

East Anglia THREE

Appendix 19.1

Preliminary Risk Assessment East Anglia ONE Onshore Cable Route and Converter Station

Environmental Statement

Volume 3

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East Anglia Offshore Wind Limited

Preliminary Risk Assessment

East Anglia One Onshore Cable Route and Converter Station

Report reference no. 41388-PRA (01)

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RSK GENERAL NOTES

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East Anglia One Onshore Cable Route and Converter Station

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GLOSSARY

ALC	– Agricultural Land Classification
BGC	- British Geological Survey
CGS	- County Geodiversity Sites
CSM	- Conceptual Site Model



PRA – Preliminary Risk Assessment

RIGS - Regionally Important Geological and Geomorphological Sites



EXECUTIVE SUMMARY

RSK Environment Limited (RSK) was commissioned by East Anglia Offshore Wind Limited to undertake a Preliminary Risk Assessment (PRA) of contamination impacts for onshore works connected to an offshore windfarm known as the East Anglia ONE Windfarm. This document is a preliminary risk assessment of the land currently under consideration for the Onshore Cable Route (including the landfall location) and the proposed Converter Station Compound. This document forms Appendix 20.1 to *Volume 3, Chapter 20 of the Environmental Statement*.

The landfall site is at Bawdsey, near Ipswich, on the coast just north of the River Deben estuary. The Preferred Onshore Cable Corridor passes westwards, crossing the River Deben, and northwards, until it reaches Martlesham, beyond which the route passes in a westerly direction across the north of Ipswich. After crossing the A14 north west of Ipswich the route then travels in a south-westerly direction to reach the converter Station Refined Area of Search near Bamford.

The preliminary risk assessment includes details of soils, geology and agricultural land classification along the Preferred Onshore Cable Corridor and at the Preferred Converter Station Location. Information is provided as to former and current minerals extraction pits, as well as areas of landfilling and potential land contamination.

The initial conceptual site model for the project indicates a large number of potential contamination sources, mainly related to disused/infilled pits, landfills and agricultural activities. Close to the landfall there is also a former RAF station. Other potential sources include a historical tramway, railways, a lime kiln, substations, a decoy pond, sewage works, mineral extraction sites and slurry lagoons.

Plausible contamination pathways include direct contact, inhalation, migration of contaminants in groundwater, root uptake and chemical attack on infrastructure.

Potential sensitive receptors have been identified to be adjacent site users, vegetation, shallow and deep groundwater, surface water features, buildings and infrastructure. An extensive review of pollutant linkages was undertaken, resulting in the following list requiring further assessment:

- Risk to neighbouring site users from direct contact with organic or inorganic soil/ groundwater contamination, from unexploded ordnance and from inhalation or explosion of hazardous ground gases;
- Risk to perched groundwater from contact with organic or inorganic soil/ groundwater contamination or from landfill leachate;
- Risk to aquifers from contact with organic or inorganic soil/groundwater contamination or from landfill leachate;
- Risk to surface waters from contact with organic or inorganic soil/groundwater contamination or from landfill leachate;
- Risk to Site of Special Scientific Interest, Special Protection Area and Ramsar site due to contact with organic or inorganic soil/groundwater contamination or landfill leachate.



The PRA concludes that a number of sites require further assessment in the form of site walkovers, to allow determination to be made of any areas where an intrusive investigation would be recommended. The following table indicates the locations requiring further consideration.

Table indicating areas of potential concern (site walkover required)

Site	Location and grid reference	
1	Bawdsey Site of Special Scientific Interest I	Bawdsey 6350 2390
2	RAF Bawdsey radar station	Bawdsey 6345 2389
3	Old sand extraction pit	Bawdsey 6348 2390
4	Electricity substation	Bawdsey 6344 2391
5+6	Areas of artificial ground	6312 2398 and 6307 2396
7	Decoy pond	River Deben 6305 2394
8	Kirton Lodge Landfill Site	Kirton 6292 2397
9	Historical tramway	Kirton 6283 2400
10	Pit located close to tramway	Kirton 6283 2399
11	Area of artificial ground	Kirton Lodge 6281 2409
12+13	Areas of artificial ground	Martlesham Creek 6263 2472 and 6263 2475
14	The Great Eastern railway line	Martlesham 6263 2476
15	Two mineral extraction sites	Seckford Hall 6250 2484 and 6247 2479
16	Historical landfill site	Culpho Hall 6204 2485
17	Sand pit/ landfill site	Tuddenham St Martin 6194 2491
18	Old sand pit/area of possible disturbed ground	Lark's Hill 6188 2490
19	Gravel pit	Akenham 6155 2492
20	Rise Hall landfill site	Akenham 6144 2488
21	Area of works	Claydon 6135 2490
22	Chalk pit	Claydon 6129 2488
23	Railway adjacent to River Gipping	Claydon 6124 2490
24	Mineral extraction site	Bramford 6123 2482
25	Blood Hill landfill site	Bramford 6113 2485
26	Works or depot (type unknown)	Little Blakenham 6113 2480
27	Electricity substation	Bramford 6101 2459

(Note: a walkover of these sites was undertaken for the purposes of the Environmental Statement and the findings are reported in Volume 3, Chapter 20.)

The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.



1 INTRODUCTION

East Anglia Offshore Wind Limited (EAOW) has been awarded a licence by The Crown Estate to develop approximately 7,200MW of wind capacity off the coast of East Anglia (referenced as the East Anglia Zone).

The East Anglia Zone will be developed as a number of individual windfarms, each dependent on securing the relevant statutory consents and approvals. The first windfarm is proposed in an area in the south of the East Anglia Zone and is known as East Anglia ONE Windfarm (East Anglia ONE).

As part of the works required to complete an environmental assessment of the site, RSK Environment Ltd (RSK) has been commissioned to complete an Environmental Statement report. A preliminary risk assessment (PRA) is necessary to determine any significant issues relating to ground conditions at the landfall site, along the proposed Onshore Cable Route and at the Converter Station Refined Area of Search. This document reports the findings of the PRA. Information provided in this PRA will also be used in completing the Environmental Statement chapter relating to ground conditions.

For additional details relating to the scope and details of the project, reference should be made to the full Environmental Statement report.

This PRA report is subject to the RSK Environment Limited service constraints provided as Appendix B to this report.

1.1 Aims and scope

The aim of this preliminary risk assessment is to enable an evaluation of the ground conditions of the landfall site, Onshore Cable Route, Converter Station Compound and surrounding area in terms of its history and environmental setting. From this information, a conceptual site model (CSM) can be produced to fully inform future site investigation design and to aid in final micro-siting the landfall location, Onshore Cable Route and Converter Station Compound.

The scope of the PRA desk study and the layout of this report has been designed with consideration of CLR11 (Environment Agency, 2004), BS 10175: 2011 (BSI, 2011) and PPS23 (ODPM, 2004), plus guidance on land contamination reports issued by the Environment Agency (2010).

The scope of works for the assessment included a review of geological, hydrogeological and hydrological information and a review of a commercially available environmental database (envirocheck), including historical plans. This information will be used to develop an initial CSM to consider any potentially complete pollutant linkages (see Section 3.7).

1.2 Existing reports

RSK has not been provided with any existing reports by the client relating to ground conditions or site investigation work in the area of the project.



2 THE SITE

2.1 Proposed development

The construction of the East Anglia ONE offshore windfarm in the southern area of the East Anglia Zone, would necessitate to completion of associated onshore electrical transmission works. This would include bringing the offshore cable onshore at the landfall location and laying the onshore cable to reach the appointed National Grid substation, plus the construction of an onshore converter station (near to the substation) in order to transform the current from DC to AC for onwards transmission. At the time of writing, it is possible that horizontal directional drilling (HDD) would be an option for bringing the cable onshore, beyond which a trench will be excavated to house the cable. The converter station will located near to an existing electricity substation.

2.2 Site location and description

For the purposes of this PRA, the project has been discussed as three discrete sections: the landfall location, the Preferred Onshore Cable Corridor, and the Converter Station Refined Area of Search. These are shown on *Volume 6, Figure 20.1.1*.

2.2.1 Landfall

The landfall location is between the mouth of the River Deben to the south and Bawdsey to the north. Initially, an area approximately 1.7km long from north to south was being considered, to allow the ES process to identify the most suitable landfall location. This site was centred on grid reference 635 239. Since the first revision of this PRA, the landfall location has been refined and now centres on grid reference 6346 2385.

2.2.2 Preferred Onshore Cable Corridor

The Preferred Onshore Cable Corridor would come onshore at the selected landfall location and proceed in a west-north-westerly orientation, parallel to the River Deben. The Onshore Cable Route would cross the river approximately 3km inland, head west for a further 2km before travelling roughly parallel to the River Deben as far north as Broom Hill (south Woodbridge). The route would then proceed in a roughly westerly direction to the north of Ipswich, crossing the A14 and the railway to the north west of Ipswich before turning south westwards to reach the Converter Station Compound.

2.2.3 Converter Station Refined Area of Search

The Preferred Converter Station is located approximately 2.5km west of Bramford, close to an existing electricity substation.



3 PRELIMINARY RISK ASSESSMENT (PRA)

3.1 Review of aerial photographs

Aerial photographs are available for this project, and as part of the PRA these have been analysed to identify any potential issues relating to ground conditions or contamination. Comments from this analysis are provided below.

3.1.1 Landfall

Beyond the beach and cliffs present along the coast, the landfall site mainly comprises agricultural land. However, there is also evidence of buildings and hardstanding associated with former RAF use of the land east of Middle Barn for a radar station.

3.1.2 Preferred Onshore Cable Corridor

The Preferred Onshore Cable Corridor primarily crosses agricultural land, with several golf courses. There was some evidence of flooding on land close to where Queen's Fleet meets the River Deben (approximate grid reference 6335 2390). Areas of rough or disturbed ground were noted at the following locations:

- An area of rough looking land (grid reference 6277 2437) close to the track leading from a nearby works, located 100m to the west of the Preferred Onshore Cable Corridor corridor.
- An area of possible disturbed ground to the west of the A12 (grid reference 6253 2481).
- A small area of possible disturbed land between Tuddenham Hall and Larks Hill (grid reference 6194 2491).
- Possible area of mineral extraction (grid reference 6122 2490) close to a lake in an area where mineral works are present outside the Preferred Onshore Cable Corridor to the west (approximately 100m).

There is also a site that appears to be some kind of works or depot within the proposed corridor south of Little Blakenham, at grid reference 6113 2480.

3.1.3 Converter Station Refined Area of Search

The aerial photographs of the Converter Station Refined Area of Search show agricultural land. There is an electricity substation bordering much of Converter Station Refined Area of Search.



3.2 Ground conditions

3.2.1 Soils

3.2.1.1 Landfall

The predominant soil unit present along the coastline within the potential landfall area is the Swaffham Prior soil association (map code 511e). Details of this soil unit are provided in Table 1.

3.2.1.2 Preferred Onshore Cable Corridor

The Preferred Onshore Cable Corridor crosses a number of different soil associations. The major units encountered between the landfall and Tuddenham St Martin are Newport 2 (551e) and Newport 4 (551g) associations. There is also a significant area of Wallasea 1 marine alluvium (813f) on both banks of the River Deben and close to Martlesham Creek. Other soil associations present over smaller distances in the eastern half of the route are the Wick 3 association (541t), Burlingham 3 association (572p) and the Hanslope association (411d).

West of Tuddenham St Martin, the dominant soil association are the Melford and Ludford associations (map codes 571o and 571x respectively). Smaller areas of the following associations are crossed by the western end of the Preferred Onshore Cable Corridor: Burlingham 3 (572p), Beccles 1 (711r), Hanslope (411d), Midelney (813a) and Swaffham Prior (511e).

Further details of the soil associations present along the Preferred Onshore Cable Corridor are provided in Table 1.

3.2.1.3 Converter Station Refined Area of Search

The soil association present within the Converter Station Refined Area of Search is the Hanslope association (411d). Further details are provided in Table 1.

Table 1: Soil associations crossed by the Preferred Onshore Cable Corridor and at the Converter Station Refined Area of Search

Code	Soil association	Soil description	Parent material
511e	Swaffham Prior	This is a well drained loamy soil, present over chalky rubble. It is at a slight risk of water erosion.	Chalky drift or chalk
551e	Newport 2	Deep well drained sandy soil with a risk of water and wind erosion.	Glaciofluvial drift over Cretaceous sand or Red Crag deposits
551g	Newport 4	Deep well drained sandy soil with a risk of wind erosion.	Glaciofluvial drift



Code	Soil association	Soil description	Parent material
813f	Wallasea 1	Deep stoneless clayey soils. Locally some peaty horizons. Groundwater controlled by ditches and pumps. Flat land, at slight risk of flooding.	Marine alluvium
541t	Wick 3	Deep well drained loamy, often stoneless soils. Risk of water erosion.	Glaciofluvial and aeolian drift
572p	Burlingham 3	Deep loamy soils.	Chalky till and glaciofluvial drift
411d	Hanslope	Slowly permeable clayey soils with slight risk of water erosion.	Chalky till
571o	Melford	Deep well drained loamy over clayey soils.	Chalky till
571x	Ludford	Deep well drained loamy and sandy soils, locally flinty with some underlying gravel in places. Slight risk of water erosion.	Glaciofluvial drift
711r	Beccles 1	Slowly permeable loamy over clayey soils, subject to seasonal waterlogging.	Chalky till
813a	Midelney	Stoneless clayey soils, mostly overlying peat. Variable groundwater, often controlled by ditches/pumps. Flat land with local flooding risk.	River alluvium over peat

3.2.2 Agricultural Land Classification

The Agricultural Land Classification (ALC) system classifies land into five grades. The 'best and most versatile land' is defined as Grades 1 and 2.

3.2.2.1 Landfall

The land within the landfall area is all classified as ALC Grade 2.

3.2.2.2 Preferred Onshore Cable Corridor

The ALC along the majority of the Preferred Onshore Cable Corridor is Grade 3. However, there are smaller areas of Grade 2 located around Falkenham and Kirton, east of the A12, north of Playford, north of Tuddenham St Martin, between Akenham and Westerfield and from Little Blakeham to the Converter Station Refined Area of Search.

3.2.2.3 Converter Station Refined Area of Search

The majority of the Converter Station Refined Area of Search is ALC Grade 2, although there is an area of ALC Grade 3 land across the northern area of the Converter Station Refined Area of Search.



3.2.3 Geology

3.2.3.1 Overview

The solid geology of the area around the project is principally chalk, predominantly overlain by superficial deposits of London Clay and outcrops of Red Crag deposits towards the coastal areas. In some areas, glacial sands and gravels are present above the clay. The Bawdsey Cliffs Site of Special Scientific Interest (SSSI), as shown on *Volume 6, Figure 20.2* in the landfall area, is designated specifically for its geological interest.

No areas of worked ground, made ground, infilled ground or landscaped ground are indicated on the geological maps for the Preferred Onshore Cable Corridor or converter station.

There are no regionally important geological and geomorphological sites (RIGS) within the study area. Two sites listed as County Geodiversity Sites (CGS) have been indicated, but neither of these are close enough to the Preferred Onshore Cable Corridor or Converter Station Refined Area of Search to require further consideration.

3.2.3.2 Landfall

Superficial geology

Geological mapping for this area shows that no superficial deposits are present close to the coastline.

Solid geology

The key issue of geological interest at the landfall is the Bawdsey Cliffs SSSI. This is located between Bawdsey Martello Tower and Bawdsey Manor and is a 2km section of early Pleistocene Red Crag deposits (see *Volume 6, Figure 20.2*).

The Red Crag formation comprises medium to coarse grained shelly sand, and is present unconformably overlying the Thames Group. The Thames Group deposits are up to 90m thick and are predominantly clay (including the London Clay).

Geological structure

The unconsolidated nature of the Red Crag units in this area is likely to mean that the coastline is vulnerable to erosion.

Borehole records

Publically available borehole records available via the BGS website are available slightly north and south of the proposed landfall area. These indicate the presence of sand (thought to be derived from the Red Crag formation) overlying clay (London Clay). Table 2 provides additional details of each of the geological units.

3.2.3.3 Preferred Onshore Cable Corridor

Superficial geology

The majority of the Preferred Onshore Cable Corridor is underlain by superficial deposits of some kind. However, superficial deposits are absent where bedrock units outcrop at



the landfall, and at several locations between Falkenham and Playford. Small outcrops of bedrock are present close to the River Gipping.

Superficial deposits present between the landfall and Falkenham are mud deposits formed in tidal flats, channels and saltmarshes. Glaciofluvial sands and gravels from the Kesgrave Formation are extensive between Kirton and Martlesham, and occur sporadically in smaller areas between Martlesham Creek and the converter station.

River terrace deposits are present around Martlesham Creek and the River Gipping. Boulder clay is encountered extensively across the western end of the route, from Playford to the converter station. Small areas of alluvium are present around the River Gipping and close to the watercourse near Larks Hill. Further details of all the superficial units are provided in Table 2.

Solid geology

As mentioned in the landfall section, the Red Crag formation is present outcropping along the coast. Further inland the Thames Group is found, underlying marine and tidal flat deposits around the River Deben, and at outcrop around Falkenham. Further outcrops of Red Crag are shown on mapping north of Falkenham, recurring intermittently as the route continues northwards parallel to the River Deben. London Clay deposits are present at the surface in a small number of locations, generally along the line of watercourses (Kirton Creek and Martlesham Creek), and are present below the superficial deposits for much of the western end of the route. Chalk Group deposits are present around the River Gipping, outcropping for small areas on both sides. There is some presence of Lambeth Group and Thanet Sand Formation deposits beneath superficial deposits near Akenham and around the converter station area. Subcrops of the Red Crag Formation are also noted around Tuddenham St Martin and south of Little Blakenham.

Geological structure

The geological structure of the area is typified by roughly horizontal beds of the various bedrock units (a slight dip towards the east is present). Unconformities are present between units from the differing depositional periods. (An unconformity is a change in rock sequence indicating a break in sedimentation, commonly accompanied by erosion of rocks below the break). River channels cutting through the bedrock units are common. No folding or faulting of units is noted on the geological mapping for this area.

Boreholes

One borehole is located just on the western bank of River Deben (grid reference 32080 38390). Clay was present from the surface to 9.4m below ground level (bgl). The clay was shelly near the surface, with increasing quantities of organic material at greater depth. Sand deposits containing gravel and flints was present to the base of the borehole at 10m.

A borehole record located close to the sewage works between Kirton and Falkenham (29270 39360) indicates topsoil over clay to 2m bgl. Fine grained red brown shelly sand is encountered to nearly 8m bgl (Red Crag), below which London Clay is proved to 9.1m.



The borehole record close to Hemley (28330 42370) indicates the presence of 0.9m of glacial sands and gravels, over pebbly, shelly sand from the Red Crag Formation to 7.6m bgl and London Clay to 8.8m bgl.

A borehole to the south of Martlesham (26110 45850) shows glacial sand and gravel to 3.4m bgl, Red Crag sands to 6.1m bgl and London Clay to the base at 9.1m bgl.

A borehole close to Little Bealings (23750 48390) shows the presence of Red Crag sands to 3m bgl, with London Clay just encountered in the base of the hole.

North of Playford (20770 48730), the borehole record indicates 4.1m of glacial sands and gravels over sand from the Red Crag formation (to a depth of 10.7m bgl), then London Clay at the base.

South of Akenham Hall (16310 48720), the borehole record shows a thicker presence of boulder clay, reaching a depth of 10.7m bgl. The underlying bedrock is the Lambeth Group and Thanet Sands, proved to a depth of 17.1m bgl.

Close to the Ipswich bypass (13455 48710), the borehole indicates sand and gravel (river terrace gravels) to 2m bgl, overlying chalk units from the Upper Chalk, proved to a depth of 10m.

West of the River Gipping (11860 48459) topsoil is present over layers of sand and sand/gravel to a depth of 7.1m bgl. The bedrock encountered is chalk.

A borehole on Back Lane in Bramford (10670 47400) shows boulder clay to 8.8m bgl, glacial sands and gravels to 11.6m bgl, sand and clay beds to 15.2m bgl and Upper Chalk to 15.8m bgl.

3.2.3.4 Converter Station Refined Area of Search

Superficial geology

The superficial deposit found at the surface beneath the whole of the Converter Station Refined Area of Search is boulder clay.

Solid geology

The bedrock unit underlying the boulder clay beneath the majority of the Converter Station Refined Area of Search is the London Clay. The northernmost extent of the site is underlain by units from the Lambeth Group and Thanet Sands Formation.

Further information is provided in Table 2.

Boreholes

The closest borehole to the Converter Station Refined Area of Search (10280 46450) shows superficial deposits of sands, gravels and boulder clay to a depth of 18.6m bgl, over units from the London Clay to 25m bgl and chalk beds to 70.1m bgl.

Table 2: Geological units crossed by the Preferred Onshore Cable Corridor and Converter Station Refined Area of Search

Geological unit	Description	General location
Superficial geology		



Geological unit	Description	General location
River terrace deposits	Sand and gravel	Kirton Creek, Martlesham Creek, River Gipping
Marine and coastal zone deposits	Mud deposits formed in tidal flats, channels and saltmarshes	River Deben
Kesgrave formation	Glaciofluvial sands and gravels	Extensive areas between Falkenham and Playford, and further presence on rest of route
Alluvium	Sandy, silty clay	Martlesham Creek, River Gipping
Boulder clay	Diamicton, stony, sandy clay rich in chalk and flint pebbles	Between Playford and converter station
Bedrock geology		
Red Crag formation	Coarse-grained, poorly sorted, cross-bedded, abundantly shelly sands. Typically yellow or reddish brown. Basal bed of rounded flint pebbles	Outcrops irregularly along much of eastern half of Preferred Onshore Cable Corridor
Thames Group (including London Clay)	Predominantly a silty clay/ mudstone, with some sandy silts and sandy clayey silts of marine origin. The London Clay is a fine, sandy, silty clay	Underlies superficial deposits from landfall to Akenham
Chalk Group	Chalk, with or without flint and discrete limestone and fossil-rich beds	Around River Gipping
Lambeth Group and Thanet Sand Formation	There are various units within this group, which mainly comprise sand with flint pebbles, clay (often with interposed sand beds) and interlayered beds of sands, silts and clays	Western end of route and beneath northern part of Converter Station Refined Area of Search

3.2.4 Quarrying and mineral extraction

Evidence has been sought to identify any mining and quarrying operations, past and present, which have taken place in the vicinity of the onshore electrical transmission works. The sources of information referenced in this element of the desk study include:

- Envirocheck report;
- Suffolk Minerals and Waste; and
- Geological maps.

Superficial glacial sand and gravel deposits are known to have been subject to extraction in this area of Suffolk. The London Clay has also been extracted in some areas through the excavation of brick pits. Disused quarries, sand pits and brick pits may have been used as landfill sites (see Section 3.2.5).



Mineral extraction sites are shown on *Volume 6, Figure 20.1.3*. The Envirocheck Report does not include details of any mineral extraction sites within the preferred onshore cable corridor. There is no indication of any quarrying or mineral extraction on the geological plans.

Data on mineral extraction sites provided by Suffolk Minerals and Waste are provided below:

- Proposed mineral extraction site close to Waldringfield Heath (there is an operational landfill site at this location currently), approximately 500m west of the preferred onshore cable corridor (grid reference 6261 2446)
- Two mineral extraction sites at Seckford Hall, close to where the route crosses the A12 (approximate grid references 6250 2484 and 6247 2479)
- Church Lane Quarry mineral extraction site (6126 2498)
- Blood Hill mineral extraction site (6112 2485)
- Mineral extraction site on Loraine Way, Bramford (extensive site area), in the area of the existing sand and gravel pits which are just outside of the preferred onshore cable corridor (grid reference at centre 6123 2482).

3.2.5 Land stability

Geological information provided within the Envirocheck report indicates the following with regards to land stability hazards:

- There is a potential risk from collapsible and compressible ground stability hazards within the Converter Station Refined Area of Search, and for approximately 1km eastwards.
- A small length of the Preferred Onshore Cable Corridor close to Bramford (approximately 1km north of the converter station) is potentially affected by ground dissolution hazards.
- Landslide and running sand ground stability hazards are identified on the Envirocheck mapping at the same location as the collapsible and compressible ground hazards indicated above, around the Converter Station Refined Area of Search and 1km to the east.
- There are no areas indicated to be at risk from hazards relating to shrinking or swelling clays along the Preferred Onshore Cable Corridor or around the Converter Station Refined Area of Search.
- There is an area indicated to be potentially at risk from radon, and this coincides with the area around the Converter Station Refined Area of Search and 1km eastwards.

3.2.6 Landfilling and potential land contamination

3.2.6.1 Pollution incidents to controlled waters

The following pollution incidents affecting controlled waters are held in the Envirocheck database:



- A category 3 (minor) incident affecting River Fynn in 1997 relating to fire fighting foam (grid reference 6256 2478);
- A category 2 (significant) incident near River Fynn in 1993 (unknown contaminant, grid reference 6251 2482); and
- A category 3 incident in the River Gipping in 1992 (grid reference 6130 2490).

As the land along much of the preferred onshore cable corridor is agricultural, there is the potential for both diffuse and point sources of pollution to be present.

Within the built-up areas along the preferred onshore cable corridor, there is the potential for historical contamination to be present from railways and highways, in-filled quarries and sand and brick pits.

Known landfill sites are shown on Figure 20.1.3 and are listed in Table 3 below.

Table 3: Known landfill sites

Site Name/Location	Grid Reference	Comments	Approximate distance from Preferred Onshore Cable Corridor Centreline	Source
Kirton Lodge Landfill Site	6292 2397	No current licence. Operated by G H and J G Paul. Licensed from 1989 to 1993 for inert and commercial waste	250m	EA website, accessed March 2012
Waldringfield Quarry	6263 2447	An operational landfill site licensed for non-biodegradable wastes. Licensed to Brett Aggregates Ltd. Waste management no. 70723, Environmental Permit ref no. EAEPR\EA/EPR/CP31 95NW/A001	800m at nearest point	EA website, accessed March 2012
Caravan site, Waldringfield	6262 2453	No current licence and no details of dates, waste types, etc.	500m	EA website, accessed March 2012
Culpho Hall, north of Playford	6204 2486	This site is listed as an historical landfill. No current licence. Operator, dates of operation and waste types accepted not known (pre-1974).	Crossed by Preferred Onshore Cable Corridor	EA website, accessed March 2012



Site Name/Location	Grid Reference	Comments	Approximate distance from Preferred Onshore Cable Corridor Centreline	Source
Former sand pit, Tuddenham St Martin	6194 2493	No current licence. Operated by J H Weavers Ltd from Dec 1948 to Dec 1991 for inert, industrial and commercial waste	Crossed by Preferred Onshore Cable Corridor	EA website, accessed March 2012
Rise Hall Farm, Akenham	6144 2488	No current licence. Previously licensed to H W Hall and Son. Received inert and commercial waste (soil and inert mineral waste) from Dec 1990 to Dec 1995	80m at nearest point	EA website, accessed March 2012
Blood Hill Pit, Somersham Road, Bramford	6111 2484	Licensed to Cubitt Theobald (Long Melford) Ltd. Non-hazardous landfill, waste management no. 70694, Environmental Permit ref no. EAEPR\EA/EPR/TP379 5NJ/A001. Closed landfill site being monitored by Suffolk County Council	180m at nearest point	EA website, accessed March 2012
Blood Hill, Bramford	6112 2450	Just to north of currently licensed site at Blood Hill Pit. Operated 21 July 1983 to 31 Oct 1992 by Suffolk County Council. Accepted industrial, commercial and household waste. No licence number	120m at nearest point	EA website, accessed March 2012

3.2.6.2 Historical Pits

There are also several locations where symbols on historical mapping indicate the presence of old pits, as itemised below:

- Old pit at grid reference 6301 2392, shown on historical map from 1928, approximately 400m from Preferred Onshore Cable Corridor;
- Old Crag Pit, shown at grid reference 6296 2393 on map from 1928, around 100m from Preferred Onshore Cable Corridor;



- Pit located close to tramway at grid reference 6283 2399, shown on historical map from 1884-1888, around 50m from the Preferred Onshore Cable Corridor;
- Ranglin's Pit, shown on 1928 mapping at grid reference 6278 2425, approximately 120m from Preferred Onshore Cable Corridor;
- Old sand pit near Seckford Hall, present at grid reference 6250 2485, around 150m from Preferred Onshore Cable Corridor. Shown on 1904 mapping;
- Sand pit shown on historical mapping from 1884 to 1887 at grid reference 6204 2486, approximately 100m from Preferred Onshore Cable Corridor;
- Disused pit at grid reference 6195 2491, shown on 1980 to 1989 maps approximately 50m from Preferred Onshore Cable Corridor;
- Old sand pit shown on 1904 mapping at grid reference 6188 2490, approximately 50m from Preferred Onshore Cable Corridor; and
- Area of works located around grid reference 6135 2490, shown on 1980 to 1989 maps around 100m from the Preferred Onshore Cable Corridor.

3.2.6.3 *Potentially contaminated sites*

For the western part of the Preferred Onshore Cable Corridor (under Mid Sussex District Council jurisdiction) there are no sites that are currently listed on MSDC's Contaminated Land Register. However, according to consultation with MSDC, there are a number of potentially contaminated sites in this district area, which are listed below along with potentially contaminated sites on the Suffolk County Council register.

- Gravel pit, Akenham Hall Farm, Akenham (grid reference 6155 2492), marked as a gravel pit on historical maps;
- Rise Hall landfill, Akenham (see Table 3);
- Sand and gravel pit south of Claydon Court, Old Ipswich Road, Claydon (6131 2493). Noted as having been reinstated as a road;
- Chalk pit north of Mockbeggars Hall, Claydon (6129 2488). This site is a chalk pit on historical maps;
- Blood Hill Landfill Site, Somersham Road, Bramford (see Table 3);
- Slurry lagoons at Cottage Farm, Little Blakenham (6116 2492);
- Household waste recycling facility, Blood Hill, Somersham Road (6111 2484); and
- Site adjacent to main landfill site on Somersham Road, Bramford (6112 2485). There is an application in Suffolk County Council records for a landfill site.

3.2.6.4 *Potential contamination in Converter Station Refined Area of Search*

Within the Converter Station Refined Area of Search there are no sites listed on the MSDCs Contaminated Land Register, nor are there any landfill sites listed.

Babergh District Council (BDC) has confirmed that there are no landfill sites located within the vicinity of the Converter Station Refined Area of Search.



The adjacent Bramford electricity substation may be a potential source of contamination e.g. from fuels and oils associated with the transformers.

3.3 Hydrogeology

3.3.1 Aquifer characteristics

Bedrock along the majority of the Preferred Onshore Cable Corridor is classified as a principal aquifer. The Converter Station Refined Area of Search is underlain by bedrock that is a secondary aquifer, and further small areas of secondary aquifers are present around Akenham and Martlesham.

The superficial deposits are secondary A aquifers around the River Gipping and close to Tuddenham St Martin. A larger extent of secondary A aquifer is present between Playford and Hemley. Very minor areas of secondary B aquifer are present between Playford and Little Bealings.

It is possible that localised perched water may also be present along the Preferred Onshore Cable Corridor and at Converter Station Refined Area of Search, due to the presence of any clay materials, or if any made ground is present.

The presence of low permeability boulder clay at relatively shallow depths in some areas, while restricting downwards migration, may increase the potential for lateral migration of shallow groundwater (and therefore mobile contamination, if present).

3.3.2 Vulnerability of groundwater resources

The groundwater vulnerability classification is mainly high across the Preferred Onshore Cable Corridor, with less extensive areas of intermediate vulnerability.

3.3.3 Licensed groundwater abstraction

A number of licensed groundwater abstractions are present along the Preferred Onshore Cable Corridor, as listed below:

- Groundwater abstraction for the same location as above, with the licence number 7/35/10/*G/0018; and
- Licence held by Blakenham Farms for spray irrigation from water abstracted from the ground, located at 6130 2490 (licence number 7/35/10/*G/0178).

3.3.4 Groundwater Source Protection Zones

In terms of aquifer protection, the EA adopts a three-fold classification of source protection zones (SPZ) for public supply abstraction wells.

- Zone 1 or 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source;



- Zone 2 or 'outer protection zone' is defined by a 400-day travel time to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants; and
- Zone 3 or 'total catchment' is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Information provided on the Environment Agency website indicates that three inner zones (zone 1) are present which are crossed by the Preferred Onshore Cable Corridor. These are located near Culpho Hall, north of Akenham and north of the Converter Station Refined Area of Search (approximate distances crossed by the route are 600m, 1.75km and 1.5km respectively). Two further zone 1 areas are present south of the Preferred Onshore Cable Corridor, one at Tuddenham St Martin and one at Westerfield (see Figure 20.4).

Between Great Bealings and the Converter Station Refined Area of Search, the route crosses either the zone 1 areas detailed above, or is within the outer zone (zone 2).

The eastern end of the Preferred Onshore Cable Corridor, from the landfall to Great Bealings, does not cross any groundwater protection zones.

3.4 Hydrology

3.4.1 Surface watercourses

The Preferred Onshore Cable Corridor crosses both fluvial and estuarine systems with associated creek networks and marshlands. The principal watercourses of interest are the River Deben, River Fynn and Lark, and the River Gipping, in addition to a number of smaller watercourses and drainage channels including a number of marshland areas to the East of the River Deben.

3.4.2 Flood zones

The EA has flood zone maps available on their website for much of England and Wales. The latest EA Flood Zone Mapping indicates that the majority of the Preferred Onshore Cable Corridor is located in Flood Zone 1, i.e. an area of low flood risk, but sections of the corridor are located in Flood zones 2 (medium risk) and Flood zone 3 (high risk of flooding) according to their proximity to watercourses.

It should be noted that a flood risk assessment has been produced as a separate document (see *Volume 3, Appendix 22.1* and *Volume 3, Appendix 22.2*).

3.4.3 Discharge consents

In terms of water quality, nine discharge consents are located close to the Preferred Onshore Cable Corridor, primarily for the release of final/treated sewage effluent from domestic properties or golf clubs. Receiving waters include the North Sea, the River Fynn, a tributary of the River Deben, the River Gipping, a ditch into the River Gipping and there is one consent for discharge to land.



3.4.4 Surface water abstractions

The Envirocheck report shows the following licensed surface water abstractions:

- Surface water abstraction (from a stream) for spray irrigation, licensed to G H and J G Paul at grid reference 6281 2413 (licence number 7/35/10/*s/077);
- Surface water abstraction for spray irrigation from Marsh Drain, licensed to Notcutts at grid reference 6258 2479 (7/35/10/*s/067);
- Surface water abstraction licensed to Mr G W Pipe at grid reference 6195 2491 (licence number 7/35/10/**/023); and
- Licence for surface water abstraction, held by Suffolk County Council for remedial river/wetland support at 6123 2490 (licence number An/035/0008/005).

In general terms a private water supply (PWS) is a 'non-mains' supply. Its source can be surface water or groundwater e.g. a well, borehole, spring or rainwater collection system. PWSs are usually found in remote areas of the country, where a mains supply is not feasible or practicable. The Private Water Regulations 2009 requires local authorities to keep a record of all PWSs in their area of jurisdiction.

This issue will be further assessed within the Water Resources and Flood Risk assessment for this project (*Volume 3, Chapter 22*).

3.5 History of landfall, Preferred Onshore Cable Corridor and Converter Station Refined Area of Search

The history of the area has been determined from an assessment of historical maps available within the Envirocheck report. Where possible, historical features have been tied in with features still present on current mapping or aerial photography.

3.5.1 Landfall

The oldest mapping, from 1884 to 1888 shows the area to be largely put to agricultural use, with field boundaries, drains and some small dwellings. An old sand pit is marked at approximate grid reference 6348 2390. There is no significant difference to 1957 or 1975 map editions.

The map edition from 1990 to 1993 shows an electricity substation just north of Middle Barns.

It should be noted that the presence of a military base is not shown on historical mapping for security reasons. However, the area formerly used as the RAF radar station can be seen on current aerial photography and current mapping, with hardstanding tracks and helicopter pads and a number of small buildings. It is understood this facility was constructed some time prior to 1937, at which date it was operated by the RAF.

Due to the military history of this area, it is possible that unexploded ordnance may be present.



3.5.2 Preferred Onshore Cable Corridor

Table 4: History of land along Preferred Onshore Cable Corridor

Date of Historical Plan	Scale	Comments
1881	1:2,500	The Preferred Onshore Cable Corridor mainly crosses agricultural land, the railway near Martlesham has been constructed by this date, as has the railway adjacent to the River Gipping. An area of possible disturbed ground is present at 6188 2490.
1884 to 1888	1:10,560 scale	This map edition primarily shows the route to cross agricultural land, with drainage present at intervals along the Preferred Onshore Cable Corridor. Old pits are present (as detailed in Section 3.2.5.2) and a tramway is indicated close to Kirton. The Great Eastern railway line is present north of Martlesham.
1903 to 1904	1:2,500	No significant changes
1904	1:10,560	No significant changes
1926 to 1927	1:2,500	No significant changes
1928	1:10,560	No significant changes
1957 to 1958	1:10,000	Nursery north of railway line. Some additional small dwellings.
1965 to 1970	1:2,500	No significant changes
1971 to 1972	1:10,000	Decoy pond labelled just west of River Deben crossing (grid reference 6305 2394). Sewage works just west of the Preferred Onshore Cable Corridor to the south of railway crossing
1973	1:2,500	No significant changes
1975	1:10,000	Sewage works east of Kirton appear
1980 to 1989	1:10,000	No significant changes
1983	1:10,000	No significant changes
1990	1:2,500	No significant changes
1990 to 1993	1:10,000	Decoy pond still labelled near River Deben

3.5.3 Converter Station Refined Area of Search

A review of historical maps indicates that the Converter Station Refined Area of Search is primarily agricultural, with no evidence of other previous historical uses. The adjacent land is an electricity substation, which has been present since between the 1958 and 1971 map editions.

3.6 Sensitive land uses

The proposed onshore electrical transmission works all lie within a nitrate vulnerable zone. As detailed previously, the landfall is within Bawdsey Cliffs SSSI, designated due to geological interest.



The Deben Estuary, where it is crossed by the Preferred Onshore Cable Corridor east of Falkenham, and at Martlesham Creek, is a Ramsar site, SSSI and special protection area (SPA).

A comprehensive evaluation of ecological receptors is outside the scope of this report.

3.7 Initial conceptual site model

The information presented in the earlier sections of this report has been used to compile an initial conceptual site model (CSM). The identified potential sources of contamination and associated contaminants and receptors have been considered with plausible pathways that may link them. The resulting potential pollutant linkages are considered in Section 3.7.4 and Table 6. The risk classification has been estimated in accordance with information provided in Appendix C to this report.

3.7.1 Potential contamination sources

Due to the nature of the project, a large number of potential contamination sources have been identified along the Preferred Onshore Cable Corridor and around the Converter Station Refined Area of Search. These are detailed in Table 5, beginning at the landfill and working westwards towards the Converter Station Refined Area of Search.

Table 5: Potential sources and types of contamination

Potential sources	Location	Contaminants of concern
On-site historical		
Areas of artificial ground	Both banks of River Deben (6312 2398 and 6307 2396)	Unknown
Historical tramway	East of Kirton	Possible made ground, fuels, fuel oils, PAHs, ash
Area of artificial ground	Kirton Lodge, 6281 2409, just within Preferred Onshore Cable Corridor	Unknown
Areas of artificial ground	Both banks of Martlesham Creek (6263 2472 and 6263 2475)	Unknown
An area of rough looking/ disturbed land	Newbourne, just within or on boundary of Preferred Onshore Cable Corridor corridor. Grid reference 6277 2437	Possible made ground? Unknown contamination
Former sand pit, also indicated to be a historical landfill site and appearing as a small area of possible disturbed land on aerial photos	Crossed by Preferred Onshore Cable Corridor. Tuddenham St Martin, between Tuddenham Hall and Larks Hill (grid reference of centre 6194 2491)	Possible infill material of unknown composition, landfill gases and leachate



Potential sources	Location	Contaminants of concern
Chalk pit	North of Mockbeggars Hall, west of Claydon (6129 2488), within Preferred Onshore Cable Corridor/area for HDD construction	Possible infill material of unknown composition
On-site present day		
The Great Eastern railway line	Crossed by the Preferred Onshore Cable Corridor just north of Martlesham	Possible presence of made ground, fuels, PAHs, PCBs, solvents
Railway adjacent to River Gipping	Crossed by the Preferred Onshore Cable Corridor west of Claydon	Possible presence of made ground, fuels, PAHs, PCBs, solvents
Diffuse and point sources of pollution from current agricultural activities	Majority of Preferred Onshore Cable Corridor	Possible fuels, oils, solvents, herbicides, pesticides, heavy metals and chemicals
Off-site historical		
RAF Bawdsey radar station	West of proposed landfall location	Unexploded ordnance, fuels
Old sand pit	Just west of the proposed landfall area, approximate grid reference 6348 2390	Possible infill material of unknown composition
Electricity substation	Approx 100m south of the Preferred Onshore Cable Corridor, close to landfall (north of Middle Barns)	Fuel oils, lubricating oils, heavy metals, polychlorinated biphenyls (PCBs), PAHs
Old pit	Falkenham, at grid reference 6301 2392, approximately 400m from the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
Old Crag Pit	Falkenham, grid reference 6296 2393, around 100m from the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
Decoy pond	Just west of River Deben crossing (grid reference 6305 2394), approx 150m south of the Preferred Onshore Cable Corridor	Potential unexploded ordnance
Kirton Lodge Landfill Site	Kirton, 6292 2397, licensed from 1989 to 1993 for inert and commercial waste, approximately 100m from the Preferred Onshore Cable Corridor. Also noted as having been used prior to 1974 when regulation was introduced	Possible infill material of unknown composition, landfill gases and leachate
Pit located close to tramway	East of Kirton at grid reference 6283 2399, around 200m from the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
Sewage works	East of Kirton, 6286 2397, approx 300m to west of the Preferred Onshore Cable Corridor	Acids, alkalis, PCBs, methane, carbon dioxide and hydrogen sulphide



Potential sources	Location	Contaminants of concern
Ranglin's Pit	Between Newbourne and Hemley, grid reference 6278 2425, approximately 120m from the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
An area of possible disturbed ground	North of Preferred Onshore Cable Corridor (approx 200m). West of the A12 north of Martlesham (grid reference 6253 2481).	Possible made ground? Unknown contamination.
Category 2 (significant) pollution incident	Close to River Fynn, 1993. To east of Preferred Onshore Cable Corridor by approx 200m (grid reference 6251 2482)	Unknown contaminant
Old sand pit	Near Seckford Hall, grid reference 6250 2485, around 150m from the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
Historical landfill site/ former sand pit	Culpho Hall, north of Playford (6204 2485). Approx 100m-150m north of the Preferred Onshore Cable Corridor.	Landfill gases, leachates, infill material of unknown composition
Old sand pit/ area of disturbed ground	West of Lark's Hill, grid reference 6188 2490, approximately 50m south of the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
Gravel pit	Akenham Hall Farm, Akenham (grid reference 6155 2492), approx 100m north of the Preferred Onshore Cable Corridor	Possible infill material of unknown composition
Rise Hall landfill site	Akenham (6144 2488), landfill for soil and inert mineral waste. Two licences, both surrendered. Approx 200m to south of the Preferred Onshore Cable Corridor	Landfill gases, leachate
Former lime kiln	Wood House, Church Lane, Claydon (6139 2498). Greater than 800m from the Preferred Onshore Cable Corridor	Alkaline soils, PAHs, metals
Area of works	Adjacent to A14, west of Claydon, grid reference 6135 2490, just outside the Preferred Onshore Cable Corridor to south.	Fuel, made ground
Sand and gravel pit	South of Claydon Court, Old Ipswich Road, Claydon (6131 2493). Approx 150m north of the Preferred Onshore Cable Corridor. Noted as having been reinstated as a road	Possible infill material of unknown composition
Possible area of mineral extraction	South of Little Blakenham (grid reference 6122 2490) close to a lake in an area where mineral works are present outside the Preferred Onshore Cable Corridor to the west (approximately 700m).	Made ground, fuel and fuel oils
Blood Hill Landfill Site	Somersham Road, Bramford (6113 2485). Closed landfill site being monitored by SCC. Approx 300m west of the Preferred Onshore Cable Corridor.	Landfill gases and leachate
Off-site present day		



Potential sources	Location	Contaminants of concern
Waldringfield Quarry operational landfill site	Waldringfield Heath, approximately 1km west of the Preferred Onshore Cable Corridor (grid reference 6261 2446)	Landfill gases, leachate
Sewage works just west of route to south of railway crossing	Approx 100m south of where the Preferred Onshore Cable Corridor crosses railway at Martlesham	Acids, alkalis, PCBs, methane, carbon dioxide and hydrogen sulphide
Two mineral extraction sites	Seckford Hall, close to where the Preferred Onshore Cable Corridor crosses the A12 (approximate grid references 6250 2484 and 6253 2486). Approx 100m north of Preferred Onshore Cable Corridor	Made ground, fuel and fuel oils
Church Lane Quarry mineral extraction site	800m north of Preferred Onshore Cable Corridor in Claydon (6126 2498)	Made ground, fuel and fuel oils
Slurry lagoons	350m north of Preferred Onshore Cable Corridor, Cottage Farm, Little Blakenham (6116 2492)	Nitrates, ammoniacal nitrogen
Blood Hill mineral extraction site	South of Little Blakenham, 200m west of Preferred Onshore Cable Corridor (6112 2485)	Made ground, fuel and fuel oils
Household waste recycling facility	Blood Hill, Somersham Road (6111 2484), approx 300m west of Preferred Onshore Cable Corridor	Fuels
Works or depot (type unknown)	Just west of the Preferred Onshore Cable Corridor, south of Little Blakenham, at grid reference 6113 2480	Fuels, metals, PAHs
Mineral extraction site	Lorraine Way, Bramford, in the area of the existing sand and gravel pits which are just outside the Preferred Onshore Cable Corridor (grid reference at centre 6123 2482).	Made ground, fuel and fuel oils
Electricity substation	Adjacent to Converter Station Refined Area of Search	Fuel oils, lubricating oils, heavy metals, polychlorinated biphenyls (PCBs), PAHs
<p>Notes</p> <p>Infill material in old pits may include the following: heavy metals, ash, clinker, sulphates, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), asbestos etc.</p> <p>Distances given are approximate, based on available details from historical mapping.</p>		

3.7.2 Plausible Contamination Pathways

The plausible pathways are summarised below:

- Direct contact (soil, dust ingestion/inhalation and dermal contact);



- Inhalation of ground gas and soil gas;
- Vertical and lateral migration of contamination in groundwater (including leaching);
- Root uptake; and
- Chemical attack of infrastructure (including cable) and buildings.

3.7.3 Potential Sensitive Receptors

Sensitive receptors relating to this project include:

- Adjacent site users;
- Vegetation;
- Perched groundwater beneath the Preferred Onshore Cable Corridor/converter station;
- Deeper groundwater (principal, secondary A and secondary B aquifers);
- Surface watercourses (including manmade drainage); and
- Buildings and infrastructure (proposed and existing).

Please note that construction workers have not been identified in the CSM as receptors because risks can be appropriately managed through health and safety procedures, including CDM regulations.

3.7.4 Potentially complete pollutant linkages

The outline CSM is shown schematically in Figure 20.1.5 and an estimate of the risk associated with each linkage is summarised in Table 6. The risk classification has been undertaken in accordance with CIRIA C552 (Rudland et al., 2001), a summary of which is included in Appendix C to this report.

Table 6: Risk estimation for potentially complete pollutant linkages

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Risk and justification
Organic and inorganic contamination within soil and groundwater, associated with: <ul style="list-style-type: none"> ▪ possible fill materials in former pits; ▪ mineral extraction; ▪ works/depots sites; ▪ railways, tramways; ▪ military bases; and ▪ electricity substations 	Adjacent site users	Direct contact	Likely: neighbours close to route in some locations	Medium: potential for damage to human health	Moderate: direct contact with neighbours is possible if contamination is mobilised by this construction project
		Migration in groundwater followed by direct contact	Low likelihood: possible but not certain that pathway may exist	Medium: potential for damage to human health	Moderate/Low: small possibility of contact if contaminated water is mobilised by construction work
	Vegetation	Root uptake	Likely: vegetation along the route could be affected by soil/groundwater contamination	Minor: damage to vegetation is not likely to be significant	Low: impact to vegetation not likely to be significant
	Perched groundwater	Vertical and lateral migration	Likely: presence of shallow perched water extremely likely and any migration of impact will affect this	Medium: potential for pollution of sensitive water resources	Moderate: potential for impact to sensitive water body
	Aquifers (including Zone 1 and Zone 2 SPZs and NVZ)	Vertical and lateral migration	Likely: construction in areas of contamination could result in migration to aquifers	Medium: potential for pollution of sensitive water resources	Moderate: potential for impact to sensitive water body
	Surface watercourses	Vertical and lateral migration	Likely: due to extent of construction work, it is possible impact will pass into a surface watercourse	Medium: potential for pollution of sensitive water resources	Moderate: potential for impact to sensitive water body
	Buildings and infrastructure	Chemical attack	Low likelihood: possible but unlikely due to routing of cable away from buildings as far as possible	Minor: potential for damage to buildings or structures	Very low: low sensitivity of receptor means this is not a significant linkage
Unexploded ordnance associated with the military base and the decoy pond	Adjacent site users	Direct contact	Low likelihood: presence of unexploded ordnance not considered likely, but possible	Severe: if encountered, potential for explosions to result in death	Moderate: although unlikely, potential effect is severe, so linkage remains moderately significant
	Buildings and infrastructure	Direct contact	Low likelihood: presence of unexploded ordnance not considered likely, but possible	Mild: explosion could result in severe damage to buildings or structures	Low: risk is considered low as buildings/structures are repairable should linkage occur
Potential contaminated groundwater and leachate from landfill sites	Adjacent site users	Migration in groundwater followed by direct contact	Low likelihood: possible but not certain that pathway may exist	Medium: potential for damage to human health	Moderate/Low: small possibility of contact if contaminated water is mobilised by construction work
	Vegetation	Root uptake	Likely: vegetation along the route could be affected by groundwater contamination	Minor: damage to vegetation is not likely to be significant	Low: impact to vegetation not likely to be significant
	Perched groundwater	Vertical and lateral migration	Likely: presence of shallow perched water extremely likely and any migration of impact/leachate will affect this	Medium: potential for pollution of sensitive water resources	Moderate: potential for impact to sensitive water body
	Aquifers (including Zone 1 and Zone 2 SPZs and NVZ)	Vertical and lateral migration	Likely: construction in areas of contamination could result in migration to aquifers	Medium: potential for pollution of sensitive water resources	Moderate: potential for impact to sensitive water body
	Surface watercourses	Vertical and lateral migration	Likely: due to extent of construction work, it is possible impact from groundwater or leachate will pass into a surface watercourse	Medium: potential for pollution of sensitive water resources	Moderate: potential for impact to sensitive water body
	Buildings and infrastructure	Chemical attack	Low likelihood: possible but unlikely due to routing of cable away from buildings as far as possible	Minor: potential for damage to buildings or structures	Very low: low sensitivity of receptor means this is not a significant linkage
Hazardous ground gases associated with landfill sites and gases associated with sewage works	Adjacent site users	Direct contact	Low likelihood: unlikely that conditions will occur where gases build up to sufficient levels to be hazardous to human health or able to cause an explosion	Severe: if gases do build up, result could be asphyxiation or explosion resulting in death	Moderate: potentially severe outcomes mean that linkage has moderate risk despite low likelihood
	Buildings and infrastructure	Direct contact	Low likelihood: unlikely that conditions will occur where gases build up to sufficient levels to cause an explosion	Mild: potential for significant harm to buildings/structures	Low: low sensitivity of receptor means that linkage has low risk
Inorganic and organic contamination associated with sewage works: Organic contamination associated with slurry lagoons	Adjacent site users	Migration in groundwater followed by direct contact	Unlikely: possible but not certain that pathway may exist	Medium: potential for damage to human health	Low: small possibility of contact if contaminated water is mobilised by construction work
	Vegetation	Root uptake	Low likelihood: vegetation along the route could be affected by soil/groundwater contamination	Minor: damage to vegetation is not likely to be significant	Very low: impact to vegetation not likely to be significant
	Perched groundwater	Vertical and lateral migration	Low likelihood: presence of shallow perched water extremely likely and any migration of impact will affect this	Medium: potential for pollution of sensitive water resources	Moderate/Low: potential for impact to sensitive water body
	Aquifers (including Zone 1 and Zone 2 SPZs and NVZ)	Vertical and lateral migration	Low likelihood: construction in areas of contamination could result in migration to aquifers	Medium: potential for pollution of sensitive water resources	Moderate/Low: potential for impact to sensitive water body
	Surface watercourses	Vertical and lateral migration	Low likelihood: due to extent of construction work, it is possible impact will pass into a surface watercourse	Medium: potential for pollution of sensitive water resources	Moderate/Low: potential for impact to sensitive water body

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Risk and justification
	Buildings and infrastructure	Chemical attack	Unlikely: possible but unlikely due to routing of cable away from buildings as far as possible	Minor: potential for damage to buildings or structures	Very low: low sensitivity of receptor means this is not a significant linkage
	SSSI, SPA and Ramsar site	Vertical and lateral migration in groundwater	Low likelihood: route passes through these areas, so mobilisation of contamination will affect them	Medium: potential for damage to sensitive ecosystems	Moderate/Low: deleterious impact on sensitive areas is possible if existing contamination is present

All pollutant linkages detailed in the table above have been allocated risk classifications. For the project under consideration, no risks of high or very high were identified. The potential pollutant linkages with a risk of moderate, and therefore requiring further consideration, are:

1. Risk to neighbouring site users from direct contact with organic or inorganic soil/groundwater contamination;
2. Risk to perched groundwater from contact with organic or inorganic soil/groundwater contamination;
3. Risk to aquifers from contact with organic or inorganic soil/groundwater contamination;
4. Risk to surface waters from contact with organic or inorganic soil/groundwater contamination;
5. Risk to SSSI, SPA and Ramsar site due to contact with organic or inorganic soil/groundwater contamination;
6. Risk to neighbouring site users from unexploded ordnance;
7. Risk to perched groundwater from contaminated groundwater or landfill leachate;
8. Risk to aquifers from contaminated groundwater or landfill leachate;
9. Risk to surface watercourses from contaminated groundwater or landfill leachate;
10. Risk to SSSI, SPA and Ramsar site due to contact with contaminated groundwater or landfill leachate; and
11. Risk to neighbouring site users from inhalation or explosion of hazardous ground gases.

Further work should be undertaken to assess these linkages to determine whether the source, pathway and receptor are all present, and whether the linkage is likely to be complete or not.

It should be noted that there is a potential risk from unexploded ordnance around the RAF station and decoy pond during site investigation and construction work. Due to the agricultural nature of most of the land, it is unlikely that there will be a risk from unexploded ordnance during any site walkovers that will be undertaken.



4 CONCLUSIONS AND RECOMMENDATIONS

The PRA has identified a number of potentially complete pollutant linkages with risk categories of moderate. These require further investigation to determine whether the pollutant linkage is complete.

It is recommended that site walkover visits should be made to potentially contaminating sites within close proximity of the Preferred Onshore Cable Corridor (ie within 100m of the centreline) and at the Converter Station Refined Area of Search. A list of sites of potential contamination concern requiring site visits is provided in Table 7. These sites are also shown on Figure 20.1.6.

In addition to inspecting the site for current evidence of pollution, it is also important to determine the exact position of the sites, in relation to the proposed Preferred Onshore Cable Corridor. It is likely that some locations shown on historical map editions may not be completely accurate when compared to the most up to date maps, and this may prove that a site thought to be crossed by the route is slightly further away, or vice versa.

Further to completion of site walkovers, it will be necessary to design a site investigation to provide additional site specific information with respect to areas where there is concern that complete pollutant linkages may result in moderate (or greater) risks to human health, or to other sensitive receptors such as controlled water or SSSIs.

Table 7: Locations of potential contamination concern

(Note: a walkover of these sites was undertaken for the purposes of the Environmental Statement and the findings are reported in Volume 3, Chapter 20.)

Site	Location and grid reference	Site ref.
On-site historical		
Areas of artificial ground	Both banks of River Deben (6312 2398 and 6307 2396)	5+6
Historical tramway	East of Kirton (6283 2400)	9
Area of artificial ground	Kirton Lodge, 6281 2409	11
Areas of artificial ground	Both banks of Martlesham Creek (6263 2472 and 6263 2475)	12+13
Sand pit/ landfill site	Tuddenham St Martin (grid reference of centre 6194 2491)	17
Old sand pit/area of possible disturbed ground	Lark's Hill, crossed by proposed route at 6188 2490	18
Chalk pit	North of Mockbeggars Hall, west of Claydon (6129 2488), within Preferred Onshore Cable Corridor corridor	22
On-site present day		
Bawdsey SSSI*	Landfall (6345 2389)	1



Site	Location and grid reference	Site ref.
The Great Eastern railway line	Crossed by the route just north of Martlesham (6263 2476)	14
Railway adjacent to River Gipping	Crossed by the route west of Claydon (6124 2490)	23
Off-site historical		
RAF Bawdsey radar station	West of landfall (6345 2389)	2
Old sand pit	West of landfall area, approximate grid reference 6348 2390	3
Electricity substation	Just north of Middle Barns, north of landfall area (6344 2391)	4
Decoy pond	Just west of River Deben crossing (grid reference 6305 2394), approx 150m south of route	7
Kirton Lodge landfill site	Kirton, 6292 2397, licensed from 1989 to 1993 for inert and commercial waste, approximately 100m from Preferred Onshore Cable Corridor	8
Pit located close to tramway	East of Kirton at grid reference 6283 2399, around 200m from the Preferred Onshore Cable Corridor	10
Historical landfill site	Culpho Hall, north of Playford (6204 2485)	16
Gravel pit	Akenham Hall Farm, Akenham (grid reference 6155 2492)	19
Rise Hall landfill site	Akenham (6144 2488), landfill for soil and inert mineral waste. Approx 200m to south of Preferred Onshore Cable Corridor	20
Area of works	Adjacent to A14, west of Claydon, grid reference 6135 2490, just outside Preferred Onshore Cable Corridor to the south.	21
Blood Hill landfill site	Somersham Road, Bramford (6113 2485). Closed landfill site being monitored by SCC	25
Off-site present day		
Two mineral extraction sites	Seckford Hall, close to where the route crosses the A12 (approximate grid references 6250 2484 and 6253 2486)	15
Mineral extraction site	Lorraine Way, Bramford, in the area of the existing sand and gravel pits which are just outside the cable corridor (grid reference at centre 6123 2482).	24
Works or depot (type unknown)	Just west of proposed cable corridor, south of Little Blakenham, at grid reference 6113 2480 (possibly connected with Blood Hill landfill site)	26
Electricity substation	Adjacent to Converter Station Refined Area of Search (6101 2459)	27



Site	Location and grid reference	Site ref.
<p>Notes</p> <p>* Although not of concern as a source of contamination, Bawdsey SSSI is included in this table as it requires a site visit due to the geological importance of the site. Site reference numbers relate to locations indicated on Figure 20.6.</p>		

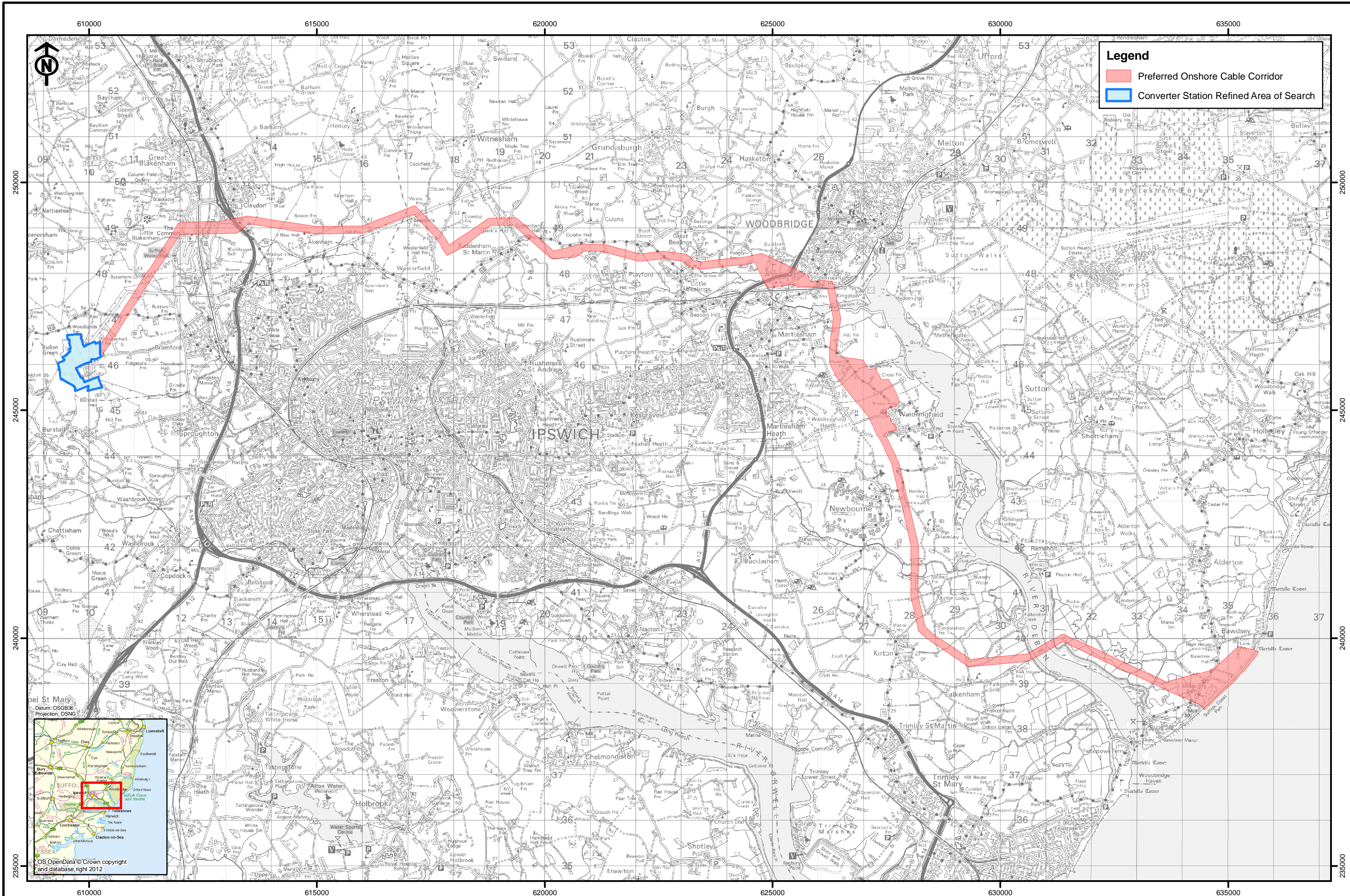


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FIGURES



Legend

- Preferred Onshore Cable Corridor
- Converter Station Refined Area of Search



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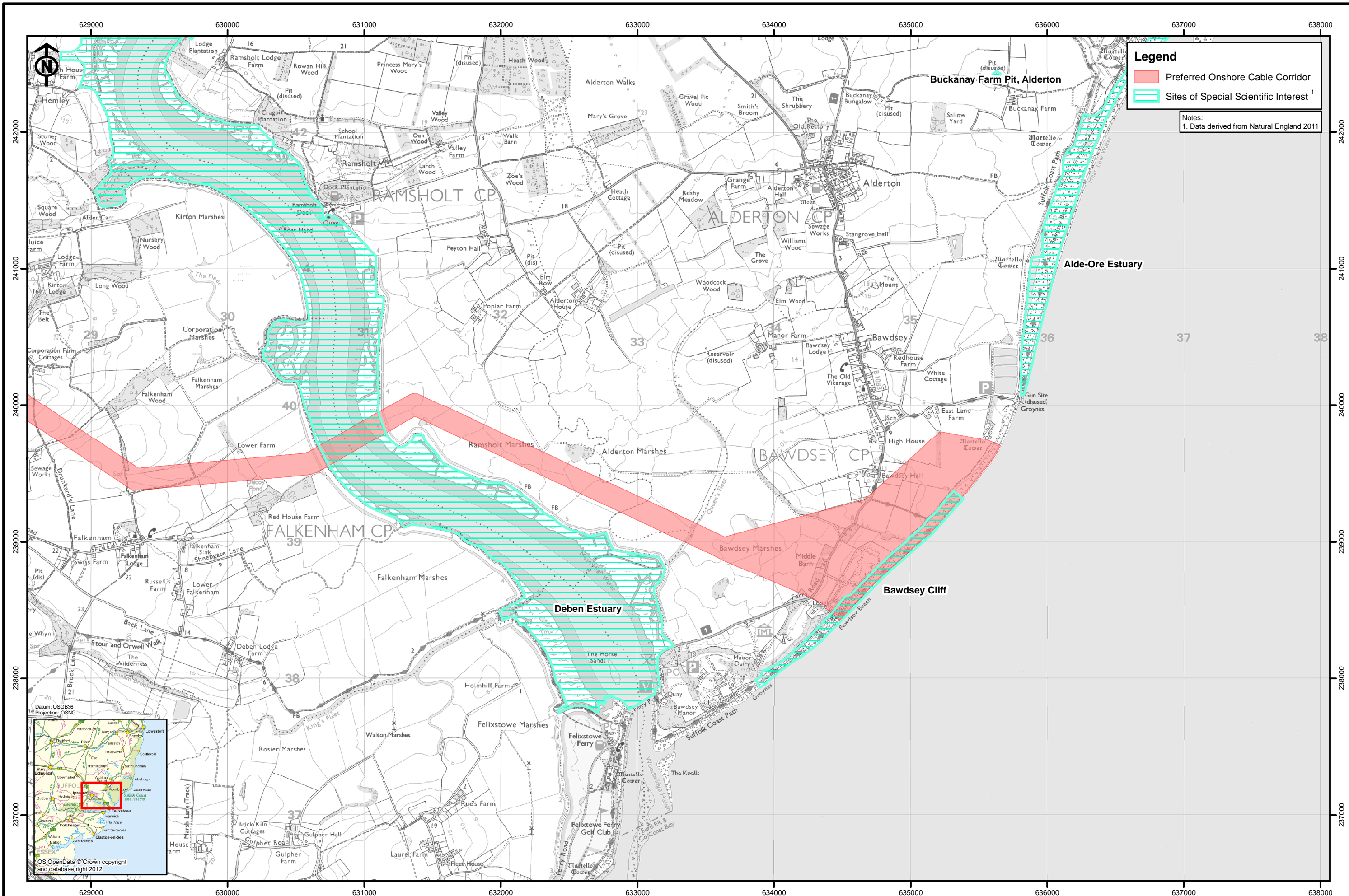
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02	01/10/12	DL	Frame updated
01	12/09/12	AJ	Frame & figure no. updated
00	22/03/12	AJ	First issue

Original A3 Plot Scale
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East Anglia Offshore Wind
Preliminary Risk Assessment -
Preferred Onshore Cable Corridor
and Converter Station

Drg No	41388-A20.1-20.1.1	Appendix 20.1
Rev	02	
Date	01/10/12	Figure 20.1.1
Layout	N/A	



Legend

- Preferred Onshore Cable Corridor
- Sites of Special Scientific Interest¹

Notes:
1. Data derived from Natural England 2011



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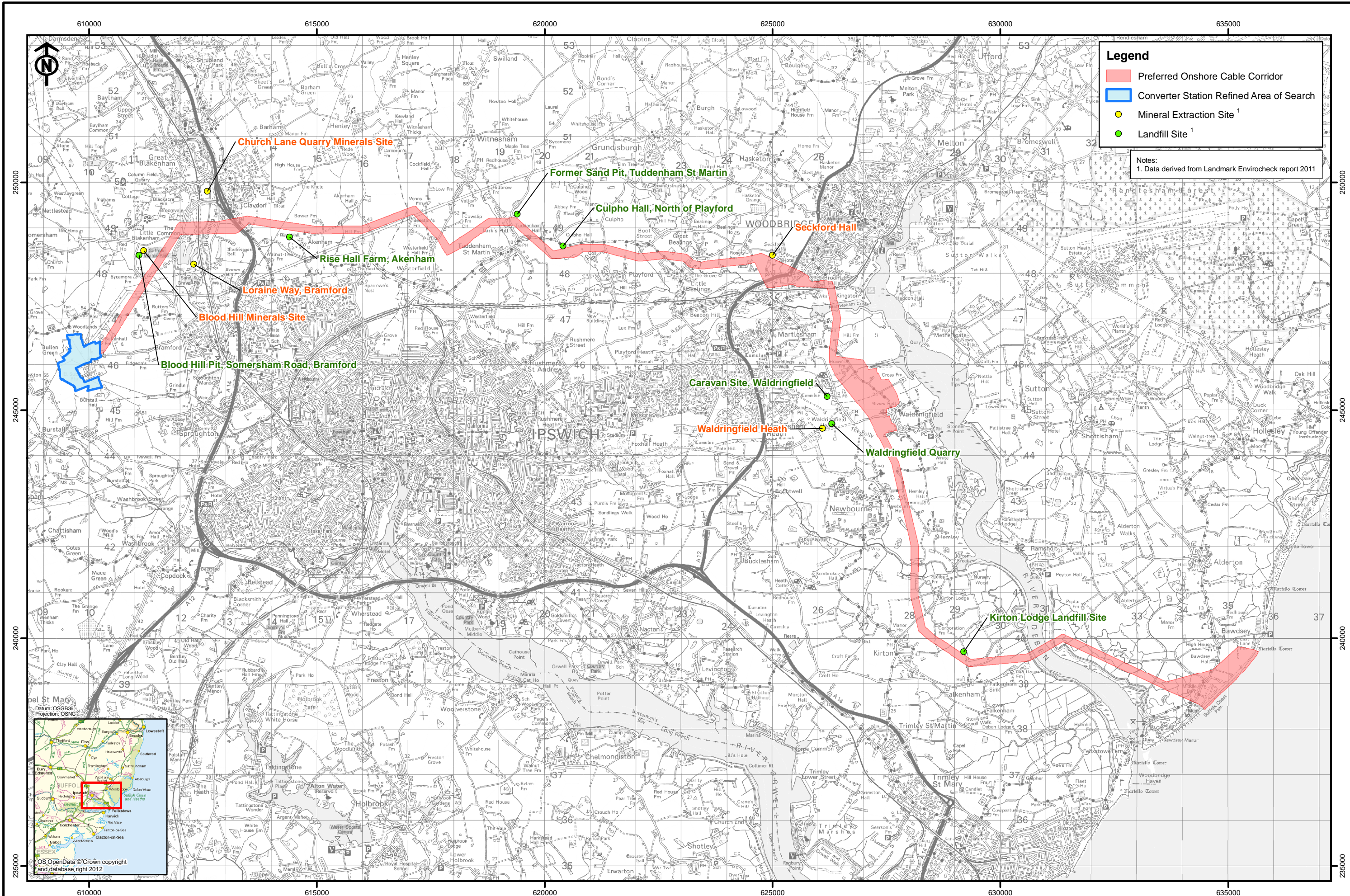
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0 0.5 1 km

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East Anglia Offshore Wind
Preliminary Risk Assessment -
Sites of Special Scientific Interest near
Landfall and Deben Crossing

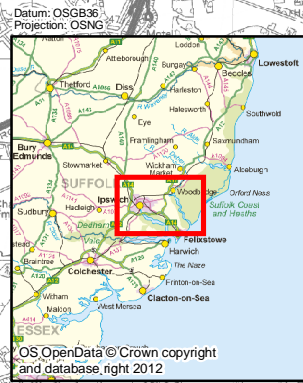
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Rev	02	
Date	01/10/12	Figure 20.1.2
Layout	N/A	



Legend

- Preferred Onshore Cable Corridor
- Converter Station Refined Area of Search
- Mineral Extraction Site ¹
- Landfill Site ¹

Notes:
1. Data derived from Landmark Envirocheck report 2011



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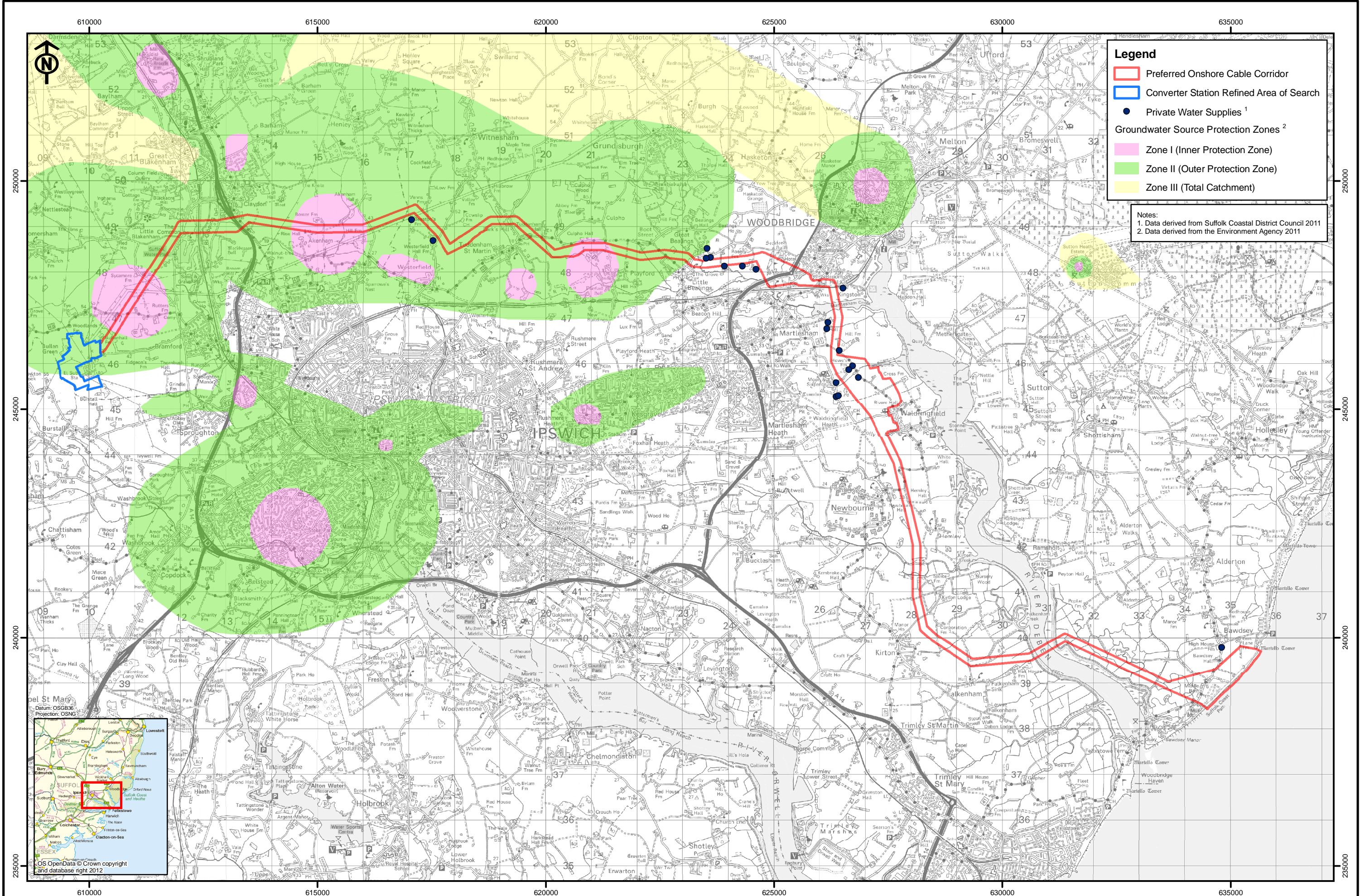
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East Anglia Offshore Wind
Preliminary Risk Assessment -
Landfills & Mineral Extraction Sites

Drg No	41388-A20.1-20.1.3	Appendix 20.1
Rev	02	
Date	02/10/12	Figure 20.1.3
Layout	N/A	



Legend

- Preferred Onshore Cable Corridor
- Converter Station Refined Area of Search
- Private Water Supplies ¹
- Groundwater Source Protection Zones ²
- Zone I (Inner Protection Zone)
- Zone II (Outer Protection Zone)
- Zone III (Total Catchment)

Notes:
 1. Data derived from Suffolk Coastal District Council 2011
 2. Data derived from the Environment Agency 2011

Datum: OSGB36
 Projection: OSNG

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
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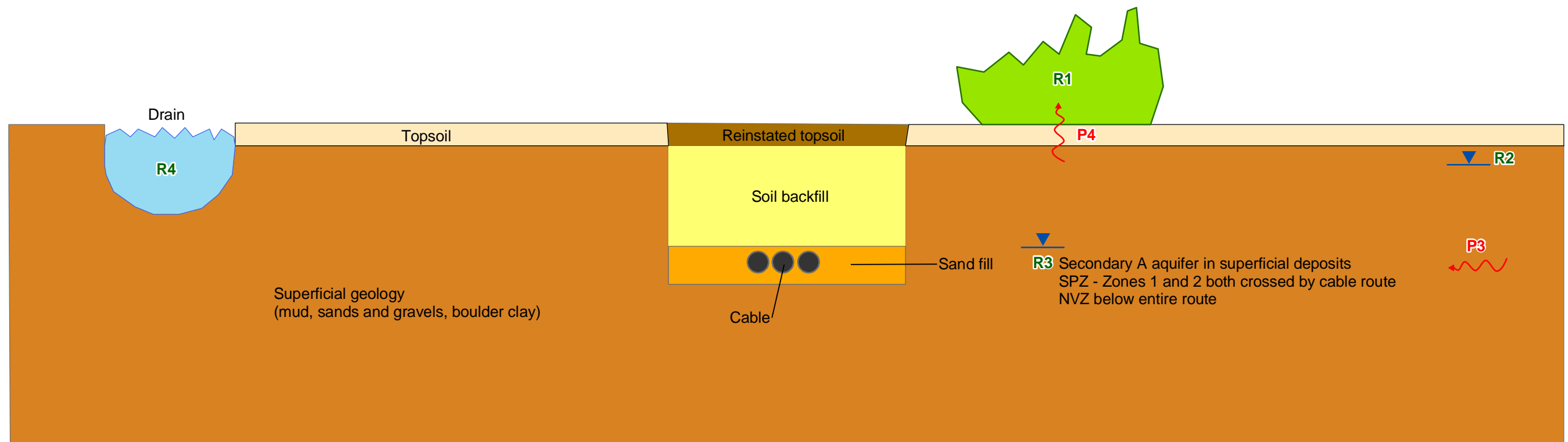
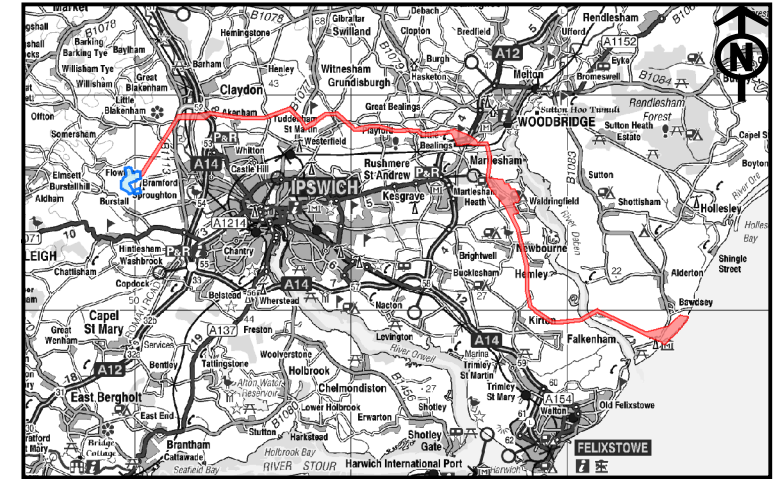
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East Anglia Offshore Wind
 Preliminary Risk Assessment -
 Groundwater Source Protection Zones

Drg No	41388-A20.1-20.1.5	Appendix 20.1
Rev	02	
Date	02/10/12	Figure 20.1.4
Layout	N/A	

Legend

- S1** Source of Contamination
- P1** Pathway
- R1** Receptor
- SPZ** Source Protection Zone
- NVZ** Nitrate Vulnerability Zone
-  Linkage
-  Preferred Onshore Cable Corridor
-  Converter Station Refined Area of Search



Potential Contamination Sources

A full list of sources is provided in Table 7. and shown on Figure 6. A summary is provided here:

- S1** - Landfill site
- S2** - Disused/infilled pit
- S3** - Disturbed ground
- S4** - Substation
- S5** - Works/depot
- S6** - Railway/tramway
- S7** - Agricultural activities
- S8** - RAF Base
- S9** - Decoy Pond
- S10** - Sewage works/slurry lagoons

Plausible Contamination Pathways

- P1** - Direct contact
- P2** - Inhalation of ground gas/soil gas
- P3** - Vertical and lateral migration of contamination in groundwater
- P4** - Root uptake
- P5** - Chemical attack of infrastructure

On-site Receptor

- R1** - Vegetation
- R2** - Perched groundwater
- R3** - Secondary A aquifer
- R4** - Surface watercourse/drainage

Off-site Receptor

- R5** - Adjacent site users
- R6** - Buildings and infrastructure

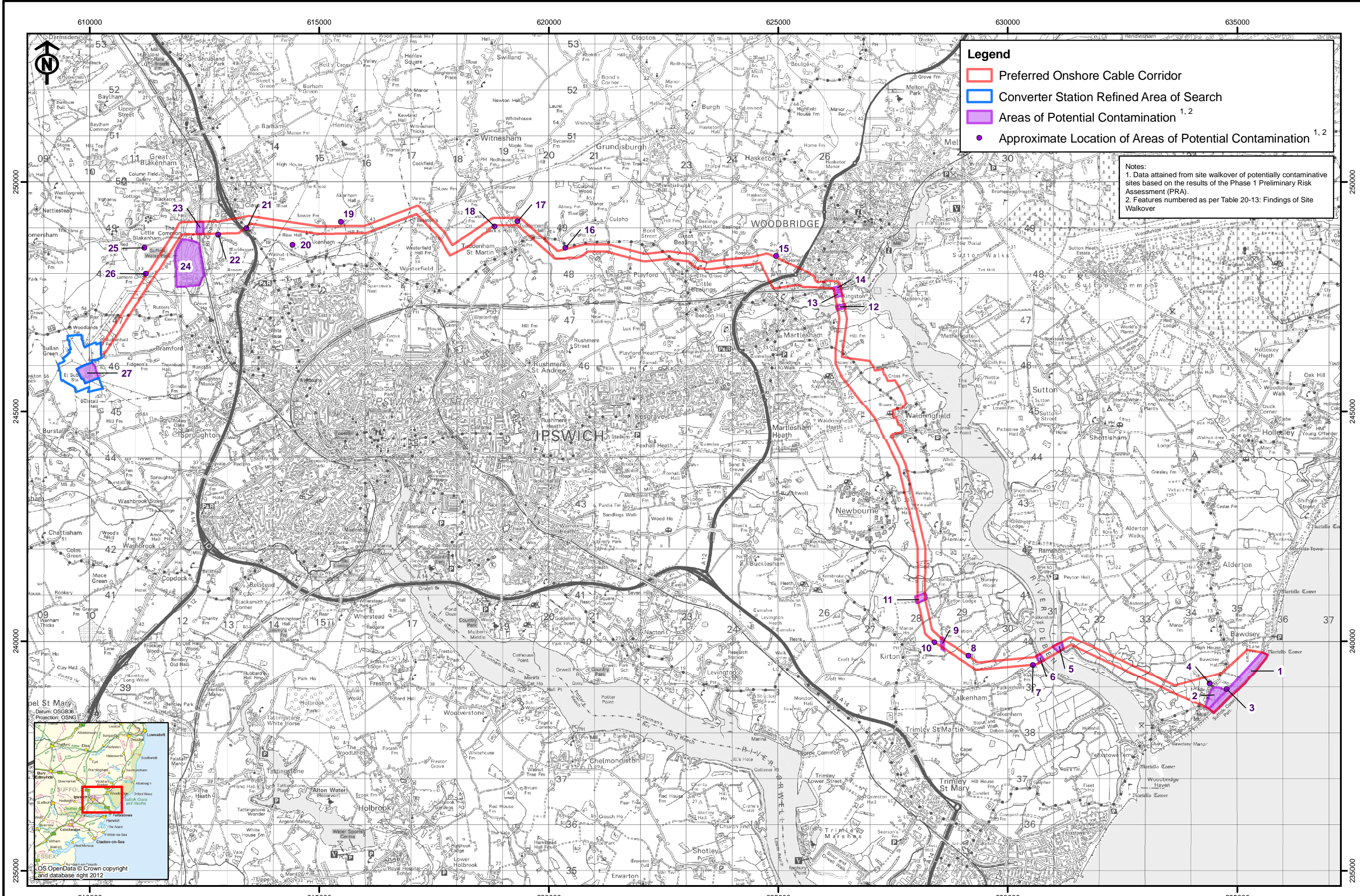
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Preliminary Risk Assessment -
Indicative Conceptual Site Model

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Rev	02	
Date	02/10/12	Figure 20.1.5
Layout	N/A	



Legend

- Preferred Onshore Cable Corridor
- Converter Station Refined Area of Search
- Areas of Potential Contamination ^{1, 2}
- Approximate Location of Areas of Potential Contamination ^{1, 2}

Notes:
 1. Data attained from site walkover of potentially contaminative sites based on the results of the Phase 1 Preliminary Risk Assessment (PRA).
 2. Features numbered as per Table 20-13: Findings of Site Walkover

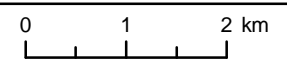


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East Anglia Offshore Wind
 Preliminary Risk Assessment -
 Areas of Potential Contamination

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Rev	02	
Date	02/10/12	Figure 20.1.6
Layout	N/A	



APPENDIX A SUMMARY OF LEGISLATION AND POLICY RELATING TO CONTAMINATED LAND IN ENGLAND AND WALES

Part IIA of the Environmental Protection Act 1990 (EPA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered all groundwater, inland waters and estuaries.

In August 2006, the statutory regime was extended and now consists of Part IIA of the EPA, as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. Associated with these changes the Radioactive Contaminated Land (Enabling Powers) (England) Regulations 2005 (SI 2005/3467), the Radioactive Contaminated Land (Modification of Enactments) (England) Regulations 2006 (SI 2006/1379) and the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented.

The intention of Part IIA of the EPA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Defra Circular 01/2006, published in September 2006, for definitions of what is significant harm: <http://www.defra.gov.uk/publications/files/pb12112-circular01-2006-060817.pdf>). This circular replaces DETR Circular 02/2000, published in March 2000, and has two functions: it promulgates the statutory guidance as now amended, which is an essential part of the regime, and it sets out the way in which the extended regime is expected to work by providing a summary of Government policy in this field, a description of the regime and a guide to the other relevant regulations.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:



- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water
- reduce pollution of water, especially by 'priority' and 'priority hazardous' substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2010 provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2010 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of



dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Contaminated land is often dealt with through planning because of land redevelopment. This approach is documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use (note that a draft revised PPS23 is currently under preparation, entitled Enabling Development). The overall aim of the planning and pollution control policy is to promote the sustainable and beneficial use of land (in particular, encouraging reuse of previously developed land in preference to greenfield sites). Within this aim, polluting activities that are necessary for society and the economy should be so sited and planned, and subject to such planning conditions, that their adverse effects are minimised and contained to within acceptable limits.



APPENDIX B SERVICE CONSTRAINTS

RSK ENVIRONMENT LIMITED SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for East Anglia Offshore Wind Limited (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.



APPENDIX C

METHODOLOGY FOR RISK ASSESSMENT

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. Under CLR11, three stages of risk assessment exist: preliminary, generic quantitative and detailed quantitative. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) pollutant linkages (source–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- Highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
- Likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- Low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- Unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- Severe: short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)



- Medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- Mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- Minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the likelihood of an event occurring and its severity have been classified, a risk category can be assigned the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- Very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required.
- High: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term.
- Moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term.
- Low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild.
- Very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

Appendix 19.1 Ends Here