay-by Sandwich Road (A256), Pegwell Bay, Thanet

The report presents the findings of a Phase 1 and 2 contaminated land assessment of the potential for contaminated land to be present at the proposed (at the time of the report) landfall cables location of the Thanet Offshore Wind Farm project. A desk-based assessment, site walkover and SI were carried out.

The site walkover identified poorly maintained tarmac with potholes in which the overlying Made Ground, composed of ash, sand, gravel and re-worked Chalk, is exposed. No evidence of leaks or spillages from parked vehicles was identified.

The SI comprised the advancement of four boreholes down to a maximum depth of 8 m bgl, completed as permanent groundwater and gas monitoring wells, and the results of subsequent soil, groundwater and gas monitoring. Three of the wells were located hydraulically downgradient of the adjacent Pegwell Bay PFS and one was located upgradient. The geology encountered was Made Ground down to maximum 0.8 m bgl, underlain by alluvium down to maximum 4.4 m, over the Chalk. Hydrocarbon staining was observed in all the boreholes from approximately 2.4 m bgl, which was coincidental with the groundwater level and hydrocarbon odours. Free-phase hydrocarbons were observed on the top of the groundwater.

Soil samples were analysed for speciated total petroleum hydrocarbons (TPHs), PAHs heavy metals and semi volatile organic compounds (SVOCs) and volatile organic compounds (VOCs). Low concentrations of heavy metals and moderate concentrations of hydrocarbons were detected and assessed against the Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values (SGVs) for residential use without plant uptake. The results were not considered to be significant.

Groundwater samples were analysed for speciated TPHs, PAHs, heavy metals, benzene, toluene, ethylbenzene, xylene (BTEX), methyl tert-butyl ether (MTBE), and chloride and assessed against the relevant UK Environmental Quality Standards (EQS), UK Drinking

Water Standards (UKDWS), World Health Organisation (WHO) Drinking Water Standards, and United States Environmental Protection Agency (US EPA) Guideline Values. All the compounds exceeded the assessment criteria. Chloride concentrations indicated that groundwater beneath was saline. Hydrocarbon exceedances detected in groundwater were considered to be associated with the adjacent petrol filling station at the three downgradient wells. The contaminants present in the upgradient borehole (which appeared to be cross-gradient) were considered to be associated with a different source, as no petrol range hydrocarbons were detected.

Ground gas monitoring results indicated the presence of methane and carbon dioxide that were considered likely to originate from the volatilisation and degradation of the hydrocarbons detected in soil and groundwater.

Low risks to human health and groundwater associated with hydrocarbon contamination – believed to be from an off-site source- were identified. It was also considered that the planned site works could create preferential pathways for contaminants mobilisation.

It was recommended that the off-site source be identified and stopped to prevent further contamination, and that the Local Authority and the EA be informed.

### 2.5.2 Planning Application Reference F/TH/11/0727

Information has also been obtained from planning application reference F/TH/11/0727: Demolition of the Three Cooling Towers and Chimney at the former Richborough Power Station, Environmental Statement, URS, August 2011.

Several Phase 1 and Phase 2 reports were reviewed and/ or prepared in connection with the power station demolition application.

#### WSP Environmental Ltd, 2007, Thanet Offshore Substation (Richborough) Ground Investigation Report

The report presents the findings of a SI carried out at the decommissioned Richborough Power Station within and west of the former transformer annex, in order to support the development of a new 275 kV transforming station and a control structure.

Four inspection pits were hand dug down to 1.2 m bgl and four cable percussion boreholes were advanced down to between 15 m and 17 m bgl. The geology encountered was Made Ground overlying estuarine and marine alluvium over TAB. Groundwater monitoring standpipes were installed within three of the boreholes to a depth of 5 m bgl. Shallow groundwater was encountered between 2.57 — 2.69 m AOD.

Four soil samples were collected from Made Ground and analysed for asbestos, pH, heavy metals, TPH, BTEX, MTBE, PAHs, cyanide, polychlorinated biphenyls (PCBs) and pH. In all the samples the concentrations detected were below the relevant screening criteria CLEA and SGVs for human health for commercial end use, or WSP screening values when no CLEA and SGVs were available.

Leachate analysis was undertaken on two samples from the Made Ground. Concentrations of long chain TPH (132 to 195 µg/l), PCBs (<1 to 19 ng/l) and benzo(a)pyrene (0.06 to 0.09 µg/l) were detected above the relevant screening criteria (respectively WHO worst case value for aromatic chain C21-C35, US EPA Ambient Water Quality Criteria (AWQC), UKDWS and UK EQS).

One sample from the Made Ground was analysed for asbestos. Amosite and chrysotile were identified as free fibre and detected at concentrations <0.1%.

No groundwater samples were analysed.

URS Corporation Ltd, 2009, Geo-environmental Interpretative Report

The reports summarises the findings of a Phase 1 and 2 contaminated land study undertaken to assess potential liabilities associated with contaminated land at the former Richborough Power Station site and geotechnical properties of the ground beneath the site. A SI was conducted across the entire site, including a portion of the site located in the eastern part, which was planned for a long-term lease. The SI comprised 49 soil borings advanced to depths between 4 — 20.2 m bgl and 22 trial pits dug down to a maximum depth of 4.1 m bgl. The geology encountered was Made Ground up to 6.3 m bgl overlying alluvium down to 11 m bgl, which were underlain by the TAB to depths in excess of 20 m bgl. A total of 18 groundwater monitoring wells were installed. Perched groundwater was encountered within the Made Ground between 0.061 — 1.008 m bgl. Main groundwater was encountered between 0.657 — 3.472 m bgl. No light non-aqueous phase liquid (LNAPL) was encountered during monitoring activities. The perched groundwater and groundwater flow directions were reported to be towards the River Stour. The perched groundwater hydraulic gradient was approximately 0.002 in a westerly direction and the main groundwater hydraulic gradient was approximately 0.003 in a south-westerly direction.

Visual or olfactory evidence of contamination was noted during the drilling and trial pitting works carried out. Black staining was observed between 0.3 m — 0.45 m bgl at the location of the former utilities tanks, and hydrocarbon odour and sheen were noticed at 0.6 m bgl in a borehole located along the eastern border of the long-lease area. At both locations the low Photo Ionization Detector (PID) readings (<0.1 parts per million (ppm)) suggested long-chain hydrocarbons compounds. Although no visual or olfactory signs of contamination were noticed, the highest PID reading (25 ppm) was recorded at 1.2 m bgl in a trial pit located along the western border of the long-term lease area – please refer to Figure 6.1.2.

A total of 65 soil samples, 20 groundwater samples and 16 leachate samples were analysed for TPH, BTEX, PAHs, heavy metals, VOCs, PCBs, and asbestos (soils only). A maximum TPH (C12 - C35) concentration of 950 mg/kg was detected at 1 m bgl in a borehole (BH12) located along the southern border of the site, whilst BTEX concentrations were reported below the Method-Reporting Limit (MRL). A maximum PAH (benzo(a)pyrene) concentration of 28 mg/kg was detected at 0.9 m bgl in a borehole (BH2) located in the north-eastern corner of the site. Concentrations of up to 1,600 mg/kg of lead, 110 mg/kg of copper, 250 mg/kg of chromium, 1.5 mg/kg of mercury, 130 mg/kg of nickel, 260 mg/kg of vanadium and 330 mg/kg of zinc were detected at depths between 1 - 3.2 m in trial pits and boreholes located within the long-lease area. Concentrations of up to 8 mg/kg of total PCBs were recorded in a trial pit (TP11) located within the long-lease area.

Based on the generic quantitative risk assessment conducted by URS, only the shallow soil sample with 28 mg/kg benzo(a)pyrene was considered to pose a potentially significant risk to human health (commercial/industrial). TPH, PAH, heavy metals and PCBs compounds were identified in soil at concentrations exceeding the controlled waters assessment criteria at a number of soil sample locations distributed across the former Richborough Power Station site. The assessment criteria used for the assessment were

derived in accordance with “Level 2 of the EA’s RTM guidance”. The water target values used were lowest of the available UK DWS or EQS.

Exceedances of the commercial/industrial human health and controlled waters assessment criteria were identified for heavy metals, TPH and PAHs. Concentrations of up to 90 µg/l arsenic, 4,900 µg/l boron, 28 µg/l nickel, 200 µg/l selenium, 47 µg/l vanadium, 1,600 µg/l TPH (C21 - C35 aliphatics), 310 µg/l TPH (C21 - C35 aromatics) and 0.23 µg/l benzo(a)pyrene were identified. Elevated concentrations of sulphate (maximum 1,900,000 µg/l) were also detected in groundwater. However, URS considered that the exceedances identified in groundwater assumed that the underlying aquifer was being used for public water supply and were therefore overly conservative.

Carbon dioxide was detected in soil gas at several locations across the site. However, it was considered that the negligible borehole gas flow rates suggested that risks resulting from soil gases were in the very low risk to low risk category (as defined by CIRIA C665).

No asbestos fibres were detected in the 23 soil samples analysed.

A composite ash sample was collected from the ground surface inside the chimney at the site and was tested for a full suite of dioxins. The total recorded concentration of dioxins was 0.00272 mg/kg.

Based on soil, groundwater and gas results, it was recommended that further groundwater monitoring and a detailed controlled waters quantitative risk assessment be carried out.

#### [URS Corporation Ltd, 2009, Detailed Quantitative Risk Assessment](#)

The report summarises the findings of a groundwater monitoring and sampling round carried out in 2009 at seven wells within the site boundary and three wells located off-site down gradient, following the results of the 2008 investigation. A Detailed Quantitative Risk Assessment (DQRA) of controlled waters was conducted for the contaminants that exceeded the relevant Generic Assessment Criteria (GAC).

Ten groundwater samples were analysed for heavy metals, TPH, PAHs, SVOCs, VOCs and PCBs. Concentrations of up to 62 µg/l arsenic, 4,400 µg/l boron, 29 µg/l chromium, 8.6 µg/l copper, 31 µg/l nickel and 140 µg/l selenium were detected in groundwater beneath the site. Elevated concentrations of sulphate (maximum 1,900,000 µg/l) were also detected. Both the 2008 and 2009 groundwater results were screened against assessment criteria based on available UK DWS and EQS. Exceedances of assessment criteria for human health and/or controlled waters were recorded for arsenic, chromium, copper, nickel, selenium, sulphate, benzo(a)pyrene and fluoranthene.

The exceedances of the assessment criteria for human health were not taken into consideration on the DQRA on the basis that no pathways were present, as the site was to be covered with hardstanding, groundwater was not to be used for public water supply and no SVOCs or VOCs had been recorded.

Benzo(a)pyrene and fluoranthene were not assessed further in the DQRA based on their estimated long travel times to reach the River Stour.

Two potential source zones of metal and sulphate contamination were identified in groundwater beneath the eastern part of the site, in the Made Ground and the TAB. Both sources are located in close vicinity to the River Stour which is likely to be in direct continuity with the aquifers underlying the site. As such, an assessment of the dilution of

the groundwater discharge into the River Stour was undertaken in accordance with EA Remedial Targets Methodology, and repeated by taking into account background concentrations in River Stour. The results indicated that none of the measured concentrations of metals in groundwater exceeded the derived site specific assessment criterion. Groundwater concentrations encountered in the Made Ground and the TAB were not considered to present a significant risk to controlled waters receptors. No remediation or further assessment was considered to be required.

#### URS Corporation Ltd, 2009, Chimney Investigation Report

The report presents the findings of an intrusive investigation carried out in 2009 at the chimney located within the former Richborough Power Station in order to identify potential contaminants and assess their impact to soil and groundwater following the demolition of the chimney.

Residue samples were collected at different intervals within the chimney and analysed for TPH, BTEX, PAHs, heavy metals, asbestos screen and identification and PCBs. Concentrations of up to 0.31 mg/kg TPH (C12 - C16 aromatics), 10 mg/kg TPH (C21 - C35 aromatics), 0.16 mg/kg benzo(a)pyrene, and very elevated heavy metals concentrations, including 210,000 mg/kg iron, 3,100 mg/kg lead, 2,200 mg/kg nickel and 7,000 mg/kg vanadium, were detected in the residue samples. No VOC and PCB were detected above the MRL and no asbestos fibres were identified.

The GAC for human health - derived in the URS Geo-environmental Interpretative Report dated January 2009 - were exceeded for iron and nickel. The GAC for controlled waters were exceeded for TPH (C12 - C16 aromatics) and TPH (C21 - C35 aromatics), benzo(a)pyrene, aluminium, antimony, arsenic, barium, calcium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, tin, vanadium, and zinc. However, the risks to human health were not considered to be a cause of concern. The risks to controlled waters were considered to be manageable provided that appropriate demolition techniques were used.

#### 2.5.3 Clayton Environmental Consultants Ltd, 1992, Investigation of Former Landfill Site at Pegwell Bay Picnic Site, Ramsgate, Kent

The report presents the findings of an intrusive investigation carried out at the historic Cliffsend Landfill at the request of the waste regulation division of KCC. The aim was to confirm polychlorinated biphenyls (PCBs) contamination due to waste from a local transformer works deposited at the landfill when it was operating.

The intrusive investigation consisted of soil sampling with a hand auger or other hand tools at ten locations (HA1 to HA10) across the landfill down to a maximum depth of 0.5m bgl. Two soil samples were collected per location, from 0 to 0.15 m bgl and at 0.5 m bgl. No groundwater or surface water samples were collected.

The stratigraphy encountered was dark loamy topsoil down to maximum 0.1 m bgl, underlain by a compact layer with Chalk, bricks and rubble down to a maximum 0.3 m, which overlaid rotted refuse, glass, metal and mixed fill. No figure showing the sampling locations was provided with the report for review.

In addition to PCBs, soil samples were analysed for PAHs and heavy metals. The report does not state the criteria used for assessment of the concentrations, except for PAHs



concentrations which were assessed against the Interdepartmental Committee on the Redevelopment of Contaminated land (ICRCL) trigger values.

Concentrations of heavy metals (nickel and lead) and concentrations of PAHS were detected in two samples collected from 0 to 0.1 m bgl. The results were not considered to be significant.

Concentrations of heavy metals and concentrations of PAHS were detected in seven out of ten samples collected at 0.5 m bgl, with up to 1,500 mg/kg lead, 18 mg/kg molybdenum, 550 mg/kg manganese, 130 mg/kg copper, 280 mg/kg zinc and 90 mg/kg nickel.

Concentrations of PAHs exceeded the ICRCL threshold trigger values in three of the samples with up to 178 mg/kg total PAHs, but were below the action levels. The heavy metal and PAHs contamination was considered to be sporadic and not significantly high.

PCBs were detected below 1 mg/kg in all samples and the results were not considered to be significant or to show definite evidence of disposal of PCB wastes at the site.

The cover of soil fill above the site was considered to be very thin as bricks and rubble could be observed on the surface during sampling. It was recommended that a thicker cover of clean soil be applied to enhance protection to the public and increase plant root depth.

There were concerns that the detected contamination could enter the food chain via grazing of animals. It was recommended that the site not be used for animal grazing.

It was recommended that surface water and groundwater sampling be carried out.

It was recommended that additional soil investigation be carried out at greater depths should the site be developed for other purposes.

#### **2.5.4 Babtie Group, 2000, Topsoil Assessment report, Pegwell Bay Closed Landfill Site, Ramsgate**

The report presents the findings of a further SI carried out at the historic Cliffsend Landfill.

The intrusive investigation consisted of soil sampling with a hand auger or other hand tools at 11 locations in the southern half of the landfill, with the majority within a plot of land fenced off for livestock grazing purposes (pits 4 to 11) and three outside the fenced land (pits 1 to 3) - refer to Figure 6.1.2. Two soil samples were collected per location, one from the topsoil or near the surface and the other from the underlying soil stratum or between 0.2 and 0.3 m bgl. A soil sample was also collected from a stockpile of topsoil. No groundwater or surface water samples were collected.

The stratigraphy encountered comprised, when present, dark brown topsoil comprising much rubble and general fill down to maximum 0.3 m bgl (in pits 1, 2, 3, 7, 8, 9, 10, 11), underlain by:

- ▶ At two sampling locations (in pits 3 and 9) a layer of orange-brown gravelly clay with flint pebbles, concrete/brick/glass rubble and Chalk pellets down to a maximum 0.3 m;
- ▶ At five locations (in pits 5, 6, 7, 10 and 11) rubbly sand with brick rubble down to a maximum 0.3 m;
- ▶ At one location (in pit 8) very dense bituminous based rubble with flint gravel down to 0.2 m bgl; and

- ▶ At one location (in pit 4) very dense clayey gravel with much flint pebbles and concrete/brick rubble down to 0.2 m;

Underneath, a layer with hard clayey brick and concrete rubble was encountered in pit 5 between 0.15 and 0.3 m bgl, and a layer with cloth and general refuse was encountered in 0.3 m bgl at pit 7.

Soil samples were analysed for PCBs, PAHs and heavy metals. The concentrations were detected and assessed against the ICRCCL 59/83 trigger values for domestic gardens and allotments, and the Dutch and Canadian guidelines. Contamination was not found to be widespread across the site, with one sample collected at 0.2 m bgl in pit 11, located along the north-western half of the fenced off area, having concentrations of 131 mg/kg copper, 662 mg/kg lead and 75.1 mg/kg total PAHs above the ICRCCL threshold levels and 1.88 mg/kg PCBs above the Dutch Intervention value of 1 mg/kg. Concentrations of total PAHs above the ICRCCL threshold levels were also detected in pits 1, 3, located outside of the fenced off area, and pit 10, located along the north-western half of the fenced off area at depths greater than 0.2 m. They were detected above the ICRCCL action level in pit 8, located along the north-western half of the fenced off area, at 0.2 m bgl.

It was suspected that some of the samples with elevated concentrations were within fill material that had been imported since the 1992 investigation.

Concentrations detected in pits located outside of the fenced off area, i.e. pits 1 to 3, were considered to pose a very low risk to human health (public using the site) and wildlife. However, it was recommended that any excavation for planting, fencing or maintenance activities be carried out with extreme caution due to the thin covering to the waste and impacted soil.

Concentrations detected in pits located within the fenced off area were considered to pose a low to moderate risk whilst remaining undisturbed. It was recommended that a minimum one metre depth of inert clay capping layer be placed at the location of pit 7, where refuse was encountered at a very shallow depth (0.3 m bgl). It was also recommended that a 0.5 m thickness of clean inert fill be placed over the north-western half of the fenced off area, where elevated concentrations of PAHs and PCBs were detected, and that the whole fenced off area be evened out with fill material.

## 2.6 Current and Historic Site Activities

Sources detailed below are displayed on Figure 6.1.3. As explained in Section 2.1 of this report, 'on-site' is defined as being located within the onshore site boundary, 'off-site' is defined as being located beyond the onshore site boundary.

### 2.6.1 Fuel Storage and Use (On-site and Off-site) (S1)

#### On-site and Off-site Tanks (S1.1)

Three on-site historic tanks are recorded in the Envirocheck report, located at the former Richborough Power Station. These could not be confirmed during the April 2017 site walkover as the area could not be accessed. The Richborough Power Station leaflet<sup>11</sup> indicates that heavy fuel oil storage tanks will have been on-site following the conversion from coal to oil power. The tanks are referred as "utilities tanks" in the URS 2009 report. Black staining observed and the low PID readings recorded during the 2008 intrusive

investigation carried out at the former tanks location suggested long chain hydrocarbon compounds<sup>13</sup>.

One on-site tank is recorded in the Envirocheck report, located to the south of Richborough Port. One on-site historic tank is also recorded on the proposed substation site. This could not be confirmed during the April and June 2017 site walkovers, as the area could not be accessed.

There are six off-site tanks recorded in the Envirocheck. One is located adjacent north of the former power station, one is located at the former power station east of the site boundary, one is located off-site to the north at the location of the Pegwell Bay PFS, one is located to the north in Cliffsend, and one is located to the south along the Sandwich/Ramsgate Road. In addition, one off-site historic tank is recorded in the Envirocheck report, located to the north of the motor vehicle depot and Richborough Port.

#### Off-site PFSs (S1.2)

There are three PFSs located adjacent off-site. An operational Jet PFS (S1.2a), which is referred as the “Pegwell Bay PFS” in the regulatory databases, is located in the northern part of the site. Based on the information gathered from TDC, the EA and previous reports supporting planning applications at the site<sup>13, 14</sup>, intrusive and remediation works were carried out at the Pegwell Bay PFS following the identification of free-phase hydrocarbon products in groundwater during an investigation conducted in at an adjacent lay-by. As per the EA correspondence dated 22 May 2017, further investigations and reporting showed no significant on-going issues and only limited historic impacts. The EA anticipates that unless there have been additional leaks, there should be no significant residual impacts.

An operational Esso PFS (S1.2b) is located adjacent off-site on the northbound A256 (Picture 1). There is also an operational Gulf PFS (S1.2c) that is located adjacent off-site on the southbound A256.

During the April 2017 site walkover, the PFSs above ground infrastructure appeared to be maintained adequately, with some staining around the pumps from spills when vehicles are filled.



Picture 1 Esso active fuel station located adjacent off-site

<sup>13</sup>URS Corporation Ltd, 2009, Geo-environmental Interpretative Report

<sup>14</sup> Royal Haskoning, 2007, Phase 1&2 Contaminated land Site Assessment Report, Lay-by Sandwich Road (A256), Pegwell Bay, Thanet

There was an above ground storage tank located at the Gulf fuel station (Picture 2), located off-site north-west of the proposed location of the substation, which appeared to be used as part of the car wash facility, but the contents were not known.



Picture 2 Above ground tank used as part of the car wash facility

#### On-site Pipeline (S1.3)

On the OS mapping (Envirocheck report), a pipeline is present on-site, running along the southern side of the road to the south of the motor vehicle depot associated with Richborough Port. There is no information on the content of this pipeline, but it is likely this was an oil pipeline from Richborough Port to the former power station<sup>11</sup>. According to a figure on the Richborough Power Station leaflet, the pipeline used to also be present above ground within the power station. Based on a previous report available for the site<sup>13</sup>, it is likely that this was dismantled during the power station decommissioning.

During the April and June 2017 site walkovers an above ground pipeline was observed to the south of the motor vehicle depot which is used as a car auction site (Picture 3). No leaks were observed. It had been terminated at the western end (Picture 4). Lagging potentially containing asbestos was observed in the pipeline at its eastern end in an area towards the River Stour (Pictures 5 and 6).



Picture 3 Pipeline running parallel to the road south of the car auction site



Picture 4 Western end of the pipeline



Picture 5 Pipeline towards the River Stour



Picture 6 Pipeline lagging

#### On-site Oil Pollution Incident at the Pfizer Sports Ground (S1.4)

A tank spill of oil or a pipe failure occurred at the Pfizer Sports Ground in 1999. The EA confirmed that the bulk of the contamination identified had been removed from the site. A remediation plan was being developed by Pfizer following hydrocarbon contamination encountered in shallow groundwater in 2011. Additional information provided by the EA on 22 May 2017 confirmed that this has been closed, following relevant remedial works to the site and additional monitoring over time. There are limited residual contaminants, but these are stable and reducing.

#### 2.6.2 Power Station (On-site) (Historical) (S2)

Richborough Power Station was historically located on the proposed location of cable connection between the onshore substation and the National Grid substation. The power station was in operation from 1962/ 63. Originally the power station was coal fired, but it was converted to burn oil in 1971. Following plant closure, demolition was carried out over a period of time between 1999 and 2017. This included the demolition of three 97 m cooling towers and a 127 m chimney stack in 2012. One building was observed remaining during the April 2017 walkover; a large rectangular building in the southern footprint of the former power station site. A pond area, now believed to be infilled, is evident of the historical maps.

SIs, a generic quantitative risk assessment and a DQRA for controlled waters have been carried out at the site. They revealed that contaminants, including PAHs, TPH, heavy metals, PCBs and sulphates, were present in soil and groundwater at concentrations exceeding the relevant assessment criteria in some places. The assessments concluded

that they did not pose a significant risk to human health or controlled waters and that no remediation or further assessment were required.

Carbon dioxide was detected in soil gas at several locations across the site, however it was considered that the negligible borehole gas flow rates suggested that risks resulting from soil gases were in the very low risk to low risk category (as defined by CIRIA C665).

However, it must be noted that the site is still listed as potentially contaminated by TDC.

The area could only partially be inspected during the June 2017 site walkover, as most of the site is a construction site. Made Ground was observed at the site, notably across the area where the cable would connect to the National Grid substation (Picture 7). According to the Envirocheck historical mapping, there used to be a railway in this area.

Arisings from the demolition of the former towers and other infrastructure were observed to be stockpiled on the ground along the road to the south of the site (Picture 8).

The pipeline was not observed.



Picture 7 Area where the cable would connect to the National Grid substation





Picture 8 Stockpiled material

### 2.6.3 Made Ground (On-site) (S3)

The BGS boreholes available for the area do not record the presence of Made Ground. However, Made Ground was encountered during the intrusive investigations carried out at the former Richborough Power Station<sup>13, 15</sup> and off-site<sup>14</sup>. Made Ground was observed at the former Richborough Power Station and at the proposed location of the substation during the June 2017 walkover.

### 2.6.4 Landfills (On-site and Off-site) (S4)

There is one historical landfill located on-site to the east of the Sandwich Road, namely the historic Cliffsend Landfill (S4.2) in which the Pegwell Bay Country Park is located. The last input at the historic Cliffsend Landfill was in 1972. It was filled with household and inert waste and also non-degradable, slowly degradable, scrap metal, putrescible, hazardous and household waste. Based on the information received from TDC, it has been partly capped, however KCC does not hold exact records or details of the construction to confirm, and it is currently a nature reserve.

The information provided by KCC<sup>10</sup> on 14 August 2017 stated that tipping started shortly before 1961 and confirmed that it stopped shortly after 1972.

The landfill lies 2 to 5 m above the level of the saltmarsh and was landraised with approximately one million cubic metres of waste, likely to be mainly putrescible waste.

Based on borehole logs available for the landfill site, anthropogenic and geological strata recorded on-site include Made Ground, landfill refuse, alluvium deposits, TAB, and the Chalk Formation. Between 2.10 m and 4.40 m of refuse are present in the landfill site centre.

It is likely that the landfill site was constructed using dilute-and-disperse principles and thus no liner is present preventing leachate from migrating into the underlying Chalk aquifer. However KCC does not hold exact records or details of the construction.

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15 WSP Environmental Ltd, 2007, Thanet Offshore Substation (Richborough) Ground Investigation Report

Environmental monitoring has been performed at the landfill site since 2006. The latest monitoring round was performed in 2016 - refer to Figure 6.1.2. It comprised gas, groundwater and surface water monitoring and indicated that:

- ▶ The major components of landfill gas are methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) that ground gas is influenced seasonally, with CH<sub>4</sub> and CO<sub>2</sub> peaks generally during the winter period. The highest gas concentration recorded in the landfill site centre;
- ▶ Groundwater is shallow and generally flows towards the south-east and Pegwell Bay, but is influenced by the estuarine environment. Groundwater quality monitored within the alluvium and TAB indicated threshold exceedances of ammoniacal nitrogen, chromium, copper, nickel, zinc, iron and lead;
- ▶ Leachate depth follows a seasonal trend, increasing during the winter and decreasing during the summer. Leachate quality monitoring in 2016 recorded guideline exceedances of ammoniacal nitrogen, total organic carbon, iron, manganese and potassium, which have all remained within the range of historic concentrations;
- ▶ Surface water quality is monitored at two locations before upstream of Pegwell Bay:
  - ▶ A small tributary of the River Stour on the south-eastern corner of the landfill site (PB-S1), where an influence by the estuarine environment and a limited influence by the landfill was identified; and
  - ▶ A stream that emerges centrally at the landfill site's eastern boundary after passing beneath the landfill (PB-S2). It is influenced by the landfill and the leachate produced with high levels of ammoniacal nitrogen and inorganic contaminants recorded at PB-S2.

Surface emissions monitoring was also carried out in 2016 and showed that the capping layer is sufficient to limit unacceptable levels of gas vertically migrating off-site, with gas levels recorded below 3.8 ppm. It is not specified in the information provided by KCC which gases were monitored, however it is assumed that these were CH<sub>4</sub> and CO<sub>2</sub> as they are the main gas components of the landfill.

There is a historical landfill located off-site at the location of the former Richborough Power Station (S4.5). This reportedly holds inert waste. The last input was in 1987.

There are two historical landfills located off-site adjacent to the west of the Sandwich Road, namely Ebbsfleet Lane Registered Landfill and Ebbsfleet – Ovenden Historical Landfill (S4.1). The last input at the Ebbsfleet - Ovenden Historical Landfill was in 1991. The deposited waste included inert waste. According to the EA website the waste received at the small Ebbsfleet - Ovenden landfill was waste that remains largely unaltered once buried such as glass, concrete, bricks, tiles, soil and stones. Ebbsfleet Lane Landfill is recorded as taking Special Waste and as having a large input rate (equal to or greater than 75,000 and less than 250,000 tonnes per year). The St Augustine's Golf Club and the Stonelees Golf Centre are located on the landfills.

The former Sandwich Road Tip (S4.3) is located off-site site to the east of the Sandwich Road, along the coast. This was used to dispose of household and inert waste. The Stonelees inert soil transfer station (S4.4) is located off-site adjacent west to the Sandwich

Road, to the south of the Ebbsfleet - Ovenden Historical Landfills. Three landfills (S4) (Richborough landfill, Old OEGB Site at Richborough and Back Sand Point landfill) are located off-site to the south.

During the April and June 2017 site walkovers, some boreholes were observed on the perimeter of the Pegwell Country Park (Picture 9), indicating that ongoing monitoring may take place. There was some possible fill material noted where footpath erosion had removed the grass and topsoil and exposed areas of anthropogenic material; glass, brick and ceramic (Picture 10). It was also noted that site clearance works had started for the Nemo (electricity connection between UK and Belgium) project by Balfour Beatty in the western area of the country park. The drainage ditches/ watercourses around the sites varied in turbidity and flow rates.



Picture 9 Borehole observed on the perimeter of the Pegwell Country Park



Picture 10 Possible fill material at the Pegwell Bay Country Park

Some parts in the south and south-east of the Stonelees Golf Centre could not be accessed during the April 2017 site walkover due to ongoing construction activities. However, observation was made from adjacent parts of the Stonelees Golf Centre that the inert soil transfer station possibly had some fuel storage in a bowser and the land was higher than surrounding land (Pictures 11 and 12). The rest of the land was fields of crops.



Picture 11 Plant equipment and soil stockpiles south-east of Stonelees Golf Centre



Picture 12 South-eastern part of Stonelees Golf Centre

In the field to the west of St Augustine's Golf Course and west of Cottingham Lane (off-site), two field markers were identified with the text 'WO' marked upon them. They appeared to be extraction points for water irrigation for the fields (Picture 13).



Picture 13 WO points noted off Cottington lane, west of St. Augustine's Golf Course

### 2.6.5 Areas of Infilled Ground (On-site and Off-site) (S5)

According to the OS mapping (Envirocheck report), there are seven areas of infilled land on-site. They are located at the former Richborough Power Station, at the Pfizer Sports Ground and at Richborough Port. According to the OS mapping and DDC data, there are 18 areas of infilled land off-site. They are located to the north in Cliffsend and near the hoverport, to the west at Ebbsfleet Farm, within the Ebbsfleet - Ovenden landfill, on the A256, within the solar farm and south of Richborough Port. For 11 of them, the works involve the backfilling with unknown ground of a pond, marsh land or stream, whilst for the area to the north near the hoverport, it is the backfilling with unknown ground of a quarry or a pit. Some of these areas are on/near surface water drains which may have the potential to interact with the site. The infilling of the watercourses is recorded to have happened at around 1874, and/or 1908 for the infilled areas to the south and in 1960 for the infilled areas to the west and the north. The infilling of the quarry/pit to the north is recorded to have happened in 1990.

### 2.6.6 Waste Water Treatment Works (On-site and Off-site) (S6)

A historical WWTW on-site associated with the former Richborough power station was observed during the June 2017 walkover (Picture 14).



Picture 14 WWTW on-site at the former Richborough Power Station

There are two WWTWs located off-site. Weatherlees Hill WWTW is north-west of the former Richborough Power Station, whilst the North Stonar WWTW is located off-site to the south. Surface water drains flow past the WWTWs and to the River Stour which flows off-site.

The Weatherlees WWTW could not be accessed during the April and June 2017 walkovers. Observations made from the surrounding areas were that there seemed to be breather pipes to the entrance of the sewage treatment works, to the east, possibly indicating an underground tank (Picture 15).



Picture 15 Breather pipes at the entrance of Weatherlees WWTW

### 2.6.7 Maintenance Facilities (On-site and off-site) (S7)

A motor vehicle depot, identified as a depot in 1960 and currently BCA Fleet Solutions 2 Limited in DDC data, is located adjacent off-site, to the north of Richborough Port.

The motor vehicle depot is currently used to repair cars prior to auction (Picture 16). The April 2017 site walkover identified a disused oil/ water interceptor located on the western area of the main buildings. This was previously emptied via tanker, but had not been used

in recent times according to the car auction site representative who accompanied the Amec Foster Wheeler consultants during the walkover of the site. Storage of diesel, engine oil and new engine oils were observed at the car auction (Picture 17). The large fuel and oil storage tanks were bunded and appeared to be in good condition (Picture 18). There was no evidence of leaks and spills surrounding the storage areas. Smaller volumes of fuels/oils stored were not bunded in some cases, and there were some signs of minor spillages on the tarmac (Picture 19). There was a watercourse, known as the Minster Stream, which flowed to a sluice gate on the bank of the River Stour within the car auction property (Picture 20).



Picture 16 Car auction site



Picture 17 Disused underground oil water interceptor (cover beneath car on left).



Picture 18 New oil and fuel storage tanks



Picture 19 Storage with signs of spillages





Picture 20 Tributary to River Stour on Maintenance Facility site

A truck depot is located on-site at Richborough Port at the proposed location of the onshore substation. It could not be accessed during the site walkovers of April and June 2017, but Made Ground was observed from the outside. The pipeline is located adjacent to the depot's northern border. According to the Envirocheck report, historical mineral railway lines and railway sidings were located in the area. The area was a military port during the First World War<sup>16</sup>. The oil-receiving connections to tankers associated with the former Richborough Power Station are located adjacent to the east of the depot<sup>11</sup>.

### 2.6.8 Hoverport (Off-site) (S8)

A disused hoverport is located off-site to the north of the cable route (Picture 21). The hoverport first appears in the 1973 map and was present up until the 2006 map (Envirocheck report). The area of the hoverport appears to have been constructed into Pegwell Bay by reclaiming an area of land. Historical records indicate the area may have been reclaimed using colliery spoil waste materials, as indicated in a previous scoping report undertaken by Royal Haskoning DHV<sup>17</sup>.

It was also indicated in the scoping report that, based on the Environmental Statement (TOWF, 2005a), ground contamination had been reported on the site through SIs using borehole and spike samples. There is evidence of former fuel storage and vehicle maintenance areas from elevated concentrations of hydrocarbons detected in the ground water. According to the scoping report, the site was considered likely to be classified as Contaminated Land under Part 2a of the Environment Act, due to the risks associated with groundwater contamination discharging to coastal waters.

During the April 2017 site walkover, a narrow diameter, apparently disused piezometer installation was noted on the hoverport tarmac pad area, indicating that SI and monitoring may have taken place in the past (Picture 22).

<sup>16</sup> <http://1914-1918.invisionzone.com/forums/index.php?/topic/105335-the-military-port-of-richborough-sandwich-kent/>

<sup>17</sup> [https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010084/EN010084-000020-Scoping%20Report%20\(low%20resolution%20version\).pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010084/EN010084-000020-Scoping%20Report%20(low%20resolution%20version).pdf)



Picture 21 Disused hoverport



Picture 22 Borehole installation observed on the hoverport tarmac

### 2.6.9 Ebbsfleet Solar Farm and Ebbsfleet Farm Biogas (Off-site) Energy Park - (S9)

The energy park could not be accessed during the April 2017 walkover. It was observed from the outside of the park, and domed structures which appeared to form part of the anaerobic digestion facility were observed. Fields of solar panels (Ebbsfleet Farm Solar Park) were located on the western and, to a lesser extent, the eastern side of the Richborough Way A256 road (Picture 23). Stockpiles (covered with dark green sheeting) were also noted on the eastern side of Richborough Way (A256), to the east of the energy park (Picture 24). These were possibly related to the energy park and may be storage for low level fertilizer produced from the anaerobic digestion.

Part of the energy park is understood to be a waste treatment facility which operates as an A23 activity under Environmental Permit (Ref. 103686), and is indicated as an anaerobic digestion facility (Picture 25).



Picture 23 Solar panels to east of Richborough Energy Park



Picture 24 Covered stockpiles – possible low level fertilizer storage derived from Richborough Energy Park



Picture 25 Anaerobic Digester facility within Richborough Energy Park

### **2.6.10 Transport Supply and Cargo Handling Activities (On-site and Off-site) – (S10)**

Two areas named 'Port Richborough' have been identified by DDC as potentially being contaminated. Transport supply and cargo handling activities have been carried out since 1946.

### **2.6.11 Pyrotechnics Manufacturing Works (Off-site) – (S11)**

A fireworks factory is shown adjacent off-site to the west of the replacement land for HMRC on the other side of Ramsgate road, on the Envirocheck historical maps dated 1955 to 1973. The fireworks factory is labelled for the first and only time on the maps from 1977 to 1987 at the location of the replacement land for HMRC. However, no buildings are visible on the maps, presumably because the fireworks factory was only located off-site on the other side of Ramsgate road, as such it has been assessed as potential off-site source.

## 3. Generic Qualitative Risk Assessment

### 3.1 Conceptual Model

The CM and potential pollutant linkages are defined below based on the desk study review of publicly available information collated in the previous sections. The CM has been developed in line with Contaminated Land Report (CLR11) and is based on the proposed industrial/commercial land use. The CM provides an assessment of the site's potential contamination status and identify the presence of potentially significant contaminant linkages that have been further considered in the ES.

#### 3.1.1 Potential Contamination (Sources)

A review of the site's history and environmental setting has identified potential contaminant sources on the site and the surrounding area, as summarised below in Table 3.1. The list of contaminants has been established through a review of the relevant Department of Environment Industry Profiles, in addition to Amec Foster Wheeler's experience of contaminated land assessment.

Table 3.1 Historical, Current and Future Contaminant Sources

No.	Source and Comment	Likely Contaminants	Location	Source to be considered further?
<b>Fuel storage and use (S1)</b>				
<b>S1.1</b>	Tanks.	Heavy fuel oil (heavy end TPH fractions) at the former Richborough Power Station.  Organics: TPH, benzene, toluene, ethylbenzene, xylene (BTEX) and Methyl tert-butyl ether (MTBE) at the PFS.  Organics: TPH, BTEX, PAHs, solvents at the other locations.	On-site and off-site.	Yes.
<b>S1.2 (a,b,c)</b>	PFSs (active and inactive).	Organics: TPH, BTEX and MTBE	Off-site.	Yes.

<b>S1.3</b>	Decommissioned pipeline formerly used to transport oil from the port to the former power station.	Organics: TPH and BTEX; Asbestos.	Used to be on-site within the former Richborough Power Station and is still present on-site to the south of the motor vehicle depot.	Yes.
<b>S1.4</b>	Oil pollution Incident at the Pfizer Sports Ground.	Organics; TPH and BTEX.	On-site.	Yes.
<b>Power Station (historical) (S2)</b>				
	Richborough Power Station.	Organics: TPH, BTEX, PCBs, PAHs, solvents;  Inorganics: heavy metals, asbestos, radioactivity <sup>(note 1)</sup> .	On-site.	Yes.
<b>Made Ground associated with past and current site uses (S3)</b>				
		Organics: TPH and PAHs;  Inorganics: heavy metals, pH.	Potentially across the whole site.	Yes.
		Asbestos.	Potentially across the whole site.	Yes.
		Ground gases (methane and carbon dioxide).	Potentially across the whole site.	Yes.
<b>Landfill (S4) (S4.1, 2, 3, 4, 5)</b>				
	Landfills and historical landfills (including biological treatment) for household and inert waste.	Organics: TPH and PAHs;  Inorganics: including heavy metals, pH.  Asbestos.  Ground gases.	On-site and off-site.	Yes.

<b>Infilled ground (S5)</b>				
Infilled ground.	Ground gases.	Infilling of a pond, marsh land or stream on-site.	Yes – assessed with S3 - Made Ground.	
		Backfilling with unknown ground of a quarry or a pit at the hoverport off-site.	Yes – assessed with S8 – Hoverport.	
<b>Waste Water Treatment Works (WWTW) (S6)</b>				
WWTW.	Organics: TPH, BTEX and PAHs;  Inorganics: heavy metals, ammonia, phosphate, and chloride.  Ground gases.	On-site and off-site.	Yes.	
<b>Maintenance activities (S7)</b>				
Motor Vehicle Depot.	Organics: TPH, BTEX, PAHs and chlorinated solvents.  Inorganics: heavy metals.	On-site and off-site.	Yes.	
Truck Depot (former railway sidings).	Organics: TPH, BTEX, PAHs, PCBs and chlorinated solvents;  Inorganics: heavy metals, radioactivity (note 1).	On-site.	Yes.	
<b>Hoverport (S8)</b>				
Hoverport (activities and infilled quarry / pit).	Organics: TPH, BTEX and PAHs;  Inorganics: heavy metals.	Off-site.	Yes.	

<b>Richborough Energy Park (S9)</b>				
Energy park – anaerobic digestion facility.	Leachates.	Off-site.		No – considered to be managed within compliance via Environmental Permitting Regulations
<b>Transport Supply and Cargo Handling (S10)</b>				
Port Richborough	Organics: TPH, BTEX, PAHs, PCBs and chlorinated solvents;	On-site and Off-site.		Yes.
<b>Pyrotechnics Manufacturing Works (S11)</b>				
Fireworks factory, west of Ramsgate road.	Organics: propellants, e.g. TNT – 2,4,6-trinitotoluene, RDX – cyclotrimethylene trinitramine, HMX – cyclotetramethylene tetranitramine, EGDN - nitroglycol, NG – nitroglycerine, NC – nitrocellulose;  Inorganics: heavy metals.	Off-site.		Yes.

**Notes:**

1) Residual radioactivity may be present in ash as coal is naturally radioactive, it is unlikely to be a significant contaminant but its potential presence has been noted.

### 3.1.2 Potential Receptors and Exposure Pathways

The potential receptors and associated pathways that have been identified through this desk-based assessment are shown in Table 3.2.



Table 3.2 Pathways and Receptors

Receptors	Potential pathways
<b>Future site users (maintenance personnel at the substation or cable route).</b>	Dermal contact, ingestion and inhalation of dusts, vapours, asbestos fibres and accumulated gases.
<b>Property (buildings, services, and / or cable).</b>	Direct contact, ingress and accumulation of soil gas.
<b>Controlled Waters: Coastal water (Pegwell Bay adjacent to the site).</b>	Surface water runoff and/or groundwater baseflow migration.
<b>Controlled Waters: Secondary A Aquifer in bedrock (BGS borehole logs indicate Chalk at a depth greater than 20 m, so not assessed as receptor except for area of the historic Cliffsend Landfill).</b>	Leaching and/or migration.
<b>Controlled Waters: Principal Aquifer in bedrock at the historic Cliffsend Landfill (KCC data indicate Chalk is also at depth but in hydraulic continuity with overlying TAB (Secondary A Aquifer) and not protected by a liner).</b>	Leaching and/or migration.
<b>Controlled waters: River Stour.</b>	Surface water runoff and/or groundwater baseflow migration.

## 3.2 Exclusions from Risk Assessment

### 3.2.1 Redevelopment Workers

The CM does not consider risks to construction workers on the basis that risks to workers will be dealt with under the Health and Safety at Work Act (1974) and regulations made under the Act. Site-specific contamination data obtained from all SIs should be included in the pre-construction information (requirement of Construction Design and Management Regulations 2015) for the proposed works, to enable any contractors to address potential risk from contamination as necessary in their risk assessments and method statements. Moreover, as the exact details of the method adopted are not currently known, it is not considered appropriate to provide a wide ranging and speculative risk assessment for redevelopment workers.

The CM focusses on land contamination issues. Geotechnical constraints including sulphate and ammonia attack of concrete are not assessed as part of the assessment.

### 3.3 Preliminary Risk Assessment

In order for land contamination risk to be realised, a 'contaminant linkage' must exist.<sup>18</sup> A contaminant linkage requires the presence of all of the following:

- ▶ Source of contamination;
- ▶ Receptor capable of being harmed; and
- ▶ Pathway capable of exposing a receptor to the contaminant.

A PRA has been undertaken for these potential source-pathway-receptor linkages to identify potentially unacceptable risks on a qualitative basis and is displayed in Table 3.3. Risk is therefore based on a consideration of both:

- ▶ The likelihood of an event (probability takes into account both the presence of the hazard and receptor and the integrity of the pathway); and
- ▶ The severity of the potential consequence (takes into account both the potential severity of the hazard and the sensitivity of the receptor).

Further information on the risk assessment methodology used is given in Appendix G. The method of dealing with identified risks and the level of significance of those risks will be a function of site use.

The risk assessment is based on the potential impact of construction of the cable route and substation on the site and buffer areas, in terms of future risk to cable maintenance workers and the potential effect on controlled waters and property.

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<sup>18</sup> Environment Agency (2004) Model Procedures for the Management of Land Contamination – *Contaminated Land Report 11*

Table 3.3 Preliminary Risk Assessment – Risks to Future Site Users and Controlled Waters from Current/Historic Sources

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
<b>S1.1</b>	On-site tanks	Three tanks are reported on site at the former location of the Richborough Power Station. It is possible that other tanks are present which have not been identified. Two are reported respectively at the proposed location of the substation and at the replacement land for HMRC.						
		Organics; TPH, BTEX, PAHs, solvents	Future site users (maintenance personnel)	Direct contact, ingestion of reworked ground	Health Hazard [Severe]	Low Likelihood	Moderate	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground due to the presence of current or historic tanks. Investigation on the former power station suggests only moderate impacts. No investigation is available for other sites.
			Controlled Waters: Coastal Water	Surface flow, baseflow migration	Coastal Water Pollution [Medium]	Low likelihood	Moderate/Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground due to the presence of current or historic tanks. The proposed cable has a potential of resulting in preferential pathways to groundwater
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Low likelihood	Moderate /Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground due to the presence of current or historic tanks. The proposed cable has a potential of resulting in preferential pathways to groundwater.
		Controlled waters: River Stour	Surface flow, baseflow migration	Surface water Pollution [Medium]	Low likelihood	Moderate/Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground due to the presence of current or historic tanks. The proposed cable has a potential of resulting in preferential pathways to the River Stour.	
<b>S1.2 a, b,c</b>	PFS off-site	Esso, Gulf and Pegwell Bay PFS are located off-site. The Pegwell Bay PFS is known to have been subject to remediation in the past. Walkover inspection of the PFSs suggested they are adequately maintained however there is a potential for ground or groundwater contamination due to unidentified spills or leakages of fuel at the PFSs which have not been investigated.						

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
		TPH, BTEX, MTBE	Future site users (maintenance personnel)	Leaks, spills on to land, migration within groundwater onto site and accumulation and inhalation of vapours	Health hazard [medium]	Low likelihood	Moderate/Low	Migration could have occurred within shallow groundwater.
<b>S1.3</b>	On-site former oil pipeline	There is no information on the content of this pipeline, but it is likely this was an oil pipeline from Richborough Port to the former power station <sup>11</sup> . According to a figure on the Richborough Power Station leaflet, the pipeline used to be present above ground within the power station. Based on a previous report available for the site <sup>12</sup> , it is likely that this was dismantled during the power station decommissioning – it was not observed to be present within the former Richborough Power Station during the June 2017 walkover. During the April and June 2017 site walkovers the above ground pipeline was observed to the south of the motor vehicle depot. No leaks were observed. It had been terminated at the western end. Lagging was observed in the pipeline at its eastern end towards the River Stour.						
		Heavy end TPH fractions	Future site users (maintenance personnel)	Direct contact, ingestion of reworked ground	Health Hazard [Medium]	Unlikely	Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with the former oil pipeline. Limited investigation is available.
			Controlled Waters: Coastal Water	Surface flow, baseflow migration	Coastal Water Pollution [Mild]	Unlikely	Very low risk	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with the former oil pipeline. The proposed cable has a potential of resulting in preferential pathways to groundwater.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Mild]	Unlikely	Very low risk	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with the former oil pipeline. The proposed cable has a potential of resulting in preferential pathways to groundwater.
			Controlled waters: River Stour	Surface flow, baseflow migration	Surface water Pollution [Mild]	Unlikely	Very low risk	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with the former oil pipeline.

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
								The proposed cable has a potential of resulting in preferential pathways to the River Stour.
		Asbestos	Future site users (maintenance personnel)	Inhalation of fibres	Health hazard [Severe]	Likely	High	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground. Pipeline lagging potentially containing asbestos - potential for exposure to any asbestos fibres in non-paved areas
<b>S1.4</b>	Oil Pollution Incident at the Pfizer Sports Ground on-site	A tank spill of oil or a pipe failure occurred at the Pfizer Sports Ground in 1999. Following remediation, the EA confirmed that the bulk of the contamination identified had been removed from the site. A remediation plan was being developed by Pfizer following hydrocarbon contamination encountered in shallow groundwater in 2011. The incident has been closed by the EA, following relevant remedial works to the site and additional monitoring over time. There are now limited residual contaminants, but these are stable and reducing.						
		TPH, BTEX	Future site users (maintenance personnel)	Direct contact, ingestion of reworked ground	Health Hazard [Medium]	Low likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potential residual contaminated ground associated with Pfizer Sports Ground.
			Controlled Waters: Coastal Water	Surface flow, baseflow migration	Coastal Water Pollution [Mild]	Unlikely	Very Low risk	The proposed cable route has the potential to coincide with potential residual contaminated ground associated with Pfizer Sports Ground. The proposed cable has a potential of resulting in preferential pathways to groundwater discharging into coastal waters.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Mild]	Low likelihood	Low	The proposed cable route has the potential to coincide with potential residual contaminated ground associated with Pfizer Sports Ground. The proposed cable has a potential of resulting in preferential pathways to groundwater.

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
			Controlled waters: River Stour	Surface flow, baseflow migration	Surface water Pollution [Mild]	Unlikely	Very Low risk	The proposed cable route has the potential to coincide with potential contaminated ground associated with potentially residual contaminated ground associated with Pfizer Sports Ground. The proposed cable has a potential of resulting in preferential pathways to the River Stour.
S2	Power Station on-site (historical)	Richborough Power Station previously operated on the proposed substation site. Previous intrusive investigations, a generic risk assessment and a DQRA for controlled waters were carried out at the site. PAHs, TPH, heavy metals, PCBs and sulphates were detected in soil and groundwater at concentrations partly exceeding the relevant GAC in some places. The assessments concluded that they were not to pose a significant risk to human health or controlled waters and that no remediation or further assessment were required. Asbestos fibres were not detected in the soil samples analysed. Carbon dioxide was detected in soil gas at several locations across the site, however it was considered that the negligible borehole gas flow rates suggested that risks resulting from soil gases were in the very low risk to low risk category (as defined by CIRIA C665). It is not known whether the investigation or assessments have been accepted by regulators. It is possible other contamination is present that has not been detected which may represent a risk to receptors.						
		Organics (Polychlorinated Biphenyls (PCBs), TPH, BTEX, Polycyclic Aromatic Hydrocarbons (PAHs), solvents), heavy metals	Future site users (maintenance personnel)	Direct contact, inhalation, ingestion of reworked ground	Health Hazard [Medium]	Low Likelihood	Moderate/low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the former Power Station.
			Controlled Waters: Coastal Water	Leaching, surface water, baseflow migration	Coastal Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has a potential of resulting in preferential pathways to groundwater discharging into coastal waters.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has a potential of resulting in preferential pathways to groundwater.
			Controlled Waters: River Stour	Leaching, surface water, baseflow migration	Surface Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has a potential of resulting in preferential pathways to River Stour

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
		Asbestos	Future site users (maintenance personnel)	Inhalation of fibres	Health hazard [Severe]	Unlikely	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the former Power Station. Potential for exposure to any asbestos fibres in non-paved areas.
<b>S3 and S5</b>	On-site Made Ground associated with site past and current uses, including infilled ground areas	Made Ground was encountered during the intrusive investigations carried out at the former Richborough Power Station <sup>13, 15</sup> and off-site at the lay-by located along Sandwich Road <sup>14</sup> . It is anticipated across the site including the infilled ponds/ ground areas. It was observed at the former Richborough Power Station and at the truck depot during the June 2017 walkover. The DQRA undertaken for the former Richborough Power Station in 2009 concluded that there was no significant risk to controlled waters. An assessment of the dilution of the groundwater discharge into the River Stour was undertaken in 2009 at the former Richborough Power Station site and groundwater concentrations were not considered to present a significant risk to controlled waters receptors. Metals, PAHs and long-chain hydrocarbons generally have low mobility in soil and lighter organics are likely to have degraded. The site is not in a SPZ.						
		Inorganics including heavy metals, pH, PAHs and TPH	Future site users (maintenance personnel)	Direct contact, inhalation or ingestion.	Health hazard [Medium]	Unlikely	Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with Made Ground and infilled ground areas. Potential for exposure in non-paved areas. Previous investigation and assessment suggests risk to future site users is not likely to be significant.
			Controlled Waters: Coastal Water	Leaching, surface water, baseflow migration	Coastal Water Pollution [Medium]	Unlikely	Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with Made Ground and infilled ground areas. The proposed cable and substation location have a potential of resulting in preferential pathways to groundwater discharging into coastal waters. Previous investigation and assessment suggests risk to controlled waters is not likely to be significant.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Unlikely	Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
								Made Ground and infilled ground areas. The proposed cable and substation location have a potential of resulting in preferential pathways to groundwater. Previous investigation and assessment suggests risk to controlled waters is not likely to be significant.
			Controlled Waters: River Stour	Leaching, surface water, baseflow migration	Surface Water Pollution [Medium]	Unlikely	Low	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with Made Ground and infilled ground areas. The proposed cable and substation location have a potential of resulting in preferential pathways to River Stour. Previous investigation and assessment suggest risk to controlled waters is not likely to be significant.
		Asbestos	Future site users (maintenance personnel)	Inhalation of fibres.	Asbestosis [Severe]	Low Likelihood	Moderate	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with Made Ground and infilled ground areas. Potential for exposure in non-paved areas. Previous investigation and assessment suggest risk to future site users is not likely to be significant.
		Ground Gases (methane, carbon dioxide)	Future site users (maintenance personnel)	Ingress to buildings at the substation or to cable inspection chambers, and accumulation, inhalation of gas	Health hazard, explosion, asphyxiate [Severe]	Low likelihood	Moderate	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with Made Ground and infilled ground areas. Gas monitoring data available indicated limited ground gas present. Previous investigation and assessment suggests risk to future site users is not likely to be significant.



No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
			Property (Buildings, cable and services)	Ingress to buildings at the substation or to cable inspection chambers, and accumulation, inhalation of gas	Explosion [Severe]	Low likelihood	Moderate	The proposed cable route and substation location have the potential to coincide with potentially contaminated ground associated with Made Ground and infilled ground areas. Previous investigation and assessment suggests risk to future property is not likely to be significant.
S4	Landfills on-site and off-site	<p>The Geo-environmental desk study has identified one previous landfill on-site, that is the historic Cliffsend landfill (which was likely filled with putrescible waste until 1972) on which the Pegwell Bay Country Park is located. The cable would be trenched underground (Options 1 and 3) with the exception of a possible above ground section through the historic Cliffsend landfill (Option 2). The cable landfalls could be located in the landfill.</p> <p>There are a number of landfills located adjacent off-site along the Sandwich Road, namely Ebbsfleet Lane (recorded as having accepted Special Waste), Ebbsfleet - Ovenden (recorded as accepting inert waste as recently as 1991), Stonelees inert soil transfer station and the former Sandwich Road Tip located along the coast (also accepted household and inert waste), and the historic Richborough Power Station landfill (inert waste until 1987). Three landfills, namely Richborough landfill, Old OEGB Site at Richborough and Back Sand Point landfill, are located off-site further to the south.</p> <p>No detailed investigation is available to characterise soil or groundwater contamination in the landfills or the gassing or leaching potential of the waste.</p>						
		Ground gases (methane, carbon dioxide)	Future site users (maintenance personnel)	Ingress to cable inspection chambers accumulation, inhalation of gas Creation of pathway for gases through sand in the trench around cable (where the cable runs underground) and accumulation	Health hazard, explosion, asphyxiate [Severe]	Likely	High.	The proposed cable route will pass close to or through areas of the former landfill with gassing potential.
			Property (cable)	Creation of pathway for gases through sand in the trench around cable and accumulation	Explosion [Severe]	Likely	High	The proposed cable route will pass close to or through areas of the former landfill with gassing potential.

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
		Inorganics including heavy metals, pH, PAHs, TPH, sulphide, cyanides	Future site users (maintenance personnel)	Direct contact, inhalation, ingestion	Health hazard [Medium]	Likely	Moderate	The proposed cable route will pass close to or through areas of the former landfill. The proposed cable route has the potential to coincide with potential contamination associated with former landfill.
		Asbestos	Future site users (maintenance personnel)	Inhalation of fibres	Asbestosis [Severe]	Likely	High	The proposed cable route will pass close to or through areas of the former landfill. The proposed cable route has the potential to coincide with potential contamination including asbestos associated with former landfill.
		Leachates	Future site users (maintenance personnel)	Direct contact, inhalation	Health hazard [Medium]	Likely	Moderate	The proposed cable route (will pass close to or through areas of the former landfill. The proposed cable route has the potential to coincide with former landfills with leachate generation potential.
			Property (landfall, cable)	Direct contact	Damage to property [Medium]	Likely	Moderate	The proposed cable route will pass close to or through areas of the former landfill. The cable landfall is located at the landfill. The proposed landfall location and cable route have the potential to coincide with former landfill with leachate generation potential.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Likely	Moderate	The proposed cable route will pass close to or through areas of the former landfill. The cable landfall is located at the landfill. The proposed landfall location and cable route have the potential to coincide with former landfill with leachate generation potential. The proposed landfall and cable have a potential to result in preferential pathways to groundwater.
			Controlled Waters: Principal Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Likely	Moderate	The proposed cable route will pass close to or through areas of the historic Cliffsend landfill. The cable

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
								landfall is located at the landfill. The proposed landfall location and cable route have the potential to coincide with former landfill with leachate generation potential.  The proposed landfall and cable have a potential to result in preferential pathways to groundwater and there is no liner preventing leachate from migrating into the Chalk aquifer.
			Controlled Waters: Coastal Water	Surface flow, baseflow migration	Coastal Water Pollution [Medium]	Likely	Moderate	The proposed cable route will pass close to or through areas of the former landfill. The cable landfall is located at the landfill. The proposed landfall has the potential to coincide with former landfill and could accelerate waste erosion in leaching into the sea.  The proposed landfall and cable have a potential to result in preferential pathways to groundwater.
			Controlled waters: River Stour	Surface flow, baseflow migration	Surface water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route will pass close to or through areas of the former landfill. The cable landfall is located at the landfill. The proposed cable route has the potential to coincide with former landfill with high leachate generation potential. The proposed cable has a potential to result in preferential pathways to the River Stour.
S6	WWTW		There is one WWTW on-site, associated with the former Richborough power station.					
		Organics; TPH, BTEX and PAHs, Inorganics; heavy metals, ammonia, phosphate, and chloride.	Future site users (maintenance personnel)	Direct contact, inhalation or ingestion of reworked ground.	Health hazard [medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the WWTW.

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
			Controlled Waters: Coastal Water	Leaching, surface water, baseflow migration	Coastal Water Pollution [Medium]	Unlikely	Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with WWTW. The proposed cable has a potential to result in preferential pathways to groundwater discharging in coastal waters.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with WWTW. The proposed cable has a potential to result in preferential pathways to groundwater.
			Controlled Waters: River Stour	Leaching, surface water, baseflow migration	Surface Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with WWTW. The proposed cable has a potential to result in preferential pathways to River Stour
		Ground gases (methane, carbon dioxide)	Future site users (maintenance personnel)	Ingress to cable inspection chambers and / or adjacent substation buildings accumulation, inhalation of gas	Health hazard, explosion, asphyxiate [Severe]	Low Likelihood	Moderate	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the WWTW.
			Property (Buildings)	Ingress to inspection cable chambers and / or adjacent substation buildings accumulation	Explosion [Severe]	Low Likelihood	Moderate	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the WWTW.
<b>S7</b>	Maintenance Activities	<p>A motor vehicle depot (car auction) is located on-site and adjacent off-site to the south east. The April 2017 site walkover revealed that a disused oil/water interceptor was located on the western area of the main buildings. This was previously emptied via tanker, but had not been used in recent time according to the site representative during our site visit. Storage of diesel, engine oil and new engine oils were observed on the site. The large fuel and oil storage tanks were bunded and appeared to be in good condition. There were no evidence of leaks and spills round them. Smaller volumes of fuels/oils were not bunded in some cases and there was some signs of minor spillages on the tarmac. There was a drainage stream which flowed to a sluice gate on the bank of the River Stour within the car auction site.</p> <p>A truck depot is located on-site at Richborough Port. It is the proposed location of the onshore substation. It could not be accessed during the site walkovers of April and June 2017, but Made Ground was observed from the outside. The pipeline is</p>						

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
				located adjacent to the depot's northern border. According to the Envirocheck report, a historical mineral railway used to cross the area. The area was a military port during the First World War and then railway sidings. The oil receiving connections to tankers associated with the former Richborough Power Station are located adjacent to the east of the depot <sup>11</sup> .				
		TPH, BTEX, PAHs, PCBs, heavy metals	Future site users (maintenance personnel)	Direct contact, ingestion of reworked ground	Health Hazard [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the motor vehicle depot, the truck depot and railway sidings. Potential for exposure to shallow soils in non-paved areas.
			Controlled Waters: Coastal Water	Surface flow, baseflow migration	Coastal Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the motor vehicle depot, the truck depot and railway sidings. The proposed cable has a potential to result in preferential pathways to groundwater discharging into coastal waters.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the motor vehicle depot, the truck depot and railway sidings. The proposed cable has a potential to result in preferential pathways to groundwater.
			Controlled waters: River Stour	Surface flow, baseflow migration	Surface Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the motor vehicle depot, the truck depot and railway sidings. The proposed cable has a potential to result in preferential pathways to adjacent River Stour.
		Asbestos	Future site users (maintenance personnel)	Inhalation of fibres	Asbestosis [Severe]	Likely	High	Substation location has the potential to coincide with potentially contaminated ground. Pipeline lagging potentially containing asbestos located at the area's northern border - potential for

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
								exposure to any asbestos fibres in non-paved areas.
<b>S8 and S5</b>	Hoverport (activities and infilled ground)							
		TPH, BTEX, PAHs, heavy metals, chlorinated solvents	Future site users (maintenance personnel)	Leaks, spills on to land, migration within groundwater onto site and accumulation and inhalation of vapours	Health hazard [medium]	Unlikely	Low	Onshore cable route and landfall would be located about 850 m to the south of the hoverport.
<b>S10</b>	Transport Supply and Cargo Handling activities							
		TPH, BTEX, PAHs, PCBs, heavy metals	Future site users (maintenance personnel)	Direct contact, ingestion of reworked ground	Health Hazard [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the former Richborough Port activities. Potential for exposure to shallow soils in non-paved areas.
			Controlled Waters: Coastal Water	Surface flow, baseflow migration	Coastal Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the former Richborough Port activities. The proposed cable has a potential to result in preferential pathways to groundwater discharging into coastal waters.
			Controlled Waters: Secondary A Aquifer	Leaching, migration	Groundwater Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the former Richborough Port activities. The proposed cable has a

<sup>19</sup> Thanet Extension Offshore Wind Farm Environmental Impact Assessment, Report to Inform Scoping, Royal Haskoning DHV, December 2016

No.	Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance	Comment
								potential to result in preferential pathways to groundwater.
			Controlled waters: River Stour	Surface flow, baseflow migration	Surface Water Pollution [Medium]	Low Likelihood	Moderate/Low	The proposed cable route has the potential to coincide with potentially contaminated ground associated with the former Richborough Port activities. The proposed cable has a potential to result in preferential pathways to adjacent River Stour.
S11	Pyrotechnics Manufacturing Works	A fireworks factory is shown adjacent off-site to the west of the replacement land for HMRC on the other side of Ramsgate road, on the Envirocheck historical maps dated 1955 to 1973. The fireworks factory is labelled for the first and only time on the maps from 1977 to 1987 at the location of the replacement land for HMRC. However, no buildings are visible on the maps, presumably because the fireworks factory was only located off-site on the other side of Ramsgate road.						
		Propellants, e.g. TNT – 2,4,6-trinitotoluene, RDX – cyclotrimethylene trinitramine, HMX – cyclotetramethylene tetranitramine, EGDN - nitroglycol, NG – nitroglycerine, NC – nitrocellulose, heavy metals	Future site users (maintenance personnel)	Leaks, spills on to land, migration within groundwater onto site and accumulation and inhalation of vapours	Health Hazard [Medium]	Low Likelihood	Moderate/Low	The replacement land for HMRC would require some excavation works relating to utilities and fencing. There is a potential for exposure to shallow soils in non-paved areas. However the activity ceased in the late 1980's and propellants, often have a high solubility (except for NC) and degradation is very likely.

## 4. Geotechnical Assessment

### 4.1 Review of Existing Data

In order to provide a preliminary assessment of the geological and geotechnical ground conditions on-site and in the surrounding buffer area, a review of previous ground investigation reports supplied by TDC and borehole records available via the British Geological Survey 'GeoIndex' website was conducted.

The borehole records accessed are summarised in Table 4.1 below.

Table 4.1 Borehole Records Accessed via GeoIndex Website

Area	No of Records	Year Drilled	BGS Reference	BH Name	Comments
<b>Pegwell Bay</b>	4	1967	TR36SW41 TR36SE1 TR36SW42 TR36SE2	Pegwell Bay BH1 Pegwell Bay BH2 Pegwell Bay BH3 Pegwell Bay BH4	Off site to north of landfall area of cable – in vicinity of former hoverport
<b>Pegwell Bay</b>	3	2010	TR36SW113 TR36SW114 TR36SW115	Viking Picnic Site BH2 Viking Picnic Site BH3 Viking Picnic Site BH4	Off site to north of landfall point of cable. Picnic site adjacent to Sandwich Road, overlooking former hoverport.
<b>Ebbsfleet Farm</b>	1	1899	TR36SW65	Ebbsfleet Farm, Minster	Off site to the west, close to boundary of buffer area.
<b>Weatherlees WTWW</b>	7	1992	TR36SW76 TR36SW77 TR36SW82 TR36SW86 TR36SW87 TR36SW92 TR36SW95	Richborough WTW W7 Richborough WTW W9 Richborough WTW W17 Richborough WTW W25 Richborough WTW W27 Richborough WTW W35 Richborough WTW W43	WWTW in western part of buffer area, north of proposed substation. Due to the large number of boreholes on and around the site only the easternmost borehole positions were reviewed.



<b>Richborough 6</b>	Not Given	TR36SW36 TR36SW37 TR36SW38 TR36SW39 TR36SW40	Stonar Camp BH65 Stonar Camp BH66 Stonar Camp BH67	In the south-west corner of the buffer area, south of proposed substation site. Most boreholes in this area are restricted and cannot be viewed. Exploration borehole drilled by Ebbsfleet Coal Syndicate.
	1911	TR36SW63	Stonar Camp BH68 Stonar Camp BH69  Ebbsfleet	

In addition, TDC provided records from two historical ground investigations, as summarised in Table 4.2 below.

Table 4.2 Thanet District Council Borehole Records

<b>Area</b>	<b>Year Drilled</b>	<b>Source</b>	<b>No. of Holes</b>
<b>Richborough Power Station</b>	2008	URS Consultants	18 Cable Percussive Boreholes 21 Machine Excavated Trial Pits 30 Window Samples
<b>Sandwich Road, Cliffsend</b>	2007	Royal Haskoning DHV	4 Window Samples
<b>Thanet Offshore Substation (Richborough)</b>	2007	WSP Environmental UK	4 Cable Percussive Boreholes

The encountered geology is summarised in Table 4.3 below.

Table 4.3 Summarised Geology

Stratum	Description	Depth to Base (m bgl)	Thickness (m)
<b>Topsoil</b>	Brown sandy silty TOPSOIL	0.2 – 0.3	0.2 – 0.3
<b>Made Ground</b>	Reworked Chalk, brick and concrete gravel at Sandwich Road. Reworked flint gravel, colliery spoil at Richborough Power Station	0.2 – 6.3	0.2 – 6.3
<b>Estuarine Alluvium / Tidal Flat Deposits</b>	Soft to firm brown, grey or black sandy SILT or CLAY	1.40 – 18.0	0.6 – 18.0
<b>TAB</b>	Predominantly medium dense greenish grey silty SAND with locally described as firm to stiff silty CLAY.	2.75 – 33.0	2.35 – 27.3
<b>MaCk</b>	Structureless CHALK composed of Chalk and flint fragments in a clayey silty matrix	Not Proven	Not Proven

Broadly, the boreholes indicate the presence of several metres of TAB, underlain by Chalk. The TAB is overlain locally by variable superficial deposits and Made Ground. The base of the TAB was not proved in Richborough Power Station, and the formation becomes thinner and shallower towards the northern end of the site.

Made Ground was encountered in the Sandwich Road investigation, to depths of between 0.4- 0.8 m bgl, and in all of the exploratory holes formed in 2008 in Richborough Power Station, to a maximum depth of 6.3 m bgl. The deeper deposits of Made Ground comprised a mixture of brick rubble, crushed concrete and colliery spoil, thereby supporting evidence that such material was used to artificially raise the site of the power station above the flood plain.

No superficial deposits were encountered on either side of the A256 Richborough Way road corridor from Ebbsfleet Roundabout to the crossing over Cottington Lane. Where present, the superficial deposits appear to be thicker in the southern half of the site, although the thickness was also found to be greatly reduced in the north-west corner of the former Richborough Power Station, where TAB was located at shallow depths

The TAB was not reported in the 2007 Royal Haskoning investigation, where the Made Ground was apparently underlain by alluvium. However, this material was logged as medium dense brown sand with shell fragments and therefore may have been TAB, incorrectly logged as alluvium.

Made Ground is also likely to be present to significant depths in the former landfill areas, infilled areas identified in the Envirocheck report, and the former Pegwell Bay hoverport, which was also raised artificially using colliery spoil, according to evidence provided by Royal Haskoning.

No borehole data have been sourced and made available within the intertidal area or in the former landfill areas, although there is some evidence of boreholes having been drilled in the past (likely to be for monitoring purposes), as was observed during the walkover.

Although not encountered in any of the boreholes, it should be noted that the southern half of the study area is within the Coal Authority Coal Reporting area. This means that coal mining may have taken place historically in the area. However, the Coal Authority website indicates that any coal mining in the area took place to the west and to the south of the site. Furthermore, the proposed study area is not indicated to be in a high risk to development area, according to the information available on the Coal Authority website.

## 4.2 Site Walkover

A walkover survey was carried out by a geotechnical engineer on 5 – 6<sup>th</sup> April 2017.

The main geotechnical findings are outlined below:

- ▶ Pegwell Bay – Thanet Sands visible in cliffs above former hoverport (off-site, Picture 26). The formation appears to be pale yellowish brown to orange brown weakly cemented silty sand. There is also some evidence of potential localised instability of the cliff. Chalk also visible in lower part of cliffs. Thanet Sands observed to become thinner to the north, with the cliffs appearing to become predominantly Chalk in the Ramsgate area. Pieces of slag found in former hoverport area. The source of this is unknown, but an area of filled ground is indicated in this area on the Envirocheck maps, and it may be possible that slag may have been included within the material placed to artificially raise levels to allow the hoverport to be constructed. Anecdotal evidence suggests that Colliery Spoil material from the East Kent Coalfield and Richborough Power Station was used to raise the levels at the site (Kent Online);
- ▶ Pegwell Bay Nature Reserve – Situated in intertidal area from the hoverport area to the River Stour estuary. It comprises marshy areas, ephemeral streams and very soft silts and sands that are inundated at high tide. The site is marked with no entry signs at intervals, due to the presence of sensitive wildlife, and unstable ground;
- ▶ Pegwell Country Park and Stonelees Nature Reserve – Situated inland of the intertidal area, to the east of Sandwich Road. Formerly the historic Cliffsend Landfill site, which accepted household and inert waste until 1972. No signs of gas vents around the site. In one small area, it could be seen that fragments of waste had been exposed at the surface. In addition, a stockpile of Chalk was found on the site, with a sign stating that the Chalk was used to cover over areas where waste was exposed. This, coupled with the fact that there are no vent stacks apparent, would indicate that the landfill was not capped. There were no signs of gross settlement having occurred, although it was noted that the ground surface was somewhat undulating in some areas;

- ▶ St. Augustine's and Stonelees Golf Courses – Situated west of Sandwich Road, opposite Pegwell Country Park. These sites are situated within the former Ebbsfleet - Ovenden landfill site, which accepted inert waste until 1991, and the Ebbsfleet Lane Landfill site. The site has been extensively landscaped to form the respective golf courses. The Ebbsfleet Lane landfill is still an operational waste management facility and is situated next to the Stonelees Golf Course. This could be seen from the golf course although the site could not be accessed. The site appeared to be placing inert waste but this could not be verified. The site was elevated with respect to the Golf Course;
- ▶ Motor Vehicle Maintenance depot (British Car Auctions Site (Ambrosetti)), Richborough – No soil exposures could be seen at the site but the site manager escorting the Amec Foster Wheeler staff indicated that the site was on very soft ground. Numerous depressions and hollows were noted in the operations yard area at the front of the maintenance facility, but it was not clear whether these were due to settlement of the underlying ground. The site is next to the River Stour estuary and is crossed by the Minster Stream, a tributary of the Stour. It could be seen at the nearby Kingfisher Sluice that the outfall of the Minster Stream into the river channel is choked with large accumulations of mud and silt at low tide. It is therefore reasonable to surmise that these estuarine/alluvial silts may at least partially underlie the Ambrosetti site.



Picture 26 View of cliffs behind Pegwell Bay Hoverport, note apparent instability of cliff

Much of the rest of the walkover was in areas of farmland or roadside locations where no geotechnical observations of note were made.

The observed geological strata appears to broadly concur with the geology indicated to be present in the British Geological Survey data.

A Geotechnical Risk Register (GRR) has been developed to show the degree of risk attached to various ground related aspects of the development. The purpose of the register is to provide an assessment of the risk posed to the project by the potential geotechnical risks and hazards identified in this study, and to identify suitable mitigation

measures to control the risk to an acceptable level. The risk register should be treated as a live document and therefore reviewed, refined and developed in line with project stages. In this way, the geotechnical risk register can continue to be used to update and manage geotechnical risks, as the project progresses.

The GRR has been developed in general accordance with the guidance presented in the ICE/DETR Document 'Managing Geotechnical Risk' (2001) and is presented in Appendix G.

### 4.3 Potential Geotechnical Constraints

The following potential geotechnical constraints have been identified during the study.

The assessments have allowed a broad appreciation of the geological context of the area surrounding the proposed cable route, but the geotechnical assessment has thus far been limited to a review of historical borehole logs for developments offset from the proposed route, sufficient for the purposes of the EIA. The following potential geotechnical hazards have been identified during the study:

- ▶ Lack of information on ground and groundwater conditions within the proposed route corridor and surrounding buffer area;
- ▶ Information on site history indicates the presence of Made Ground potentially placed by uncontrolled tipping (Pegwell Bay (on-site and off-site) and Richborough), which can lead to variation of contents and composition and thus contamination and potentially aggressiveness to construction materials;
- ▶ Available boreholes indicate the presence of several metres of cohesive materials of variable nature and consistency. This material is susceptible to settlements and therefore, if their presence is confirmed along the route corridor, this would have an impact on the design alignment and depth of the cable as well as foundation design and construction of the substation and associated ancillary facilities;
- ▶ Potential for development of artesian water due to perched groundwater and water from Secondary Aquifers;
- ▶ Potential for groundwater contamination;
- ▶ Potential for cliff instability and debris movement at Pegwell Bay, off site to the north of the proposed landfall; and
- ▶ Potential for several metres of putrescible waste at former landfill sites, either side of Sandwich Road.

As part of the post-consent detailed design process for a finalised cable route, intrusive SI would be required to provide information on the geotechnical ground and groundwater conditions along the route. This is needed to characterise and evaluate the review findings and observations outlined above and thereby allow a reliable assessment of the geotechnical issues and constraints, and their consideration in design and construction.

## 5. Conclusions and Recommendations

### 5.1 Conclusions

#### 5.1.1 Contamination

Potentially significant contamination risks have been identified associated with the following on-site and off-site sources:

- ▶ Fuel storage and use (existing and historical tanks and contamination);
- ▶ Landfills;
- ▶ Infilling and Made Ground;
- ▶ Historical power station;
- ▶ Waste water treatment plant;
- ▶ Maintenance activities;
- ▶ Historic hoverport;
- ▶ Transport supply and cargo handling activities; and
- ▶ Pyrotechnics manufacturing works.

Risks to future site users (maintenance workers) range from low to high. High risks have been identified associated with the landfills and asbestos from the pipeline and maintenances activities.

Risks to coastal waters resulting from the installation of the cable and substation range from very low to moderate. Moderate risks have been identified associated with the landfills.

Risks to groundwater resulting from the installation of the cable and substation range from very low to moderate. Moderate risks have been identified associated with the landfills.

Risks to the River Stour resulting from the installation of the cable and substation range from very low to moderate.

Risks to property resulting from the installation of the cable and substation range from moderate/low to high. High risks have been identified associated with the landfills.

#### 5.1.2 Geotechnical

A preliminary assessment of the geological and geotechnical ground conditions on-site sufficient for the purposes of the EIA has been undertaken. The study has identified a number of geotechnical issues and potential constraints which require further characterisation and evaluation as part of the post consent design process, as follows:

- ▶ Lack of information on ground and groundwater conditions along the proposed route;

- ▶ Localised areas of Made Ground potentially formed by uncontrolled tipping of variable, aggressive and contaminated materials;
- ▶ Potential for artesian groundwater;
- ▶ Potential for groundwater contamination; and
- ▶ Presence of several metres of unconsolidated cohesive materials which are variable in nature and composition, but are largely soft and highly compressible, and therefore likely to impact on cable route corridor and foundation design and construction.

All of the above can have deleterious effects on infrastructure placed within such materials.

## 5.2 Recommendations

This Phase 1 report constitutes a preliminary characterisation of the receiving environment to support the EIA. The site reconnaissance and desk-based assessment has identified a number of potential contaminant linkages and geo-environmental constraints associated with the proposed onshore development. In order to gain a more detailed understanding of these constraints, further SI and assessment would be required post-consent as part of the detailed design process, prior to construction.

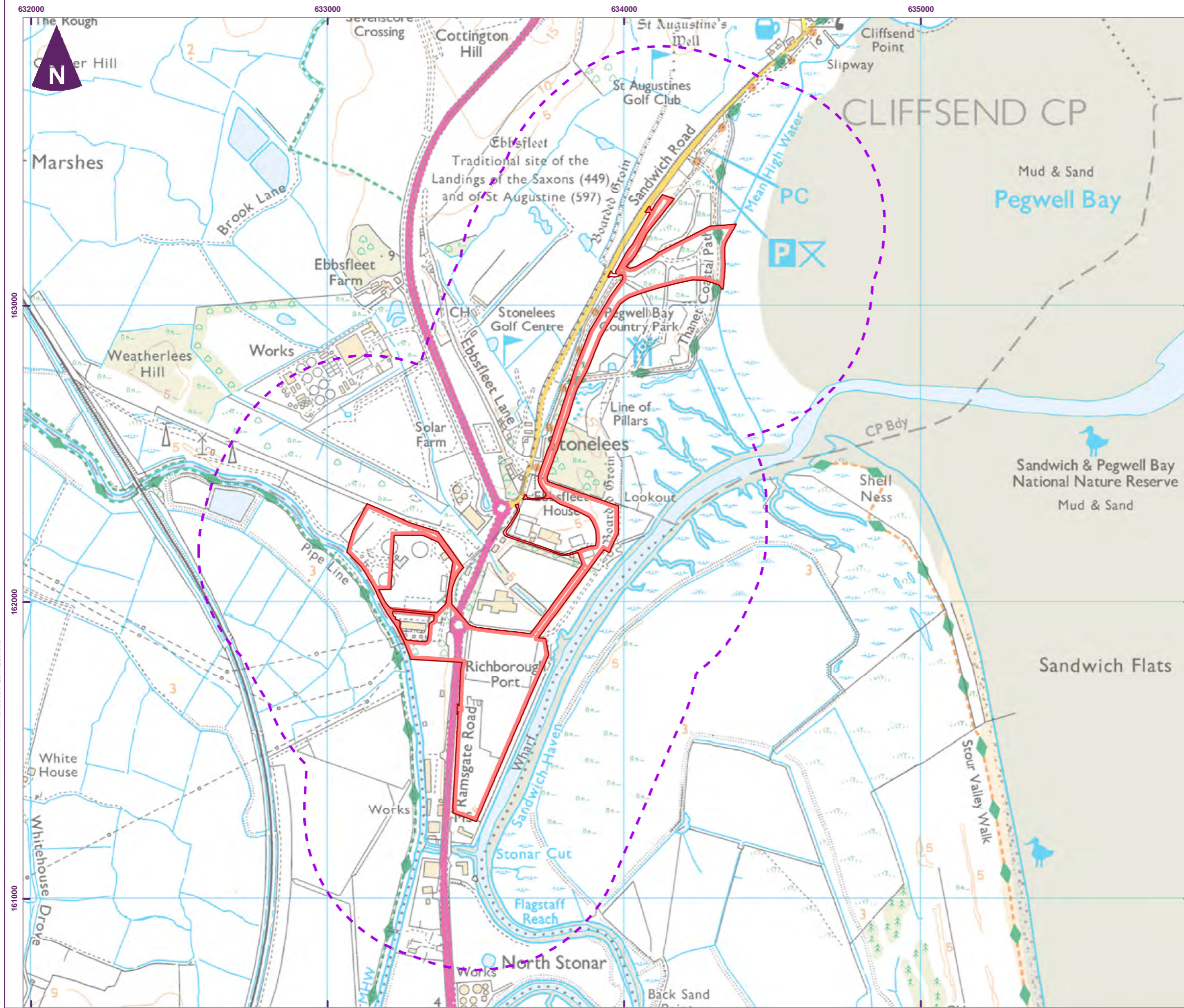
Whilst geotechnical issues are not a material planning consideration, geotechnical data would be required to inform the detailed design of the proposed development. An intrusive SI is recommended to provide further characterisation of the site's ground and groundwater conditions as part of the detailed design process, prior to construction. A detailed UXO threat and risk assessment should be carried out prior to any intrusive works.

Adopting a combined geo-environmental approach at the outset, making use of the SI undertaken to support planning and to also obtain initial geotechnical data, would avoid duplication of efforts and present a saving in terms of cost and programme. The combined approach would also assist in highlighting any ground abnormalities, although it is acknowledged that more detailed geotechnical assessment would be required once the final form and layout of the proposed development is confirmed.

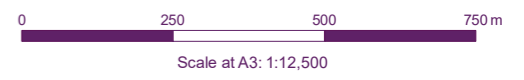


# Figures





- Onshore Red Line Boundary
- Study site

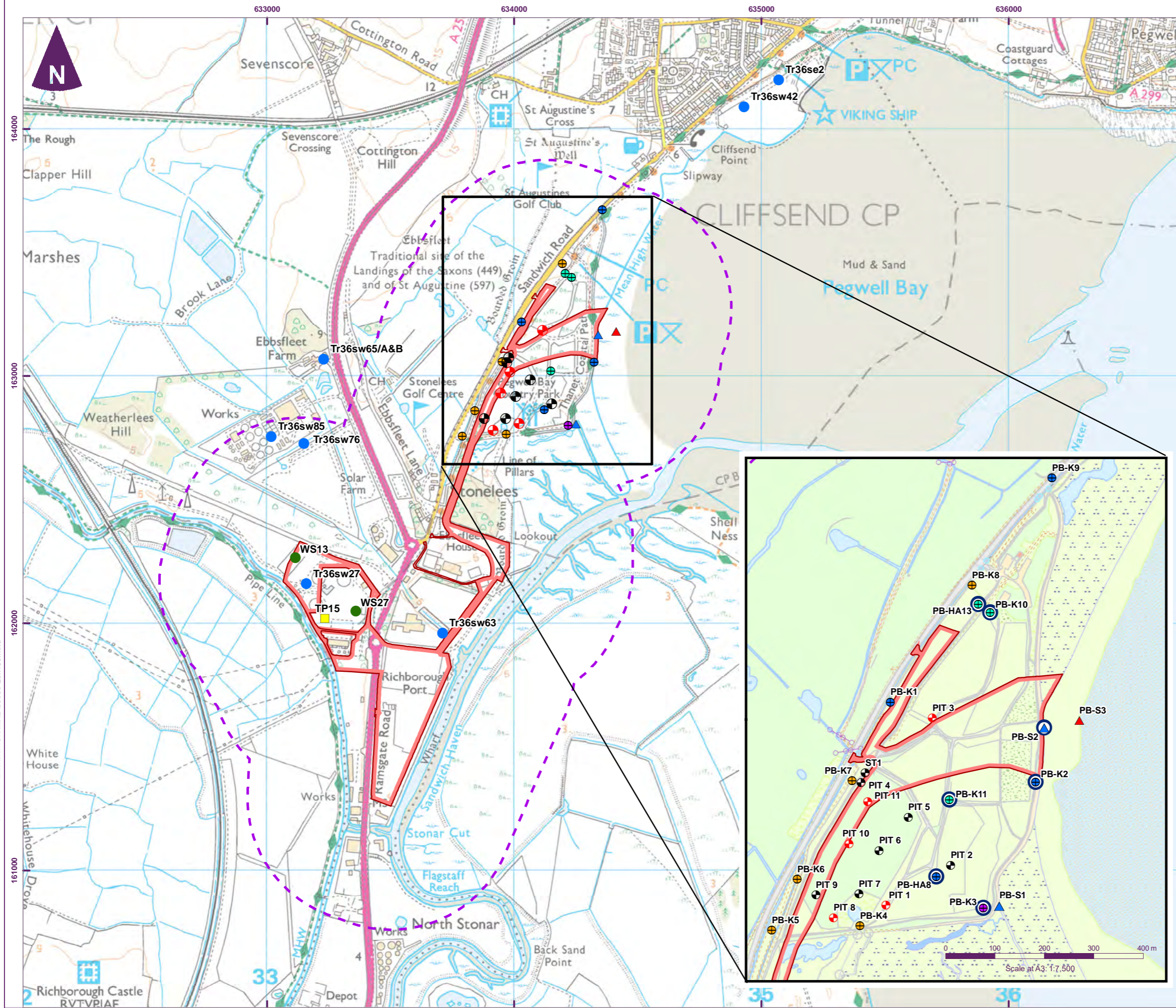


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**VATTENFALL**

Thanet Extension  
Offshore Wind Farm  
Phase 1  
Geo-environmental  
Desk Study

**Figure 6.1.1**  
**Site Boundary and Study Site**



**Key**

- Onshore Red Line Boundary
- Study site
- BGS borehole location

**URS borehole / trial pit points**

- Boreholes with visual/olfactory signs of contamination
- Trial pit with the highest PID reading

**Babtie trial pit points**

- ⊕ Soil pit
- ⊕ Soil pit with contaminant concentration above the threshold values

Note: Pit 7 refuse encountered at 0.3mbgl

**Waterman borehole, monitoring well and surface water sampling points**

- ⊕ Gas
- ⊕ Gas and Groundwater
- ⊕ Gas and Leachate
- ⊕ Groundwater
- ▲ Sediment Sample
- ▲ Surface Water
- Highest contaminant concentration recorded

0 200 400 600 800 m  
Scale at A3: 1:15,000



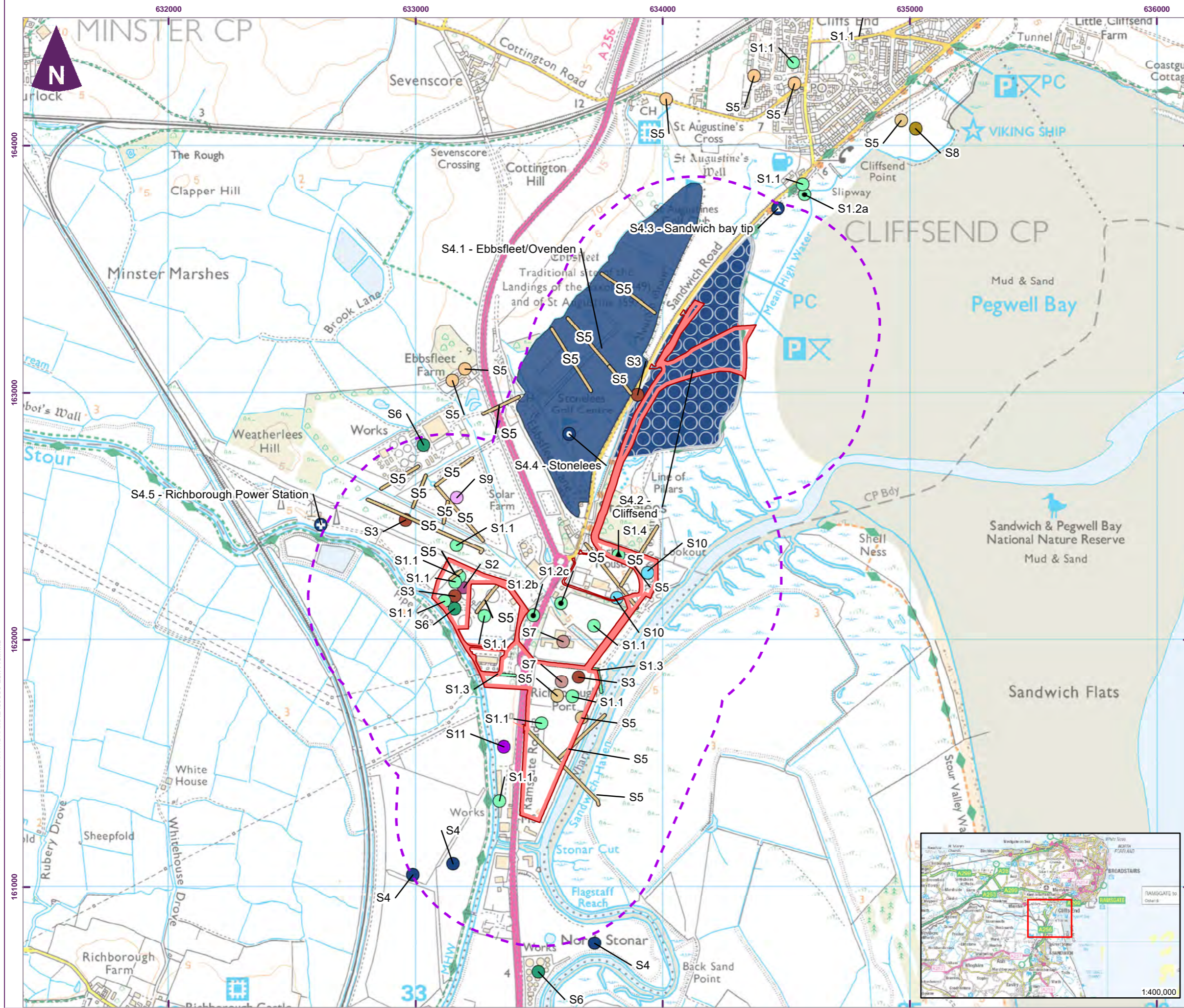
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Thanet Extension  
Offshore Wind Farm  
Phase 1  
Geo-environmental  
Desk Study

**Figure 6.1.2**  
BGS, URS 2009, Babtie 2000 and  
Waterman 2016 sampling/monitoring  
locations



**Key**

- Onshore Red Line Boundary
- Study site

**Potential Contamination Source**

- S1.1 - Fuel installation and usage tanks
- S1.2a-c - Active petrol filling station
- ▲ S1.4 - Oil Pollution incident at Pfizer Sports Ground
- S1.3 - Former oil pipeline
- S2 - Power station
- S3 - Made ground associated with past and current site uses
- S4 - Landfill / inert soil transfer station
- S4.1 - Landfill: inert waste (Ovenden) Special Waste (Ebbsfleet)
- S4.2 - Landfill: inert and household waste (Cliffsend)
- ▲ S4.3 - Landfill: inert waste (Sandwich bay tip)
- S4.4 - Inert soil transfer station (Stonelees)
- + S4.5 - Landfill: inert waste (Richborough Power Station)
- S5 - Area of infilled ground
- S5 - Area of infilled ground
- S6 - Waste Water Treatment Works (WWTW)
- S7 - Maintenance activities
- S8 - Hoverport (disused)
- S9 - Energy park
- S10 - Transport supply and cargo handling (Port Richborough)
- S11 - Pyrotechnics Manufacturing Works

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Scale at A3: 1:15,000

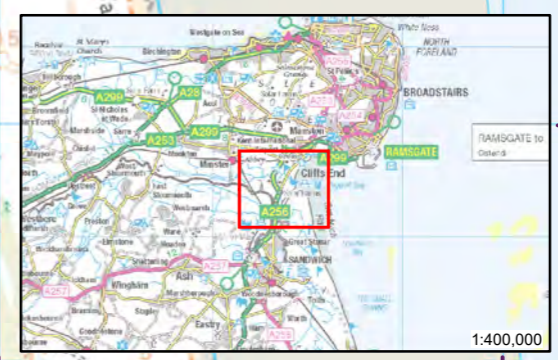
Client

**VATTENFALL**

Thanet Extension Offshore Wind Farm Phase 1 Geo-environmental Desk Study

**amec foster wheeler**

**Figure 6.13**  
**Potential Contamination Sources**



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# Appendix A Envirocheck Report