Annex D1

Phase 1

D1 ANNEX D1 PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

D1.1 PREAMBLE

D1.1 Environmental Resources Management (ERM) was commissioned by Sembcorp Utilities UK Ltd ('Sembcorp') to undertake a Phase I Environmental Site Assessment (Phase I ESA) of land off Greystone Road, Eston, Cleveland, TS6 8JF, United Kingdom (UK) ('the Project Site'). This Phase I ESA forms part of a wider Development Consent Order (DCO) application, which Sembcorp intends to submit to the UK Planning Inspectorate.

D1.2 BACKGROUND

D1.2 Sembcorp intends to construct a natural gas fired combined-cycle gas turbine (CCGT) generating station with an output capacity of up to 1,700 MWe ('the Project') at the Project Site and requires a Phase I ESA to be completed to inform the DCO application.

D1.3 The Project Site is known to have a history of similar industrial use, specifically a CCGT plant was operated at the Project Site by Enron Power Company (later GDF Suez) from c.1990. Prior to this date (1990) the Project Site is understood to have comprised undeveloped / agricultural land. The previous installation (Enron / GDF Suez) is known to have ceased operations c.2013, with the decommissioning and demolition of all buildings and plant having taken place between 2013 and 2015. The ground bearing slabs and foundations are, however, still present on site.

D1.4 Sembcorp has provided ERM with a Site Condition Report (SCR) detailing the condition of the land in April 2015. This document (referred to hereafter as the '2015 SCR') provides detail of environmental investigation, monitoring and decommissioning works undertaken at the Project Site and is referenced throughout this Phase I ESA. The Project Site investigation was completed in 2015 but was designed to address not only the surrender of the environmental permit (which was subsequently achieved in July 2016) but also the surrender of the lease.

D1.3 REPORT AIM AND SCOPE OF WORKS

D1.5 In general terms, the purpose of this assessment is to provide Sembcorp (and ultimately the Planning Inspectorate) with a good understanding of the Project Site's history, its environmental setting and its potential to be affected by land contamination.

D1.6 In line with the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) guidance concerning the development of land affected by

contamination (*Technical Guidance for Developers, Land Owners and Consultants, YALPAG, v8.2 2017*), this is accomplished by the following:

- appraisal of the Project Site's history using historical mapping and other records where available;
- assessment of the environmental setting of the Project Site (in terms of its vulnerability and sensitivity to contamination) by reference to geological / hydrogeological mapping and other publicly available data (e.g. UK Environment Agency (EA) records);
- assessment of the current / proposed land use and surrounding land uses by reference to publicly available permit / licence databases;
- review of previous reports relating to land contamination at the Project Site and any associated remedial works;
- formulation of a Conceptual Site Model (CSM); and
- completion of preliminary risk assessment based on the source-pathway-receptor model, with reference to the above CSM.

D1.4 LIMITATIONS

D1.7 This report is based upon the application of scientific principles and professional judgment to certain facts with resultant subjective interpretations. Professional judgments expressed herein are based on the information currently available within the limits of the existing data and other factors. To the extent that more definitive conclusions are required than are warranted by the currently available information, it is specifically ERM's intent that the conclusions and recommendations stated herein will be intended as guidance and not necessarily a firm course of action, except where explicitly stated as such. ERM makes no warranties, express or implied, including, without limitation, warranties as to merchantability or fitness for a particular purpose. In addition, the information provided to Sembcorp in this report is not to be construed as legal advice.

D1.8 Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the Project Site described in the report is free of any potential environmental liability.

D1.5 REPORT STRUCTURE

D1.9 The remainder of the report is structured as follows:

- *Section 2*, Site Location and Environmental Setting;
- *Section 3*, Site History and Previous Works;
- *Section 4*, Public Database Review;
- *Section 5,* Conceptual Site Model;
- *Section 6,* Refinement of Conceptual Site Model; and
- *Section 7*, Recommendations.

D2 SITE LOCATION AND ENVIRONMENTAL SETTING

D2.1 SITE LOCATION AND LAYOUT

D1.10 The Project Site occupies a total area of approximately 155,000m^2 and is located approximately 6.5km to the east of Middlesbrough town centre in the north east of the United Kingdom (UK). All above ground structures previously present at the Project Site were cleared to ground level between 2013 and 2015. As such, the Project Site currently comprises open ground, surfaced with a mixture of concrete slab (c.60% - equivalent to the footprint of the previous buildings / structures), gravel (c.35% - equivalent to areas where voids have been backfilled with site won demolition crush, or where gravel existed previously) and soft landscaping (<5% - limited to site periphery). The 2015 SCR indicates that there are two electricity sub-stations remaining at the Project Site, located in the south eastern and south western areas (referred to as Greystone A and Greystone B respectively). These sub-stations are owned and maintained by National Grid, with the land upon which they are located being leased from Sembcorp.

D1.11 The Project Site location and boundary are presented in *Figures D.1* and D.2.

NORTH SEA

SITE LOCATION

0 1 2 3 4 5
kilometres

N

SCALE: 1:250,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: RE
DATE: 16/05/2017	APPROVED: RE

Figure D.1
Site Location

ERM

sembcorp

PROJECTION: British National Grid

Path: \\ukbrsdc02\Data\Bristol\Confidential Projects\0375193 TLP2 DCO Support.RE\2. Working Folders\2. GIS\MAPS\PEIR\FigD.01_0375193_SiteLocation_A01.mxd

Indicative Site Boundary

Trunk Road
Cooler
Cooler
Mains Dike
A174
66
Bolckow Road
Greystones Road
Grangetown
Kettle Beck
A1053
Birchington Avenue
Birchington Avenue
North Lodge
Wilton Lane
Greystones Road
A174
Lazenby
High Street
Wilton
A1053
Kettle Beck
Fabian Road
Church La
Scrath Farm
Lackenby
B1380
Normanby Road
California
Cross Beck
Eston
High Street
Jubilee Road
242
Eston Nab

0 100 200 300 400 500
Metres

N

SCALE: 1:15,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: RE
DATE: 16/05/2017	APPROVED: RE

Figure D.2
The Project Site

ERM

sembcorp

PROJECTION: British National Grid

Path: \\ukbrsdc02\Data\Bristol\Confidential Projects\0375193 TLP2 DCO Support.RE\2. Working Folders\2. GIS\MAPS\PEIR\FigD.02_0375193_SiteLayout_A01.mxd

D2.2 SURROUNDING AREA

D1.12 The Project Site is located in the southwestern section of Wilton International industrial park, this being a multi-occupancy chemical manufacturing site. Land use to the north and east of the Project Site is industrial (Wilton International), however, agricultural land is present to the immediate south and residential properties are present at minimum distance of 550 m to the western boundary. Land use in the area surrounding the Project Site is further summarised in *Table D2.1*.

Table D2.1. Land Use in Surrounding Area

Direction	Land Use
North	Commercial / Industrial properties extending to in excess of 1.0km (Wilton International).
East	Commercial / Industrial properties extending to in excess of 1.0km (Wilton International).
South	Agricultural land adjacent, beyond which is a residential area (Lazenby c.700m SE) and Greystone Road (c.600m S).
West	Agricultural land adjacent, beyond which is Greystone Road (c.150m W) and residential areas (minimum distance c.550m W).

D2.3 TOPOGRAPHY

D1.13 The Project Site is situated at an elevation of approximately 19m above Ordnance Datum (AOD) and is generally flat. Land in the vicinity of the Project Site generally declines to the north and north east, towards the River Tees. In the wider area (>2.0km), land declines to the east, towards the Tees Estuary and the North Sea coastline.

D2.4 GEOLOGY

D1.14 British Geological Survey (BGS) digital mapping indicates that (Made Ground notwithstanding) the Project Site is directly underlain by superficial deposits of till / glacial diamicton (terrigenous sediment that is unsorted / poorly sorted containing particles ranging in size from clay to boulders) across the majority of the Project Site, and Glaciolacustrine Deposits (clay and silt) limited to the north / western areas. These (superficial) deposits are identified as being in the region of 11m thickness in the local area (although not directly beneath the Project Site). The underlying bedrock is mapped as Redcar Mudstone Formation, described as "*Grey, fossiliferous, fissile mudstones and siltstones with subordinate thin beds of limestone in lower part, and fine-grained carbonate cemented sandstone in upper part*". These (bedrock) deposits are listed as being up to c.280m depth in this area.

D2.5 HYDROGEOLOGY

D1.15 UK EA digital mapping indicates that the superficial glacial till deposits (present across the majority of the Project Site) and the bedrock formation

(Redcar Mudstone) are designated as Secondary Undifferentiated aquifer units. This designation is usually assigned in cases where it has not been possible to attribute either category Secondary A or Secondary B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics (i.e. permeability) of the rock type. The Glaciolacustrine Deposits limited to the north / western areas of the Project Site are designated as Unproductive Strata (indicative of low permeability deposits with marginal groundwater storage / productivity characteristics).

D1.16 No active groundwater abstractions are known to be present within 1km of the Project Site and the Project Site does not lie within a groundwater Source Protection Zone (SPZ) of any type. The UK EA no longer make Water Framework Directive (WFD) groundwater classifications public, however, the 2015 SCR indicates that groundwater resources at the Project Site were classified(at that time) as having 'Good' quantitative status and 'Poor' chemical quality.

D1.17 The 2015 SCR report states that groundwater flow direction is likely to be to the north based on resting level monitoring. This is concurrent with the general topography of the Project Site and the immediate surrounding area.

D1.18 Based on the above, ERM considers groundwater resources at the Project Site to be of low / moderate vulnerability and of low sensitivity.

D2.6 HYDROLOGY

D1.19 Several minor watercourses are present within the area immediately surrounding the Project Site (<250m), as summarised in *Table D2.6a*.

Table D2.6a Summary of Site Hydrology

Feature	Location	Flow Direction	Comments
Kettle Beck	Adjacent to western site boundary	S to N	Water quality not rated by EA. Forms confluence with Kinkerdale Beck c. 550m N of site, with Kinkerdale Beck flowing SW to NE towards River Tees.
Drain 1	Adjacent to northern site boundary	E to W	Possibly culverted beneath the southern site area. Discharges to Kettle Beck c.20m N / E of site
Drain 2	c.20m north of site boundary	Unknown, likely E to W	Possibly partially culverted. Likely discharges to Kettle Beck to north of site.
Drain 3	c.50m east of site boundary	Unknown	Likely associated with neighbouring industrial properties.
Drain 4	c.50m south of site boundary	Unknown	Likely associated with agricultural land to south of site.

D1.20 No active surface water abstractions are known to be present within 1km of the Project Site.

D1.21 One discharge consent is identified associated with the Project Site ("*Teesside Power Station*"). This consent was issued in July 1993 for discharge to Kettle Beck (listed as 33m SW of the Project Site), prior to being revoked in November 1997.

D1.22 The 2015 SCR report indicates that the Project Site is located within an area designated by the UK EA as low probability flood risk (Flood Zone 1 – assessed as having a less than 1 in 1000 annual probability of flooding from rivers or the sea (<0.1% in any year)).

D1.23 Based on the above, ERM considers surface water at the Project Site to be of moderate / high vulnerability and of moderate sensitivity.

D3 SITE HISTORY AND PREVIOUS WORKS

D3.1 SITE HISTORY

D1.24 The history of the Project Site has primarily been determined by reference to historical mapping dating from c.1850 to 2016. These maps were obtained by ERM as part of a *Landmark Envirocheck* report (ref. 111168878_1_1 20/01/2017), which was procured for the specific purposes of this assessment (provided as Annex D2 to Chapter 6). Where available, other sources (such as the UK EA public registers, other publicly available records and previous site investigation reports) have also been reviewed.

D1.25 In summary, the above sources indicate that the Project Site comprised undeveloped / agricultural land until c.1990, at which point it was developed into a CCGT power station. As described in *Section 1.2*, this installation ceased operations in 2013 and was demolished to slab level between the dates of 2013 and 2015. As such, the Project Site currently comprises open ground surfaced with a mixture of concrete slab (c.60%), gravel (c.35%) and soft landscaping (<5%). ERM has confirmed this to be the current condition of the Project Site in a site walkover, completed in January 2017.

D1.26 *Table D3.1a* provides further detail of the history of the Project Site and that of the surrounding area (up to 1km), as determined by reference to the historical maps and other sources where available.

Table D3.1a Site History

Date	On site	Offsite (up to 1km)	Source(s)
1856 - 95	• The Project Site is depicted as undeveloped / agricultural land • *Ratten Lane* is visible intersecting the central / western section of the Project Site, orientated SE-NW. • Two minor streams / drainage channels are shown running in a S–N direction through the central western and central eastern sections of the Project Site.	• Predominantly undeveloped / agricultural land. • Two roads are identifiable c.200m E and 250m W of the Project Site, labelled *Pasture Road* and *Lackenby Lane* respectively. • Low density residential areas are present c.600m S and 600m SE of the Project Site, labelled *Lackenby* and *Lazenby* respectively. • *Kettle Beck* is identifiable running in a SE - NW direction, adjacent to the western site boundary.	Yorkshire 1856-57; Yorkshire 1895
1919	• No significant changes.	• Area remains predominantly undeveloped / agricultural. • A *Saw Mill* with associated *Tank* is present c.500m SE. • Three small features labelled *Gravel Pit* or *Old Gravel Pit* are present c.750m S of the Project Site. • A new road labelled *Union & U.D. Bypass* is identifiable c.550m W.	Yorkshire 1919

Date	On site	Offsite (up to 1km)	Source(s)
1953	• No significant changes.	• A small feature labelled *Filter Beds* is present c.400m SE of the Project Site. • Significant medium density residential development is now present c.550m W, labelled *Grangetown*. • Unlabelled commercial / industrial type development is identifiable c.750m NE.	OS 1953
1967-1969	• No significant changes.	• Significant industrial development is present c.75m N of the Project Site, included within which are two *Cooling Towers*, fourteen features labelled *Tanks* and numerous small, unlabelled circular structures (likely tanks or stacks). The 2015 SCR (Environ) indicates that this facility was in fact present since the late 1950s, however, this is not evident from the available mapping. This report (2015 SCR) indicates that the facility was (at that time) operated as a 'Nylon Works' by Imperial Chemical Industries (ICI). • A new road is present c200m W of the Project Site. • *Allotment Gardens* are identifiable c.260m SE.	OS 1967; OS 1969; Environ SCR 2015
1975 - 1976	• *Ratten Lane* and the two minor streams / drainage channels previously present at the Project Site are no longer identifiable. • A *Drain* is identified running through the eastern section of the Project Site, orientated SW-NE.	• Further commercial / industrial development is now identifiable in the area c.750m NE of the Project Site. • The road c.200m W is now labelled Greystone Road. • The *Grangetown* residential area has extended considerably in area to the south and appears of increased density. • A *Sports Ground* is identifiable c.300m NW.	Russian Military 1975; OS 1976
1981-85	• No significant changes.	• A third *Cooling Tower* is now present c.50m N associated with the ICI site in this area. • An electrical sub-station is now present c.15m N of the Project Site. • Additional commercial / industrial development is identifiable c.500m E. This includes six small circular features, collectively labelled as *Tanks*.	OS 1981-85
1993 - 2000	• The Project Site is now evidently developed for industrial use; the Enron / GDF Suez *Power Station* is identifiable. This comprises what appear to be eight turbines in the central / northern site area and an associated *Cooling Tower* in the central / eastern section. Two additional unlabelled circular features (likely tanks) are identifiable in the northern eastern area and two electrical substations are present in the south eastern and south western site areas	• No significant changes.	National Grid 1993; 10k Raster Mapping 2000; Envirocheck Public Database Search

Date	On site	Offsite (up to 1km)	Source(s)
	respectively. The *Envirocheck* public database search confirms that an IPC permit was registered to the Project Site on 24th July 1992 for 'Combustion processes within the fuel and power industry'.		
2006-2017	• The 2015 SCR indicates that the Enron / GDF Suez installation ceased operations in 2013 and all buildings and other above ground infrastructure were cleared to slab level between 2013 and 2015. The available site mapping and contemporary aerial photography (Google Earth) do not yet reflect these changes.	• Land adjacent to the east of the Project Site has been developed for industrial use. A total of seven unlabelled circular structures are identifiable within this area (likely tanks or stacks). The 2015 SCR report indicates that this facility is an operational bioethanol plant, operated by *Ensus Ltd*. • The industrial installation c.500m E of the Project Site appears to have been partially demolished / reconfigured. • Environ's 2015 SCR indicates that the former ICI / Du Pont facility located to the north of the Project Site ceased operations in the 'late 2000s'.	10k Raster Mapping 2006; Vector Map 2016; Aerial Photography (Google Earth); Environ SCR 2015

D3.2 PREVIOUS WORKS

D3.2.1 Site Condition Report (SCR), Environ, 2015

D1.27 As part of the previous installation's permit surrender, a site condition report was produced for the Project Site by Environ in 2015. This report confirms the historical land use at the Project Site (as determined above) and specifies the following as potential contaminants associated with this:

- Chemicals used in cooling and boiler water treatment, including solvent based cleaners, acids and inorganic compounds (such as hydrazine);
- Petroleum hydrocarbons used in plant maintenance and operations, including lubricating oil, control oil, starter oil and transformer oils. Regarding these, this report states that "*Back-up fuel of naptha is transferred via pipeline to the plant. Diesel is brought on site in tanks by subcontractor fleet vehicles*".
- Waste oil, collected on site in oily water sumps.

D1.28 An intrusive site investigation was carried out (by Environ)comprising the drilling of nineteen boreholes to a maximum depth of 5.0m bgl across the Project Site, and the recovery of soil and groundwater samples. Groundwater samples were also recovered from seven wells pre-existing at the Project Site as part of this investigation.

D1.29 The onsite locations of the boreholes advanced as part of the 2015 Environ site investigation are provided as Figure D.3.

Pre-Existing SPMP Boreholes

2015 Windowless Sample Boreholes

2015 Monitoring Wells

Indicative Site Boundary

0 20 40 60 80 100

Metres

N

SCALE: 1:15,000	VERSION: A01
SIZE: A3	DRAWN: sB
PROJECT: 0375193	CHECKED: RE
DATE: 16/05/2017	APPROVED: RE

Figure D.3
Borehole Location Plan

ERM

sembcorp

PROJECTION: British National Grid

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\ukbrsdc02\Data\Bristol\Confidential Projects\0375193 TLP2 DCO Support.RE\2. Working Folders\2. GIS\MAPS\PEIR\FigD.03_0375193_BoreholeLocationPlan_A01.mxd

Geology / Hydrogeology

D1.30 *Table D3.2a* provides a summary of the geological conditions encountered by Environ during the 2015 ground investigation.

Table D3.2a, Site Geology recorded by Environ (2015)

Layer	Description	Depths	No. of Locations Encountered
Surface	Concrete.	0.12-0.4m	14 of 19
	Sandy gravel with varying proportions of ash, slag, concrete, limestone and brick.	0.3-0.7m	4 of 19
	Grass underlain by clay.	0.3m	1 of 19
Made Ground	Sandy gravel with varying proportions of ash, slag brick and concrete.	0.4-2.0m	19 of 19
	Reworked clay with fragments of brick, coal, ash, slag, mudstone, limestone and sandstone	0.3-2.0m	16 of 19
	Greenish brown silt, possible relict topsoil.	1.15-2.2m	3 of 19
Superficial Deposits	Slightly sandy, slightly gravelly clay. Containing sand bands of up to 1.0m thickness in two locations.	0.4-5.0m (base not proven)	15 of 19

D1.31 Other than the ash / slag content of the soils, no visual or olfactory evidence of significant impact was observed by Environ at any location.

D1.32 Distinct groundwater strikes were not generally recorded during the drilling works in the Made Ground or superficial deposits at the Project Site (limited to 2 of 19 locations).

Analytical Work and Risk Assessment

D1.33 A total of 27 soil samples and 14 groundwater samples were recovered as part of the 2015 ground investigation and scheduled for chemical analysis. The results of this analysis are summarised below:

- Low concentrations of metals, Total Petroleum Hydrocarbons (TPH), Semi Volatile Organic Compounds (SVOCs) (carbazole) and Polycyclic Aromatic Hydrocarbons (PAHs) were detected in soils at the Project Site. Regarding these concentrations, no exceedances of Environ's Generic Assessment Criteria (GAC) for a commercial land use were identified. The risk to human health from soil contamination at the Project Site was assessed (by Environ) as being Low.
- Concentrations of metals, sulphate, petroleum hydrocarbons and PAH were detected in groundwater at the Project Site. Regarding these, metals (specifically Chromium VI, and selenium) a range of PAH and aliphatic and aromatic TPH fractions were reported in excess of the applied controlled waters screening level (UK EQS & DWS), however,

these impacts are described as 'generally localised'. Additionally, no exceedances of the Project Site's Site Protection and Monitoring Programme (SPMP) groundwater 'limits' (as applied during the installation's operational life) were identified in the 2015 investigation. Environ concluded that the detected concentrations did not represent widespread contamination of groundwater and the risk to controlled waters was assessed as being Low.

- Concentrations of petroleum hydrocarbons (aliphatic C12-18 fraction) were identified in groundwater above the Environ screening criteria for human health (by vapour inhalation) at one location (MW07 – central eastern site area adjacent to former cooling tower). Regarding this, the 2015 SCR states that "*Environ do not consider the results to indicate a risk via the vapour pathway as the concentration was localised and no buildings are currently present in this area; there is no opportunity for concentrations to accumulate in confined spaces*".

D1.34 No soil gas / vapour samples were recovered and no soil gas risk assessment was undertaken as part of this assessment, on the basis that no receptors were identified at the Project Site in its current configuration. Regarding this, however, the report states that "*The requirement for ground gas monitoring should be reassessed in the event of redevelopment*".

Decommissioning Works

D1.35 The 2015 SCR also provides detail of works undertaken during the decommissioning phase to remove potential pollution risks identified at the Project Site. Primarily this comprised the 'washing down' and 'plugging' of subsurface voids, stated as including oily water pits, cable pull pits, transformer bunds, the cooling tower base, deluge valve chambers, condenser pits and steam pits. Following decommissioning all voids were backfilled with clean crushed material. The 2015 SCR states that a photographic record of this process was maintained; however, this has not been witnessed / inspected by ERM.

D1.36 In addition to the above the 2015 SCR states that "*GDF Suez commissioned a third party to clean the storm water and oily water drainage systems using high pressure jet washing and complete a CCTV survey of both systems*". On GDF Suez's exit from the Project Site, both the storm water and oily water drainage systems are described as having been left in a 'cleaned' condition, however, ERM has not reviewed any documentation relating to this.

D3.2.2 Environ Phase I Assessment, August 2015

D1.37 Prior to undertaking the 2015 ground investigation (see above), Environ also completed a Phase I 'desktop' assessment of the Project Site. In summary, the findings of this report indicated a potential risk to land and groundwater from the activities undertaken onsite. This report states that "*Notable volumes of oil and chemicals have been stored and used within the power station. Pollution prevention measures including the management and control of oil and chemicals*

appear to have been implemented and well documented, based on information provided to Environ by the site however spillages and uncontrolled releases are known to have occurred". A list of spillages / uncontrolled releases known to have occurred at the Project Site is provided in the 2015 SCR (*Table 5.1 Environmental Incidents* (p.7)). This table provides details of a total of seventeen incidents recorded as having taken place in various areas of the Project Site between the dates of 2001 and 2014.

D1.38 This report also provides a summary of groundwater monitoring completed at the Project Site between 1997 and 2013 (as part of the SPMP), concluding that concentrations of metals petroleum hydrocarbons are "*slightly elevated in the shallow groundwater*".

D4 PUBLIC DATABASE REVIEW

D4.1 INTRODUCTION

D1.39 This section summarises known current / recent land use at the Project Site and in the vicinity of the Project Site, by reference to regulatory permitting records and other relevant contemporary records. These were obtained by ERM as part of the *Envirocheck* report for the specific purposes of this assessment (provided as Annex D2, Chapter 6), or are publicly available from other sources (for example the UK EA public registers).

D4.2 ACTIVE/OPERATIONAL PERMITS

D1.40 The Project Site is located within Wilton International industrial park. As such, numerous permitted activities are registered within a 1km distance of the Project Site as are summarised below:

D4.2.1 IPPC Permits

D1.41 Nine IPPC permits / permit variations are registered to the Project Site.

- Four entries appear registered to *GDF Suez Teesside Ltd* for 'Combustion; Any fuel greater or equal to 50Mw', of which one is listed as 'Effective', dated April 2014. This should now be obsolete since the permit has been surrendered.

- Three entries appear registered to *Px Ltd* (TPL) for 'Combustion; Any fuel greater or equal to 50Mw'. These are dated between December 2006 and November 2007. This should now be obsolete since the permit has been surrendered.

- One entry appears registered to *Ensus UK Ltd* for 'Organic Chemicals; Oxygen containing compounds'. This permit is understood to in fact be associated with the neighbouring Ensus bioethanol plant (see below) however it is listed in the Envirocheck as 'onsite' due to inaccuracies in the IPPC registration system.

D1.42 A further three IPPC permits / permit variations are reported within 500m of the Project Site, all of which are registered to *Ensus UK Ltd* for 'Organic Chemicals; Oxygen containing compounds'. Of these, one entry is listed as 'Effective', located 170m NE of the Project Site, dated April 2011. The remaining entries / variations are dated between July 2009 and September 2010.

D4.2.2 IPC Permits

D1.43 Ten superseded IPC permits / permit variations are registered to the Project Site. These are dated between July 1992 and April 2001 and are all listed to *Px Ltd* (TPL) for 'Combustion processes within the fuel and power industry'.

D1.44 A further 25 superseded IPC permits / variations are registered within 500m of the Project Site, as below.

- Two additional entries appear registered to *Px Ltd* (TPL) for 'Combustion processes within the fuel and power industry'. These are reported at distances of 160m SW and 310m NW from the Project Site however, it is likely that these are associated with the Project Site itself. The reported distances are likely a result of inaccuracies in the IPC registration system.

- A total of 21 permits / variations are registered to *Invista Textiles UK Ltd* for 'Manufacture and use of organic chemicals within the chemical industry'. These are reported at distances of between 378m and 462m north of the Project Site, dated from February 1994 and April 2002. These permits are associated with the former ICI nylon works to north of the Project Site. The 2015 SCR indicates that the Project Site was operated by DuPont following the breakup of ICI, with Invista (at that time) being a subsidiary of DuPont. This facility is no longer present.

- Two permits / variations are registered to *Basell Polypropylene Ltd* for 'Manufacture and use of organic chemicals within the chemical industry'. These are both reported at a distance of 194m N of the Project Site, dated May 1997 and November 1998. This facility is no longer present.

D4.2.3 COMAH Sites

D1.45 One active COMAH permit is registered within 1km of the Project Site. This is an upper tier registration for *Ensus UK Ltd*, reported at a distance of 655m E. This facility (Ensus bioethanol plant) is in fact located adjacent to the east of the Project Site. The differing distance given in the Envirocheck report (Annex D2, Chapter 6) is a result of inaccuracies in the COMAH registration system.

D4.2.4 Planning Hazardous Substance Consents

D1.46 A total of seven Hazardous Substance Consents (HSC) are reported within 500m of the Project Site, as below.

- One consent is reported as granted to *Ensus UK Ltd* for propylene oxide, dated April 2008. This entry is reported in the Envirocheck report (Annex D2, Chapter 6) as being 'onsite'; however, this facility (Ensus bioethanol plant) is in fact located adjacent to the east of the Project Site.

- Six consents are reported as granted to Dupont, located between 378m and 433m north of the Project Site. These are registered for flammable

substances or ammonia (where this information is provided). Of these, two entries are dated January 1995; however, no application date is supplied in the remaining four entries. This facility is no longer present.

D4.2.5 Registered Radioactive Substances

D1.47 Two Registered Radioactive Substance entries are reported associated with the Project Site, registered to *GDF Suez Teesside Ltd* for the 'keeping and use of radioactive materials', dated April 2008 and September 2009. A further two entries are registered to the Project Site / GDF Suez for the 'disposal of radioactive waste', dated April 2008 and September 2009.

D1.48 A further seven Registered Radioactive Substance entries are reported within 500m of the Project Site, as below:

- Two entries are reported at a distance of 190m N of the Project Site, registered to *Teesside Power Ltd*, dated August 1996. These relate to the 'keeping and use of radioactive materials' and the 'disposal of radioactive waste'. It is not clear whether these entries apply to the Project Site itself or are associated with the former ICI / Du Pont facility present in this area (north of site).

- Four entries are reported at distances of between 378m and 472m N of the Project Site, registered to *Du Pont (UK) Ltd*, dated between March 1998 and May 2000. These relate to the 'keeping and use of radioactive materials' and the 'disposal of radioactive waste'.

- One entry is reported at a distance of 487m N of the Project Site, registered to *Teesside Engineering Services Group*, dated August 1989. This relates to the 'keeping and use of mobile radioactive sources'.

D1.49 These facilities are no longer present on site and, therefore, this information is considered to be out of date.

D4.2.6 Waste

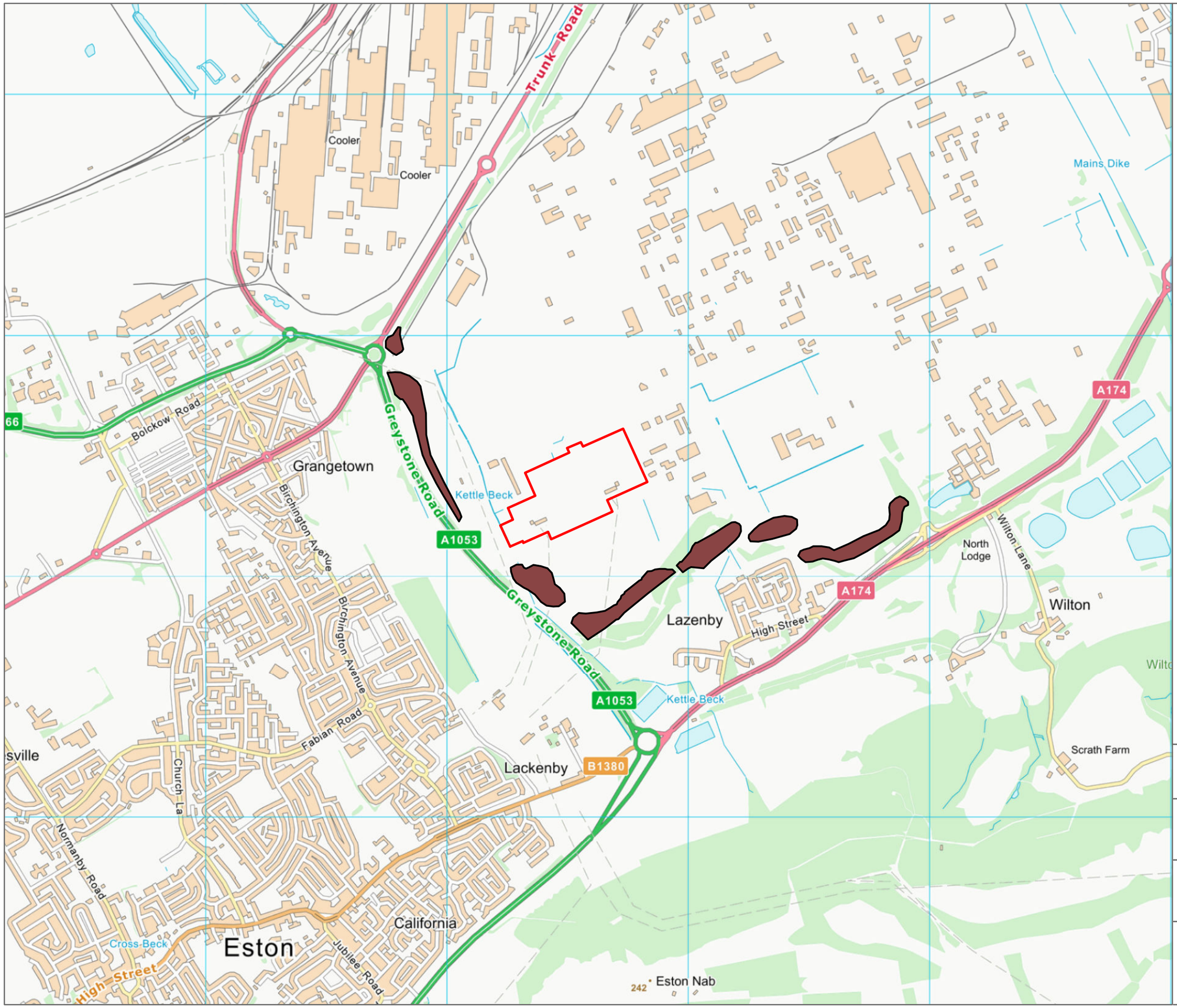
Landfilling

D1.50 Five licensed landfills are reported within 500m of the Project Site, of which two are located within a distance of 250m (specifically, 86m S and 160m W). In all cases, these are recorded under the name '*Wilton, Perimeter Mounds*' classified as Industrial Waste Landfills and registered to *ICI Chemicals and Polymers Ltd*. These licenses were all issued in October 1978 and are now reported closed.

D1.51 In addition to the above, one historical landfill site is reported under the name '*Perimeter Mounds*', located 120m W of the Project Site, licensed to ICI. No detail regarding operational dates or waste types is provided.

D1.52 No further detail is provided regarding operational dates or the types of waste deposited in these areas, however it is believed that the Perimeter Mounds are not below ground landfills. Discussions with site management indicate that it is believed, but not confirmed, that the mounds have been capped with soil.

D1.53 The locations of the 'Wilton Mounds' landfills is provided in *Figure D.4*.



Wilton Mounds Landfills

Indicative Site Boundary

0 100 200 300 400 500

Metres

N

SCALE: 1:15,000	VERSION: A01
SIZE: A3	DRAWN: sB
PROJECT: 0375193	CHECKED: RE
DATE: 22/05/2017	APPROVED: RE

Figure D.4
Wilton Mounds Landfills

ERM

sembcorp

PROJECTION: British National Grid

Path: \\ukbrsdc02\Data\Bristol\Confidential Projects\0375193 TLP2 DCO Support.RE\2. Working Folders\2. GIS\MAPS\PEIR\FigD.04_0375193_WiltonMoundsLandfills_A01.mxd

Potentially Infilled Land

D1.54 The Envirocheck report (Annex D2, Chapter 6) identifies one area of potentially infilled land within the Project Site boundary, under the use 'Unknown Filled Ground (pond, marsh, river, stream, dock etc.)'. The relevant date of mapping is listed as 1953 and, from reference to this historical map (OS 1953), it is likely that this refers to the two minor stream / drainage channels previously present at the Project Site.

Waste Treatment or Disposal Sites

D1.55 Three registered waste treatment or disposal sites are reported within 500m of the Project Site (specifically 62m N, 234m NE and 236m NE). In all cases these are associated with the former ICI facility to the north of the Project Site and are dated between June 1990 and March 1993. The Project Site category for each of these records is given as 'Storage' and a range of authorised wastes are listed, including laboratory halogenated solvents, laboratory hydrocarbon solvents, methanol, miscellaneous inorganic waste, miscellaneous organic waste, other resins and polymer materials, oxygen containing organic compounds, phenolic waste, adiponitriles, adiponitrile blowdown tar, mixed amines, waste aniline, waste hydrocarbon solvents.

D4.3 POLLUTION INCIDENTS

D1.56 Four historical substantiated pollution incidents are recorded within 500m of the Project Site, as detailed below:

- Significant / Category 2 impact to air recorded 107m E of the Project Site, April 2010, associated with 'chemical odour', no impact on water or land;
- Significant / Category 2 impact to air recorded 131m E, August 2010, associated with 'chemical odour', no impact on water or land;
- Significant / Category 2 impact to water recorded 452m E, April 2003, associated with crude sewage, minor impact on land, no impact on air; and
- Significant / Category 2 impact to water recorded 458m SE, Sept 2003, associated with crude sewage, no impact to air or land.

D5 CONCEPTUAL SITE MODEL

D5.1 INTRODUCTION

D1.57 The purpose of the Conceptual Site Model (CSM) is to identify potential contaminant linkages, based on the information available at this stage. The presence (or likely presence) of the following three elements is essential to the identification of a contaminant linkage:

- A potential contaminant (source) in, on, or under the land at a concentration which may cause harm or pollution;
- A receptor which may suffer harm as a result of contact with the above; and
- An exposure pathway by which the receptor may come into contact with the contaminant source.

D1.58 Where all three of the above are present (or may be present), a "plausible contaminant linkage" is said to exist.

D1.59 This section describes the potential contaminant sources, receptors and exposure pathways identified at the Project Site in the context of the environmental setting and a proposed commercial end use. Based on this, the plausible contaminant linkages present at the Project Site are determined.

D5.2 SOURCES

D5.2.1 Onsite Historical Land Use

D1.60 ERM's review of the available historical mapping indicates that the Project Site was used as a power station between the dates of c.1990 and 2013. This will highly likely have involved some limited onsite storage of fuels and various other process chemicals. As reported in Environ's previous Phase I report "*Notable volumes of oil and chemicals have been stored and used within the power station. Pollution prevention measures including the management and control of oil and chemicals appear to have been implemented and well documented, based on information provided to Environ by the site however, spillages and uncontrolled releases are known to have occurred*".

D1.61 As described in *Section 3.1*, previous ground investigation / monitoring works have been completed at the Project Site and limited soil / groundwater contamination has been identified, as below:

- Site Condition Report, Environ, 2015 (Annex D3, Chapter 6) - Low concentrations of metals, TPH, SVOCs (carbazole) and PAH were detected in soils at the Project Site however, no exceedances of Environ's Human

Health Commercial Land Use GAC were recorded. Concentrations of metals, sulphate, petroleum hydrocarbons and PAH were detected in groundwater at the Project Site, including occasional exceedances of the applied Controlled Waters GAC (EQS & DWS). A single exceedance of Environ's Human Health GAC relating to groundwater vapour inhalation was recorded at one location associated with C12-16 range aliphatic hydrocarbons.

- **SPMP Groundwater Monitoring, 1997 - 2013** – The 2015 SCR states that *"Biannual groundwater monitoring of seven groundwater monitoring wells was undertaken between 1997 and 2013 as a requirement of the Project Site's Environmental Permit…. Moderate concentrations of hydrocarbons and metals were identified in groundwater, the source of which may have been activities onsite*".

D5.2.2 Offsite Historical Impact

Former ICI / Du Pont Facility

D1.62 ERM's review of the available historical mapping and detail supplied within the 2015 SCR (Annex D3, Chapter 6) indicates that the area to the north of the Project Site was operated by ICI (and later Du Pont) as a nylon production facility between c.1950 and the late 2000s. The 2015 SCR identifies a range of potential contaminants associated with this use, including various organic chemicals (such as alcohols, polymers and amines), maintenance / operational fuels and oils and inorganic chemicals such as chromic acid.

Wilton Bunds Landfills

D1.63 Two authorised landfill sites are recorded by the UK EA in the vicinity of the Project Site (86m S and 160m W). In both cases these landfills are registered to ICI under the name '*Wilton, Perimeter Mounds*', and are classified as Industrial Waste Landfills. These licenses were issued in October 1978 and are now reported to be closed. No further detail is provided by the UK EA or the 2015 SCR regarding the operational dates of these landfills, the types of waste deposited therein, or any capping / gas mitigation measures implemented on closure. It is believed that the waste was tipped above the natural ground surface and has been capped with soils. The likely aim of the mounds was to act as screening bunds to the main Wilton facility. Extensive monitoring was completed as a requirement of / to support the surrender of the environmental permit of the former facility, and contamination associated with these landfills has not been detected.

D5.2.3 Offsite Current Land Use

D1.64 The Project Site is located within Wilton International industrial park. As such, numerous permitted activities / industrial installations are currently present within the vicinity of the Project Site, at which bulk fuel / chemical storage and use is likely. Of these, the closest / likely most relevant is the bioethanol

plant located to the immediate east, operated by *Ensus Ltd*. The Ensus facility is modern, being constructed in the mid to late 2000s and as a result benefits from modern pollution prevention measures. Given the nature of the Ensus site processes in the manufacture of bioethanol, the potential for pollution is considered to be limited.

D5.3 RECEPTORS

D1.65 A summary of the statutory receptors considered for inclusion in the CSM is provided in *Table D5.2a*. Further detail relating to the receptors identified within the table is presented in *Sections 5.2.1 – 5.2.3*.

Table D5.2a Statutory Receptors Check List

Receptor	On Site	Off Site
Human beings	✓	✓
Ecological systems (statutory designation)	X	X
Property - crops/livestock	X	✓
Property – buildings	✓	✓
Property - domestically grown produce	X	✓
Controlled waters – groundwater	✓	✓
Controlled waters – surface water	✓	✓

D5.3.1 Human Health

Onsite Permanent Workers

D1.66 In the context of a commercial land use (i.e. operation of power station), the primary human health receptor at the Project Site is likely to be an adult member of the regular site workforce. This is likely to include male and female workers between the ages of 18 and 65. The primary consideration relating to these workers is likely to be harmful effects caused by long term exposure to low contaminant concentrations (chronic effects).

Onsite Temporary Workers

D1.67 In addition to the regular workforce, it is likely that construction / ground workers will be present onsite in the future, undertaking works during which exposure to ground contamination is likely (i.e. earthworks). Given the temporary nature of this work, the primary consideration relating to these receptors is likely to be harmful effects caused by short term exposure to contaminants at higher concentrations (acute effects).

Other Human Receptors

D1.68 Given the Project Site's location, it is highly likely that numerous human health receptors will be present in the area surrounding the Project Site (i.e. neighbouring workers / residents etc.). For the purposes of the conceptual

model, with the exclusion of vapour exposure associated with migratory groundwater, risk assessment of the onsite permanent receptors is considered protective of all offsite and / or temporary equivalents.

D5.3.2 Controlled Waters

Groundwater

D1.69 UK EA digital mapping indicates that the superficial till deposits (present across the majority of the Project Site) and the bedrock formation (Redcar Mudstone) are designated as Secondary Undifferentiated aquifer units. The Glaciolacustrine Deposits limited to the north / western areas of the Project Site are designated as Unproductive Strata (indicative of low permeability deposits with marginal groundwater storage / productivity characteristics).

D1.70 No active groundwater abstractions are known to be present within 1km of the Project Site and the Project Site does not lie within a groundwater Source Protection Zone (SPZ) of any type. The groundwater resources at the Project Site have previously been classified by the UK EA as having 'Good' quantitative status and 'Poor' chemical quality.

Surface Waters

D1.71 A controlled surface watercourse (*Kettle Beck*) is present to the immediate west of the Project Site flowing in a northerly direction. This quality of water contained within this watercourse has not been rated by the UK EA. Kettle Beck forms a confluence with Kinkerdale Beck c. 550m N of the Project Site, with Kinkerdale Beck flowing in a SW-NE direction, towards the River Tees. A total of four drains / surface water channels, including one thought to be culverted beneath the Project Site, are also identified in the immediate surrounding area, of which two are thought to be in direct continuity with Kettle Beck.

D5.3.3 Property, Buildings / Buried Utilities

D1.72 A CCGT power station is proposed for construction at the Project Site, including all required site buildings infrastructure, and utilities. The Project Site is located within Wilton International industrial park, this being a multi-occupancy chemical manufacturing site. Land to the north and east of the Project Site contains numerous industrial buildings / structures (i.e. Wilton International); however, residential properties are also present at a distance of c.550m W.

D5.4 POTENTIAL PATHWAYS

D1.73 The potential pathways through which a contaminant source could plausibly be exposed to one of the receptors identified at the Project Site are listed below:

Human Health

- direct / dermal contact with contaminated soils and / or groundwater;
- ingestion of contaminated soils and groundwater;
- migration of gases / vapours by diffusion and along pressure gradients and subsequent inhalation;
- inhalation of particles in windblown dusts; and
- inhalation of groundwater derived vapours.

Controlled Waters:

- vertical migration of mobile substances;
- dissolution of contaminants in percolating rainwaters to shallow groundwater;
- lateral migration of shallow groundwater to nearby surface waters;
- migration of water via preferentially permeable subsurface structures (drainage runs etc.); and
- surface water runoff.

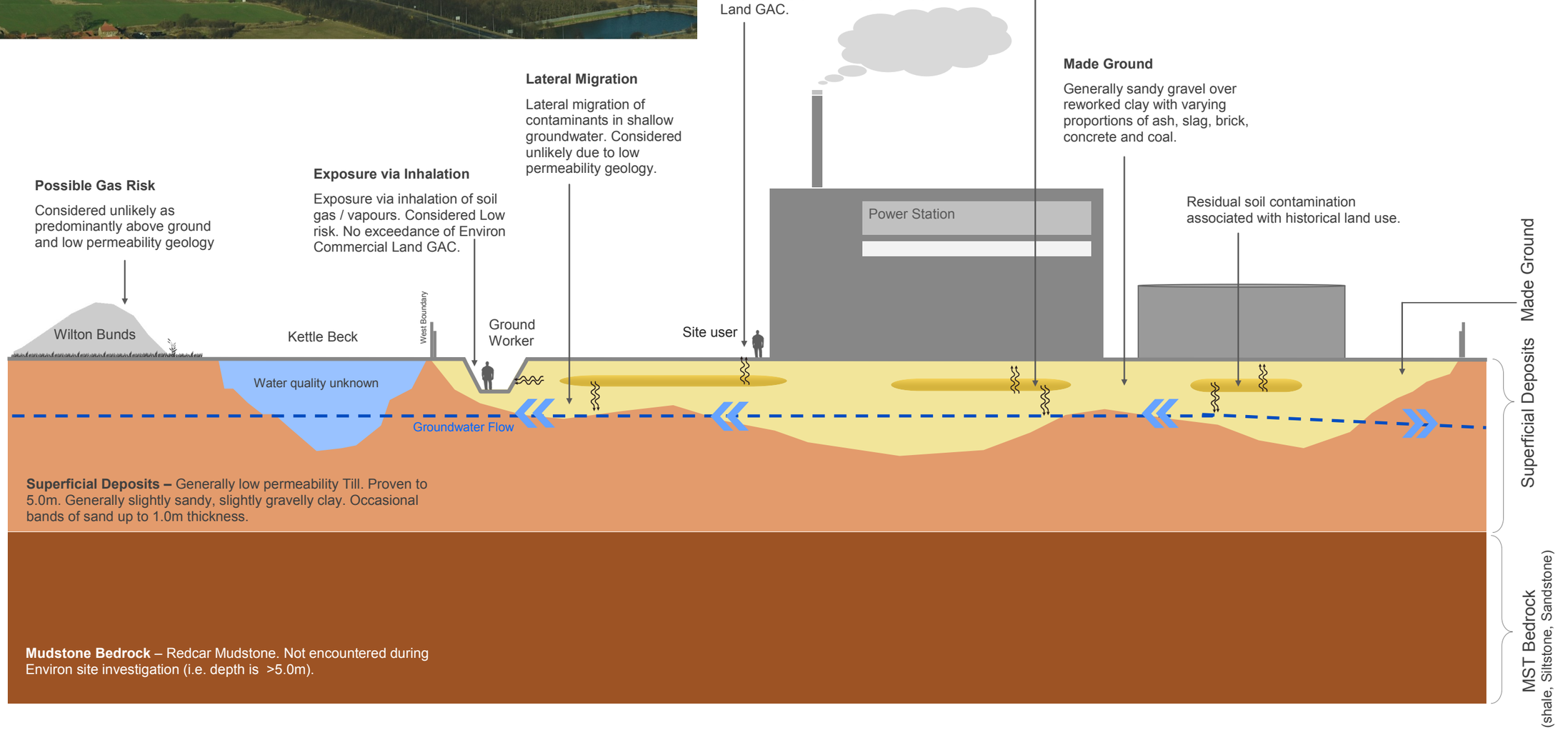
Property

- direct contact with contaminated soil and / or groundwater.

D5.5 POTENTIAL POLLUTANT LINKAGES

D1.74 Based on the above detailed sources, receptors and pathways, the potential pollutant linkages identified at the Project Site are illustrated in *Figure D.5*. These are further discussed in *Section 6* of this report.

Existing Photo of Site



Legend

- Migration
- Water Table
- Residual Soil Contamination
- Mudstone Bedrock
- Superficial Deposits
- Made Ground
- Groundwater Flow
- Grass

CLIENT: Sembcorp		**FIGURE NO : D5** CONTAMINATED SITE MODEL (CSM)	
sembcorp / ERM — ERM, 2nd Floor, Exchequer Court, 33 St Mary Axe, London, EC3A 8AA, Tel: 020 3206 5200			
DATE: 13/04/2017	**CHECKED:** NT/HB	**PROJECT:** 0375193	
DRAWN: AK	**APPROVED:** RE/KM		
SIZE: A3		**STATUS:** Final	**SCALE:** NOT DRAWN TO SCALE/ ILLUSTRATION

D6 REFINEMENT OF CONCEPTUAL SITE MODEL

D6.1 ASSESSMENT OF POTENTIAL POLLUTANT LINKAGES

D6.1.1 Soil Gas Risks (Wilton Mounds)

D1.75 Two historical industrial landfill sites have been identified in this Phase I ESA in relatively close proximity to the Project Site (*Wilton Mounds*). These are also discussed in in the previous 2015 SCR (Annex D3, Chapter 6), regarding which it is stated that "*No assessment of ground gas will be undertaken in the 2015 investigation as there are no onsite receptors, based on a continued use of the Project Site in its current configuration. The requirement for ground gas monitoring should be reassessed in the event of redevelopment*".

D1.76 Given that the waste was most likely deposited above the natural ground level and capped with soil, the risk of lateral below ground migration of gases is considered to be low. This is further reinforced by the nature of the natural ground which is likely to be low permeability.

D1.77 The risk of soil gases resulting from these perimeter mounds and impacted on the Project Site is therefore likely to be low.

D6.1.2 Risks to Human Health

Contamination of Soil

D1.78 Based on the CSM, limited soil contamination identified at the Project Site may, in theory, present a risk to human health by direct contact, by ingestion or via the inhalation of vapours / particulates. Based on the fact that the reported concentrations do not exceed Environ's commercial land use GAC, ERM would agree with Environ's assessment that soil contamination at the Project Site is representative of a Low risk to human health.

Groundwater Vapours

D1.79 As detailed in *Section 5.1.1*, a single exceedance of Environ's human health groundwater vapour screening value (commercial land use) was reported in the groundwater analytical data. Specifically, this related to a 100ug/L concentration of C12-C16 range aliphatic hydrocarbons reported at location WS07 (central western area of the Project Site, adjacent to former cooling tower).

D1.80 Regarding this, the screening value used by Environ does not appear to be a risk derived number, but instead is equivalent to the theoretical upper threshold of solubility for this compound (0.76 ug/L - i.e. it has been assumed that a potential risk is present at the point / concentration where free product may form within the groundwater). In this case, given that no free phase product was in fact observed during groundwater monitoring at the Project

Site, ERM would agree with Environ's conclusion that this concentration is unlikely to be representative of a significant risk to human health.

D1.81 Regarding risks to human health via the inhalation of groundwater vapours, ERM has derived a risk based set of Generic Assessment Criteria for Groundwater (GACGW), based on the partitioning of vapours from groundwater and subsequent migration through the unsaturated subsurface, using the standard land use assumptions detailed within the CLEA technical guidance (SR3). With regards to aliphatic hydrocarbons range C12-C16, ERM has determined a value of 1,194 mg/L as being the point at which a risk to human health may become significant via this pathway. However, given that the theoretical upper solubility threshold for this compound is 0.76 ug/L, it is highly unlikely that this concentration would ever in fact be detected in groundwater. As such, ERM does not consider the detected dissolved concentrations of C12-C16 aliphatic hydrocarbons to present any significant risk to human health under any land use scenario.

D6.1.3 Risks to Controlled Waters

D1.82 Based on the CSM, contaminants present in the subsurface soils may come into contact with the shallow groundwater at the Project Site via vertical migration of mobile substances and by dissolution within percolating rainwater. Once present in the shallow groundwater these contaminants may migrate laterally within groundwater flow itself or via preferentially permeably structures (such as drainage runs).

D1.83 Whilst some limited exceedances of the controlled waters screening criteria adopted by Environ (EQS & DWS) were reported, based on the detected concentrations observed, ERM would agree with Environ's assessment that overall risks to controlled waters at the Project Site are Low. In this case, ERM considers the fact that the screening criteria were exceeded is likely to be a function of the high level of conservatism inherent in the development of the EQS / DWS screening values, rather than an indicator of significant impact at the Project Site.

D7 RECOMMENDATIONS

D1.84 Based on the results of this Phase 1 ESA and considering the results of recent intrusive works undertaken at the Project Site (as reported in the 2015 SCR (Environ - Annex D3, Chapter 6)), ERM considers the Project Site to represent an overall low level of environmental risk. Based on this, ERM considers no further work is necessary prior to commencement of the proposed development.