FOREWIND

DOGGER BANK
TEESSIDE A & B

March
2014

Environmental Statement
Chapter 24
Geology, Water Resources and Land Quality

Application Reference: 6.24

Cover photograph: Indicative image showing installation of meteorological mast within the Dogger Bank Zone

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1 Introduction

1.1 Background

1.1.1 This chapter of the Environmental Statement (ES) assesses the potential impacts of the onshore elements of Dogger Bank Teesside A & B with respect to geology, land quality, water resources, flood risk and waste, specifically addressing:

- Geology and land quality (the Phase 1 Land Quality report is also provided as **Appendix 24A**);
- Surface water quality and quantity;
- Groundwater quality and quantity, including Source Protection Zones (SPZs);
- Flood risk (the Flood Risk Assessment (FRA) is also provided as **Appendix 24B**);
- Estimated types and quantity of waste arisings (the Site Waste Management Plan (SWMP) is also provided as **Appendix 24C**); and
- Water Framework Directive (WFD) Compliance Assessment Report is also provided as **Appendix 24E**.

1.1.2 Where the potential for impacts is identified, mitigation measures and residual impacts are presented.

2 Guidance and Consultation

2.1 Introduction

2.1.1 The assessments have been guided and informed by relevant policy, legislation, standards, guidance documents and consultation. The following section summarises the key guidance and consultation relevant to geology, water resources, land quality, waste and flood risk.

2.2 Policy

National Policy Statements

2.2.1 The assessment of potential impacts upon geology, water resources, land quality, waste and flood risk has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIP). Those relevant to Dogger Bank Teesside A & B are:

- Overarching NPS for Energy (EN-1) (DECC 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

2.2.2 The specific assessment requirements for geology, water resources, land quality, waste and flood risk, as detailed in the NPS, are summarised in **Table 2.1**, together with a reference for where in this ES each is addressed. Where any part of the NPS has not been followed within the assessment an explanation as to why the requirement was not deemed relevant, or has been met in another manner, is provided.

Table 2.1 NPS assessment requirements

NPS requirement	NPS reference	ES reference
Where the development is subject to Environmental Impact Assessment (EIA) the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance.	EN-1 Section 5.3.3	Section 4 for geological sites. Ecological sites are considered separately within **Chapter 25 Terrestrial Ecology**.
The applicant should set out the arrangements that are proposed for managing any waste produced and prepare a Site Waste Management Plan. The arrangements described and Management Plan should include information on the proposed waste recovery and disposal system for all waste generated by the development, and an assessment of the impact of the waste arising from	EN-1 Section 5.14.6	A Site Waste Management Plan has been prepared and is included as **Appendix 24C** to this chapter.

NPS requirement	NPS reference	ES reference
development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation. The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that this is the best overall environmental outcome.		
Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent.	EN-1 Section 5.15.2	A WFD Compliance Assessment is included within **Appendix 24E** and impacts discussed in Section 6.
The ES should in particular describe: • The existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges. • Existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies). • Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics. • Any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones around potable groundwater abstractions.	EN-1 Section 5.15.3	Existing environment discussed in Section 4 and impacts during construction discussed in Section 6. A WFD Compliance Assessment is included within **Appendix 24E**.
Applications for energy projects of one hectare or greater in Flood Zone 1 in England or Zone A in Wales and all proposals for energy projects located in Flood Zones 2 and 3 should be accompanied by a flood risk assessment (FRA). Further guidance can be found in the Practice Guide which accompanies Planning Policy Statement 25 (PPS25).	EN-1 Section 5.7.4 and 5.7.6	An FRA has been undertaken and is included as **Appendix 24B**.

2.3 Other legislation, standards and guidance

2.3.1 In addition, this assessment has been undertaken with due consideration of the following legislation (and amendments, where appropriate):

- The European Union (EU) Water Framework Directive 2000/60/EC;

- Water Environment (Water Framework Directive) (England and Wales) Regulations (2003);
- Environmental Protection Act (1990);
- Environment Act (1995);
- Water Resources Act (1991);
- Water Industry Act (1991);
- Groundwater Directive (2006/118/EC);
- Environmental Permitting (England and Wales) Regulations (2010);
- Private Water Supplies Regulations (1991);
- Draft Private Water Supplies Regulations (2008);
- European Council (EC) Freshwater Fish Directive (2006/44/EC);
- Land Drainage Act (1991);
- Revised Waste Framework Directive (2008/98/EC);
- Waste (England and Wales) Regulations (2011) SI No 988;
- Hazardous Wastes (England and Wales) Regulations (2005) SI No 894 (as amended);
- Site Waste Management Plan Regulations (2008) SI No. 314;
- Contaminated Land (England) Regulations (2006) Statutory Instrument No. 1380; and
- Construction (Design and Management) Regulations 2007.

2.3.2 This assessment has also been made with reference to the following statutory and general guidance:

- Flood & Water Management Act (2010);
- Coastal Protection Act (1949);
- Technical Guidance to the National Planning Policy Framework, March 2012;
- Planning Policy Statement 10: Planning for Sustainable Waste Management (DCLG 2005) (Revised, March 2011);
- Development and Flood Risk - Practice Guide: Planning Policy Statement 25 (December 2009);
- Environment Agency – Pollution Prevention Guidance (PPG) - 1 General Guide to the Prevention of Water Pollution (May 2001);
- Environment Agency PPG2 – Above ground oil storage tanks (August 2011);
- Environment Agency PPG3 – Use and design of oil separators in surface water drainage systems (April 2006);

- Environment Agency PPG5 – Works and maintenance in or near water (October 2007);
- Environment Agency PPG6 – Working at construction and demolition sites (March 2012);
- Environment Agency PPG7 – Refuelling facilities (July 2011);
- Environment Agency PPG21 – Pollution incident response planning (March 2009);
- Environment Agency PPG22 – Dealing with spills (April 2011);
- Environment Agency – Pollution Prevention Technical Information note, Major pipelines (June 2011);
- Construction Industry Research and Information Association publication C532 – Control of water pollution from construction sites (2001);
- Construction Industry Research and Information Association publication C650 – Environmental good practice on site (2005);
- Construction Industry Research and Information Association publication C515 – Groundwater Control – Design and Practice (2000);
- Construction Industry Research and Information Association publication C648 – Control of water pollution from linear construction projects (2006);
- Construction Industry Research and Information Association publication C503 – Environmental good practices – working on site (2000);
- Construction Industry Research and Information Association publication C502 – Environmental good practice on site (2000);
- Construction Industry Research and Information Association publication C697 – The Sustainable Drainage Systems (SUDS) manual (2007);
- Environment Agency Groundwater protection: Policy and practice (GP3) (2007);
- Environment Agency Model Procedures for the Management of Land Contamination (Contaminated Land Report (CLR) 11) (2004);
- Environment Agency WM2: Interpretation of the definition and classification of hazardous waste (version 2.3, updated April 2011);
- Department for Environment, Food and Rural Affairs (Defra) - Guidance on applying the Waste Hierarchy (June 2011);
- Contaminated Land: Application in Real Environments (CL:AIRE) Definition of Waste: Development Industry Code of Practice (March 2011);
- Department for Environment, Food and Rural Affairs (Defra): Non-statutory guidance for site waste management plans (April 2008);
- BS5930:1999 + A2:2010, Code of practice for site investigations (August 2010); and

- BS10175:2011, Investigation of potentially contaminated sites (March 2011).

2.4 Consultation

2.4.1 To inform the ES, Forewind has undertaken a thorough pre-application consultation process, including the following key stages:

- Scoping Report submitted to the Planning Inspectorate (May 2012);
- Scoping Opinion received from the Planning Inspectorate (June 2012);
- First stage of statutory consultation (in accordance with sections 42 and 47 of the Planning Act 2008) on Preliminary Environmental Information (PEI) 1 (report published May 2012); and
- Second stage of statutory consultation (in accordance with sections 42, 47 and 48 of the Planning Act 2008) on the ES (published November 2013) designed to allow for comments before final application to the Planning Inspectorate).

2.4.2 In addition, consultation associated with the Dogger Bank Creyke Beck application (Forewind August 2013) has been taken into account for Dogger Bank Teesside A & B where appropriate.

2.4.3 In between the statutory consultation periods, Forewind consulted specific groups of stakeholders on a non-statutory basis to ensure that they had an opportunity to inform and influence the development proposals. Consultation undertaken throughout the pre-application development phase has informed Forewind's design decision making and the information presented in this application.

2.4.4 In addition consultation has been undertaken with the EA and Redcar and Cleveland Borough Council (RCBC), to obtain further details relating to:

- Historic landfill sites;
- Private water supply abstractions;
- Public water supply abstractions;
- Historic flooding records;
- Discharge consents; and
- Water quality data.

2.4.5 Following this initial consultation, the Environmental Protection Team at RCBC also provided additional details relating to the type of waste deposited in historic landfills, which the High Voltage Direct Current (HVDC) and High Voltage Alternating Current (HVAC) cable route currently passes close to.

2.4.6 The responses from this consultation have been used to inform the gathering of baseline data. A summary of the consultation carried out at key stages throughout the project, of particular relevance to Geology, Water Resources and Land Quality, is presented in **Table 2.2**. This table only includes the key items of consultation that have defined the assessment. A considerable number of comments, issues and concerns raised during consultation have been addressed during consultation meetings and hence have not resulted in changes to the content of the ES. In these cases, the issue in question has not been captured in **Table 2.2**. A full explanation of how the consultation process has shaped the ES, as well as tables of all responses received during the statutory consultation periods, is provided in **Chapter 7 Consultation** and in the Consultation Report.

Table 2.2 Summary of consultation relating to geology, land quality and water resources

Date	Consultee	Summary of issue	ES reference
Water resources			
June 2012 (Scoping, Statutory)	Planning Inspectorate	Groundwater is the potential pathway for discharge of liquids to surface and coastal waters. The EIA should comprehensively assess the potential impact upon groundwater during the construction phase and must include, inter alia, the use and storage of hazardous substances, dewatering, discharge, drainage, physical disturbance of sub surface and dealing with sediment fines.	Section 6 and 7
June 2012 (Scoping, Statutory)	Planning Inspectorate	The EIA must consider the surface water discharge from the potential converter sites and consider the impacts in relation to discharge into tidal waters or fluvial watercourses.	Section 6 and 7
June 2012 (Scoping, Statutory)	Planning Inspectorate	A methodology for on-going water monitoring during the construction and operational phases of the development should be discussed as part of the EIA.	Section 6 and 7
March 2013 (Non-statutory)	EA	Consultation request issued to EA for Water Framework Directive comment – no response received.	N/A
September 2013 (Non-statutory)	Northumbrian Water	No comment on summary EIA findings.	N/A
December 2013 (Non-statutory)	RCBC	No issues raised.	N/A
December 2013 (Non-statutory)	EA	The development proposal should take into account the WFD in terms of maintaining good ecological and chemical status of surface and groundwater's within the study area. Consent may be required for water crossings, from either the Environment Agency or local authority.	**Appendix 24E**
Flood risk			
June 2012 (Scoping, Statutory)	Planning Inspectorate	The Scoping Report states that an FRA will only be provided if the chosen locations for the converter stations include one within a	**Appendix 24B**

Date	Consultee	Summary of issue	ES reference
		flood risk zone. The Secretary of State advises that an FRA is carried out regardless of the location of the converter stations as the landfall infrastructure within the tidal area and the cable routes from the shoreline could also be affected by flooding during construction and operation.	
February 2013 (Non-statutory)	EA	Refer to the EA Guiding Principles for Land Contamination for the type of information required in order to assess risks to controlled waters from the site. The Local Authority can advise on risk to other receptors, e.g. human health.	**Appendix 24A**
December 2013 (Non-statutory)	RCBC	Comments have also been raised with regard to flood risk and the treatment of surface water particularly with regard to the converter stations. It is advised that discussions take place with the ES and Sembcorp Utilities UK Limited who help in the operation and running of the wider Wilton Site.	**Appendix 24B**
December 2013 (Non-statutory)	EA	The EA welcome the proposals set out in paragraph 5.2.1 of the summary provided. The surface water attenuation will be sized to cope with up to and including the 100 year (plus 30% for climate change) storm event. The calculated Greenfield discharge rate of 16 l/s is acceptable.	**Appendix 24B**
Waste management			
June 2012 (Scoping, Statutory)	Planning Inspectorate	The environmental effects of all wastes to be processed and removed from the site should be addressed. The ES will need to identify and describe the control processes and mitigation procedures for storing and transporting waste off site. All waste types should be quantified and classified.	Section 6 and 7
June 2012 (Scoping, Statutory)	Planning Inspectorate	It is stated within the Scoping Report that a waste management plan will be produced as part of the application for development consent. The Secretary of State advises that the EIA should consider the impacts of waste on the environment and should clarify the types of all wastes to be processed and that the effect of the proposal, in terms of waste, should be included in the ES. The Secretary of State draws attention to the responses in Appendix 2 from the EA regarding waste regulations and the Health Protection Agency regarding the safe disposal of waste. The Waste Management Plan must consider the use of recycled materials that can be incorporated into the development.	Section 6 and 7 and **Appendix 24C**

Date	Consultee	Summary of issue	ES reference
June 2012 (Scoping, Statutory)	EA	Under the Environmental Permitting Regulations 2010 any proposals to deposit, treat, store or dispose of any waste material may require an Environmental Permit or specific exemption obtained from the EA.	Identified in Site Waste Management Plan, **Appendix 24C**
June 2012 (Scoping, Statutory)	EA	The project will require the preparation of a Site Waste Management Plan in accordance with the Site Waste Management Plan Regulations 2008. The developer should consider how they can incorporate recycled/recovered materials into the building programme.	**Appendix 24C**
June 2012 (Scoping, Statutory)	EA	The developer is encouraged to commit to the Government's Waste Recycling Action Programme's (WRAP) Halving Construction and Demolition Waste to Landfill by 2012 policy, if they have not already done so.	Referenced in **Table 3.5** Significance of Waste Arising's
December 2013 (Non-statutory)	RCBC	No issues raised.	N/A
Land quality			
February 2013 (Non-statutory)	EA	Follow the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination, when dealing with land affected by contamination.	**Appendix 24A**
February 2013 (Non-statutory)	RCBC	Draft Phase 1 Land Quality Desk Study submitted to RCBC for comment – no response received.	N/A
September 2013 (Non-statutory)	RCBC	The methodology proposed within the summary EIA findings is satisfactory.	N/A
December 2013 (Non-statutory)	Tees Valley Regionally Important Geological and Geomorphological Sites (RIGS) Group	Confirmation that the intrusive cable works will not occur in designated geologically sensitive areas.	Section 4 and **Appendix 24A**
December 2013 (Non-statutory)	RCBC	No issues were raised with regards to land quality, however it was noted that should any further discussions be required these should be with Council's environmental protection team.	N/A
December 2013 (Non-statutory)	EA	Information regarding historic landfills was discussed, as well confirmation that no landfill gas is present in the mounds identified.	**Appendix 24A**

3 Methodology

3.1 Introduction

3.1.1 This section provides a baseline with regard to the sensitivity of geology, water resources, flood risk, land quality and waste and identifies the likely implications and effects upon them from the onshore infrastructure. Where adverse impacts are predicted, appropriate mitigation actions are proposed to reduce or remove them completely. Best practice measures are also outlined.

3.2 Study area

3.2.1 Dogger Bank Teesside A & B may each have a maximum installed capacity of 1.2GW. The onshore element comprises all infrastructure landward of the Mean High Water Mark (MHWM) including:

- A preferred landfall location between Redcar and Marske-by-the-Sea;
- Two buried HVDC cable systems (each cable system contains a pair of main cables and a communications cable within a single trench);
- Two converter stations and associated development;
- Two buried HVAC cable systems (one per project) connecting to existing National Grid Electricity Transmission (NGET) substation at Lackenby; and
- Enabling works at the existing NGET substation at Lackenby.

3.2.2 For the purpose of this assessment, and to aid the baseline descriptions, two study areas have been defined to assess the impacts associated with the project:

- Direct impacts footprint – this is an area encompassing the entire onshore Dogger Bank Teesside A & B development footprint (including HVDC and HVAC cable routes, converter stations and temporary construction compounds; and
- Study area – this area incorporates a 1km buffer around the direct impacts footprint where environmental receptors may be present but no physical works will take place.

3.2.3 The approximately 260km long offshore cable route will come onshore to the north of Marske-by-the-Sea, where it will cross under the railway line and Redcar Road, south of the Marske Sewage Treatment Works. The route will then head south to the A174, where a large construction compound will be sited. The cable route will then cross agricultural fields south of Grewgrass Farm and north of Fell Briggs Farm, Thrushwood Farm and the village of Yearby, until it reaches the Wilton complex, where the converter stations and associated infrastructure will be located. The HVDC will be converted to HVAC at the converter stations and connect into the existing NGET substation at Lackenby to the west of the A1053 via an HVAC cable. Enabling works will be undertaken at the National Grid site that is included within the direct impact footprint. Horizontal Directional Drilling

(HDD) techniques will be used to cross significant obstacles such as watercourses, railway lines and major roads where trenching cannot be achieved. During HDD, tunnels are bored under the structure and / or active bed of the watercourse and the cables pulled through the underlying geology. Further detail of the onshore elements is provided in **Chapter 5 Project Description**.

3.3 Characterisation of the existing environment – methodology

Geology, land quality and water resources

3.3.1 A Land Quality Phase 1 Desk Study (**Appendix 24A**) was undertaken to inform this EIA.

3.3.2 These investigations included the following activities:

- The collation and examination of available local maps and historic plans;
- Review and interpretation of environmental data from regulatory authorities or record holders, including potentially polluting processes, discharge consents, landfill sites, other potential sources of pollution that are present on public registers, and licensed water abstraction points; and
- Completion of a site walkover.

3.3.3 Other data sources were also consulted as part of the assessment:

- Ordnance Survey (OS) and British Geological Survey (BGS) mapping;
- Northumbria River Basin Management Plan (RBMP);
- Environment Agency (EA)'s website, 'What's in My Backyard'; and
- Institute of Geological Sciences hydrogeological mapping.

3.3.4 In accordance with the Environmental Protection Act 1990, for contaminated land to exist there should be a source of contamination, a receptor where 'significant harm' or 'significant possibility of harm' may be caused or significant pollution of controlled waters is being or is likely to be caused, and a pathway which connects the two. Should any element of this contaminant linkage not be present (or be severed) then the land may not be regarded as contaminated land, as defined in Part 2A the Act.

3.3.5 Contamination is described within Part 2A as a substance or substances that can be introduced to the land where they would not normally be or at elevated levels above the baseline. These substances are often associated with industrial processes or activities that have now ceased, but where remnant waste products or residues may present a hazard to the general environment.

3.3.6 In accordance with the above approach, a conceptual model of the site was completed as part of the Phase 1 study and a risk assessment undertaken to assess the potential for source-pathway-receptor linkages (contaminant linkages) to be present which might be affected by the development.

3.3.7 The Land Quality Phase 1 Desk Study, including the conceptual site model (CSM), has been used to characterise the existing environment and to enable an assessment of the sensitivity of receptors sensitive to land quality.

Waste Management

3.3.8 Current waste arisings have been considered with reference to the existing land uses within the study area.

Flood risk

3.3.9 An FRA has been completed, which examined the existing environment through a site visit, consultation with relevant bodies including the EA and RCBC and review of relevant documentation to identify potential sources of flooding. The FRA is provided as **Appendix 24B**.

Water Framework Directive (WFD) Compliance Assessment

3.3.10 Information from the sources listed above was used to inform the WFD Assessment baseline. The EA's web-based "What's in your backyard?" mapping was used to determine which water bodies could be potentially affected by the project.

3.3.11 The names, ID numbers, designation and classification details (including mitigation measures where appropriate) for each surface water and groundwater body were then obtained from the River Basin Management Plan.

3.3.12 Additional hydromorphological and ecological baseline information was derived from walk over surveys of the site.

3.3.13 Additional consultation has also been undertaken with the EA. The WFD Compliance Assessment is given in **Appendix 24E**.

3.4 Assessment of impacts – methodology

Geology, land quality and water resources

3.4.1 Potential impacts arising from the construction, operation, and decommissioning of the onshore infrastructure are identified and assessed taking into account the following elements of the development area's environmental baseline and their sensitivities:

- Site geology;
- Any past or present sources of land contamination;
- Location and condition of watercourses and static water bodies in proximity to the site;
- The potential presence of groundwater aquifers and potential pathways beneath the site and surrounding area; and
- The potential presence of groundwater SPZ in proximity to the site.

WFD Compliance Assessment

3.4.2 The way in which WFD impacts are assessed is quite different to the approach conventionally used within the EIA process. The standard approach assesses whether an impact is minor, moderate or major, and whether it is beneficial or adverse. This is not compatible with the requirements of the WFD, which requires an assessment of whether a project (or element of a project) is compliant or non-compliant with the environmental objectives outlined in **Appendix 24E**.

3.4.3 Following the recommendations made by Murphy *et al*. (2012) the approach to this assessment is to determine whether the scheme has:

- Potential to cause deterioration in water body status by adversely affecting biological, hydromorphological and/or physico-chemical quality elements;
- Potential to prevent achieving good ecological status (GES) or good ecological potential (GEP) by impacting upon proposed mitigation measures already identified for water bodies in the area; and
- Potential to incorporate WFD mitigation measures where possible.

3.4.4 Article 4(6) of the WFD states that temporary deterioration in the status of a water body will not be in breach of the WFD, if all practicable steps are taken to prevent further deterioration and measures taken will not compromise the recovery of the quality of the water body once the temporary change in conditions is over.

Waste management

3.4.5 Waste is defined in Article 3(1) of the revised Waste Framework Directive (2008/98/EC) as:

“any substance or object which the holder discards or intends or is required to discard.”

3.4.6 The potential for waste impacts as a consequence of construction, operation and decommissioning, is assessed by taking into account the anticipated waste arisings and proposed options for waste reuse, recycling, recovery or disposal. The assessment criteria relating to magnitude of effect of waste arisings and significance of waste impacts from the proposed development are provided in **Table 3.4** and **Table 3.5**.

3.4.7 A SWMP has been drafted; the active sheets of the pre-construction SWMP have been appended to the technical report provided in **Appendix 24C**. The SWMP provides a record of any decisions made with respect to materials resource efficiency when designing and planning the works. Any assumptions on the nature of the project (its design, the construction method or materials employed) in order to minimise the quantity of waste produced on site, are captured within the SWMP.

3.4.8 The SWMP provides information on each waste type that is expected to be produced in the project with the appropriate European Waste Catalogue code and description for each waste type. It provides an estimate of the quantity of each type of waste and the proposed waste management option for each waste produced (i.e. re-use, recycling, recovery or disposal; on or off-site).

Flood risk

3.4.9 The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and associated Technical Guidance. Consultation has also been carried out with relevant bodies including the EA and RCBC. The FRA is provided as **Appendix 24B**.

Assessment of receptor sensitivity

3.4.10 The generic assessment methodology employed throughout the ES is explained in detail in **Chapter 4 EIA Process**. Consistent with this approach, the sensitivity of each of the receptors has been considered based on the generic criteria provided within **Table 3.1**.

Table 3.1 Generic criteria for receptor sensitivity geology, land quality, hydrology and hydrogeology

	Definition			
Sensitivity	**Geology**	**Hydrology**	**Hydrogeology**	**Land quality**
High	Deposit rare Deposit/strata value high (national importance/designation)	Main rivers, lakes or ponds, licensed water abstractions, or designated for ecological value	Groundwater SPZs Principal Aquifers	Contaminants very likely to represent an unacceptable risk to potential receptors
Medium	Deposit localised Deposit/strata value medium (regional importance/designations)	Drains that discharge to a highly sensitive site	Secondary A Aquifers	Contaminants likely to represent an unacceptable risk to potential receptors
Low	Deposit moderately widespread Deposit/strata value low (local importance/designation) or no value	Drains that do not discharge to a highly sensitive site	Secondary B Aquifers Secondary Undifferentiated Aquifers	Contaminants may be present but unlikely to create unacceptable risk to potential receptors
Negligible	Deposit widespread No deposit/strata value (no designation)	Non water bearing receptors	Unproductive Strata	Contaminants are unlikely to be present

Assessment of impact magnitude

3.4.11 The impact magnitude is assessed by looking at the potential consequences (severity) of the impact occurring, ranging from minor consequences (e.g. the presence of contaminants at such concentrations that protective equipment is required during the site works) to severe consequences (e.g. major spillage of contaminants from site into a controlled water body); and the probability (likelihood) of the risk occurring - ranging from unlikely (e.g. there is a pollutant linkage but circumstances are such that it is improbable that an event would occur) to high likelihood (e.g. there is a pollution linkage and an event appears very likely in the short term).

3.4.12 The impact assessment is based on these factors and professional judgement. Justification for impact magnitude is included in Sections 6 to 8.

3.4.13 The assessment includes the development of a CSM (source, pathway and receptor contaminant linkage model) against known assessment criteria, where applicable. A summary of the assessment criteria applied for each receptor is shown in **Table 3.2**.

Table 3.2 Summary of generic assessment criteria relating to the magnitude of effect

Magnitude	Receptor		
	Geology	**Surface water**	**Groundwater**
Very High	Loss or extensive change to protected geological attributes of a designated conservation site	A release to a watercourse resulting in a major pollution incident	Very high or high risk to groundwater and/or potable abstractions
High	Minor loss to protected geological attributes of a designated conservation site	A release to a watercourse resulting in a moderate pollution incident	Low to moderate risk to groundwater
Medium	Minor changes to protected geological attributes of a designated conservation site	A release resulting in a slight pollution incident	Slight low hazard to groundwater
Low	No changes to protected geological attributes of a designated conservation site	Temporary change to surface water flows or surface water quality	Very low hazard to groundwater
Negligible	No large scale loss of geology	Temporary very limited barely discernible change to surface water receptors.	Very limited barely discernible change to groundwater regime.

3.4.14 For land quality, the magnitude of effect is assessed with reference to the risk that harm from contamination will occur and is defined in Section 4.8.

3.4.15 For waste arisings, there is no formal assessment criteria relating to the magnitude of effect, so generic impact magnitude is determined by the estimated quantity of each type of waste produced.

3.4.16 For flood risk the magnitude of effect is a factor of the number of properties affected by flooding and the associated flood depths. If applicable, this is incorporated into the findings of the FRA included in **Appendix 24B**.

Overall impact

3.4.17 Following the assessment of the sensitivity of a receptor and the impact magnitude, it is possible to derive the overall impact. **Table 3.3** provides generic definitions for each impact significance category for hydrology, hydrogeology, and land quality. **Table 3.5** provides the definitions used within the assessment of waste arisings.

Table 3.3 Generic definitions for impact level

Impact significance	Generic definition
Major adverse	High magnitude effects at a highly sensitive receptor.
Moderate adverse	Low magnitude effects at highly sensitive receptor; or high magnitude effects at a low sensitivity receptor.
Minor adverse	Low magnitude effects at a low sensitivity receptor.
Negligible	The impact is sufficiently small as to be indeterminable and of no concern.
None	No identifiable impact.

Table 3.4 Assessment criteria relating to magnitude of effect of waste arisings

	Quantity	Limited quantities present <1 tonnes	Small quantities of a particular waste <10 tonnes	Residues left in large storage containers, e.g. groups of skips <100 tonnes	Considerable quantities in stockpiles on site >100 tonnes
Polluting nature of waste	Hazardous – liquid*	Low	Medium	High	High
	Hazardous - solid	Very low	Low	Medium	High
	Quantity	**Residues left in large storage containers, e.g. groups of skips <100 tonnes**	**Considerable quantities in stockpiles on site <1,000 tonnes**	**Considerable quantities in stockpiles on site <10,000 tonnes**	**Considerable quantities in stockpiles on site >10,000 tonnes**
	Non-hazardous	Very low	Low	Medium	High
	Inert	Very low	Very low	Low	Medium

*The polluting potential of liquid wastes is considered to be higher than solid wastes as they can more easily penetrate through soil layers

Table 3.5 Significance of waste arisings

Magnitude / Sensitivity	Very low	Low	Medium	High
All waste is disposed at landfill	Negligible	Minor adverse	Moderate adverse	Major adverse
Reused or recycled to reduce the waste for disposal by 50%*	Negligible	Negligible	Minor adverse	Moderate adverse
Reused or recycled to reduce the waste for disposal 75%**	Negligible	Negligible	Negligible	Minor adverse
All waste is reused or recycled	Negligible	Negligible	Negligible	Negligible

* WRAP's commitment of Halving Construction and Demolition waste to landfill by 2012.
** WRAP's Halving waste to landfill benchmarks for target setting – 75% is the average good practice target for construction waste arisings, based on the range of 70-80%.

4 Existing Environment

4.1 Introduction

4.1.1 This section describes the existing environment in relation to geology, water resources, land quality, waste and flood risk including information gathered during the following studies:

- Geology and land quality (the Land Quality Phase 1 Desk Study is also provided as **Appendix 24A**);
- Surface water quality and quantity;
- Groundwater quality and quantity, including Source Protection Zones (SPZs);
- Flood risk (the FRA is also provided as **Appendix 24B**);
- Estimated types and quantity of waste arisings (SWMP is also provided as **Appendix 24C**); and
- WFD Compliance Assessment (**Appendix 24E**).

4.2 Climate

4.2.1 Average annual rainfall for the area is approximately 726mm based on data obtained from Centre for Ecology and Hydrology (CEH) for the Leven catchment measured at Leven Bridge (National Grid Reference NGR NZ445122). This is based on monthly catchment rainfall reported by CEH from 1961 to 1990. The monitoring station is located approximately 13km west of the cable corridor.

4.3 Site walkover

4.3.1 A site walkover was undertaken by a Royal HaskoningDHV environmental consultant on 28 November 2012. The aim of the walkover was to gain an understanding of the site environs with particular focus on the Wilton Complex (site of the proposed converter stations), potential historic landfill sites, as well as river and drain crossings.

4.3.2 The Wilton Complex is an area zoned for industrial development. The complex comprises a mixture of operational heavy and light industrial works as well as derelict brownfield and arable land. The complex is a former chemical works. The site visit to the Wilton Complex was restricted to the pertinent areas of the proposed location of converter stations for Dogger Bank Teesside A & B. At the time of the visit the area of the proposed converter stations was open land with soil mounds along the boundary and a small brick hut nearby. The line of the HVAC cable route followed the road network of the Wilton Complex bounded by metal fencing to one side and a small dike to the other. The route of the HVDC cable route was not inspected however the largely follows the road network of the Wilton Complex.

4.3.3 A number of historic landfills are shown on the EA website in proximity to the Wilton Complex in the west of the project boundary and to the east near the landfall and railway line. The landfills to the west are marked as Wilton Perimeter Mounds. It is likely that these were constructed from locally won surplus material from the Wilton works. These may contain contaminated soils and construction waste, potentially including asbestos. The historic landfills to the east are located on / or adjacent to the onshore cable route of Dogger Bank Teesside A & B and comprise:

- Coastal Protection Works The Stray, Redcar, licensed to take construction waste;
- Marske Treatment Works, Green Lane, Marske, licensed to take construction waste; and
- The Ings Residential Development, licensed to take general household skip waste and construction industry waste.

4.3.4 Reference should be made to the Land Quality Phase 1 Desk Study, (**Appendix 24A**) for more detailed information relating to these landfills and associated risks.

4.3.5 During the walkover, no olfactory or visual evidence of former landfills was noted.

4.3.6 It should be noted that the walkover was undertaken during a period of heavy rainfall and as such the ground at Dogger Bank Teesside A & B converter stations and adjacent to the watercourses was noted to be saturated and marshy. River levels were also noted to be particularly high, with out of bank flows in some areas.

4.3.7 Photographs taken during the walkover are contained within **Appendix 24D**.

4.4 Hydrology

4.4.1 The area of the cable route is relatively flat and low lying and is drained by the Tees River Catchment area. The land in which the cable corridor is situated is actively managed through drainage channels. Any streams, drains or ditches located in proximity to the cable corridor drain north towards the River Tees and the coast.

4.4.2 Due to the high density of drains in the area, the proposed cable route will cross 14 surface water bodies. The majority of these river crossings have been surveyed as part of the ecological fieldwork programme, as presented in **Chapter 25 Terrestrial Ecology**. The route does not cross named rivers but does cross four named drains: Long Beck, Rogers Dike, Mains Dike and Kettle Beck. A summary of the surface water body crossings is provided in **Table 6.3** in Section 6.

4.5 Geology and water resources

4.5.1 **Table 4.1** summarises the geology and aquifers indicated to be present within the study area. The information within the table is based on BGS published digital mapping at a 1:50,000 scale and Guisborough solid and drift series geology map1998 1:50,000 (Sheet 34) and information obtained from the EA website.

Table 4.1 Summary of underlying geology and aquifer properties

	Stratum	Age	Description	Aquifer properties
Drift	Beach And Tidal Flat Deposits (Undifferentiated)	Quaternary, Post-Glacial, Flandrian	Clay and silt	Defined by the EA as a Secondary A aquifer. Deposits with permeable layers with the capability to support water supplies at a local rather than strategic scale and provide an important source of base flow to rivers.
	Glaciofluvial Deposits (probably including post-glacial river terrace deposits)	Quaternary, Mostly Glacial, Devensian	Sand and gravel	Defined by the EA as a Secondary A aquifer. Deposits with permeable layers with the capability to support water supplies at a local rather than strategic scale and provide an important source of base flow to rivers.
	Till	Quaternary, Glacial, Devensian	Stony Clay	Defined as unproductive strata. Deposits have low permeability, with negligible significance for water supply or base flow to rivers.
Solid	Redcar Mudstone	Jurassic	Mudstone	Defined by the EA as a Secondary B aquifer. Deposits with predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Drift (superficial) geology

4.5.2 The drift geology across the study area generally comprises glacial till with localised deposits of alluvium and glacial sand and gravels. The till is described as a group of sediments laid down by the direct action of glacial ice with variable composition (usually sandy, silty clay with pebbles, but can contain gravel-rich, or laminated sand layers), colour and consistency. Borehole records in the area indicate that the till is approximately 10m in thickness and composed predominantly of clay.

4.5.3 The drift geology beneath the direct impact footprint is shown to comprise considerable thickness of clayey till with only one potential area of Glaciofluvial deposits to the far west of the cable route. The till is defined as an unproductive aquifer with low permeability. The clayey nature of the till and its thickness represents a significant barrier for the vertical migration of contaminants at the ground surface. Its presence is considered to act as a protective cover to the underlying Secondary B aquifer within the solid geology. Therefore groundwater is considered to have a low sensitivity. The drift geology across the study area is shown on **Figure 4.1**.

Solid (bedrock) geology

4.5.4 The underlying bedrock geology across the direct impact footprint is Redcar Mudstone. The Redcar Mudstone Formation is described as predominantly grey, well bedded, marine calcareous mudstone and silty mudstone over 200m in thickness. The solid geology across the study area is shown on **Figure 4.2**. All the BGS logs reviewed are presented in **Appendix 24A**.

4.5.5 The direct impacts footprint does not run through any RIGS identified by the Tees Valley RIGS Group. Although one is identified within the study area to the north of the landfall in the intertidal zone. The site known as Red Howles, lies approximately 150m from the direct impact footprint.

Abstractions

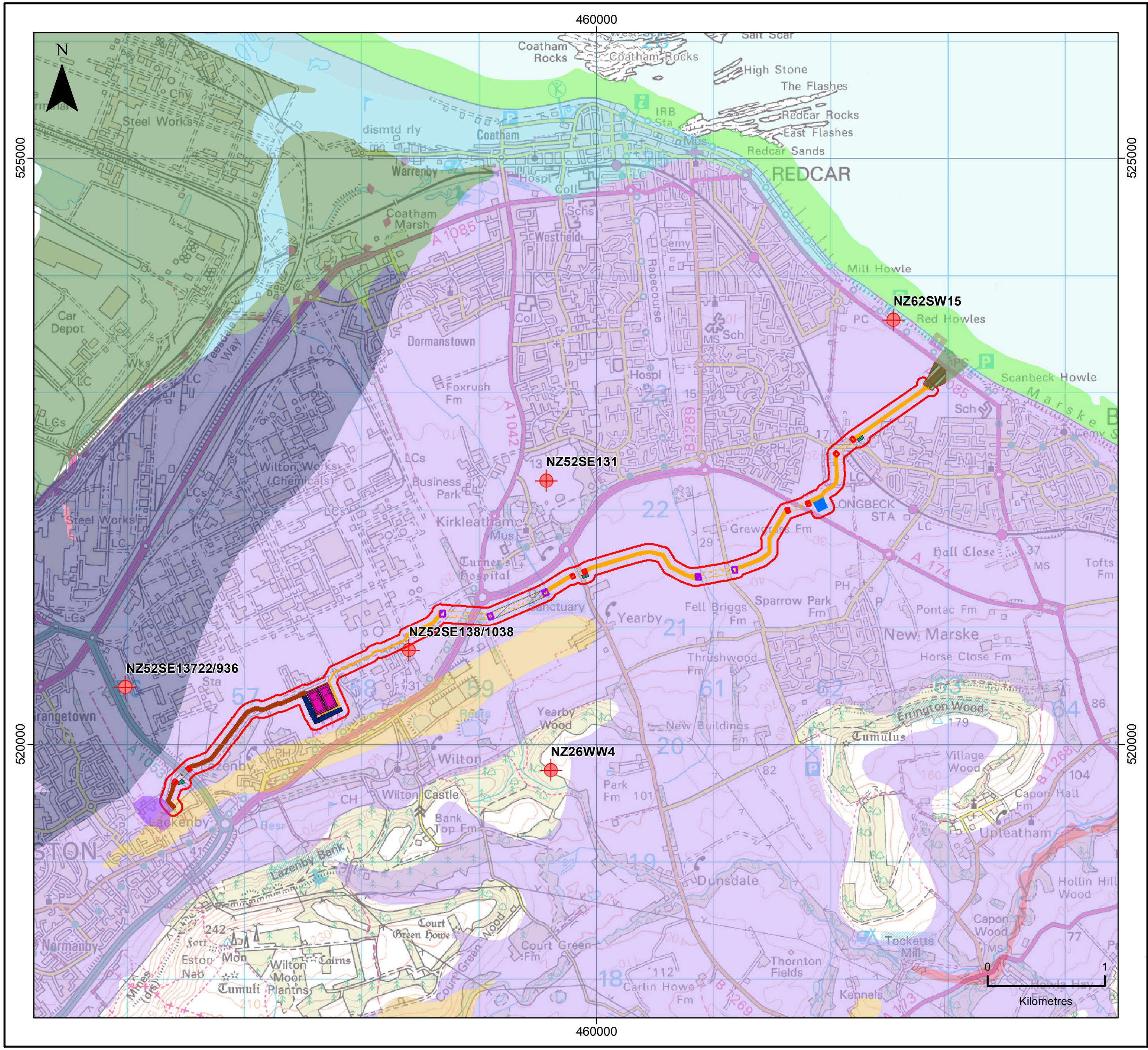
4.5.6 The EA has defined SPZs for groundwater sources which are used for public drinking water. There are no SPZs within 1km of the study area.

4.5.7 The EA has provided details of all other licensed groundwater and surface water abstractions (without designated SPZs) within the study area. There are no licensed groundwater abstractions or surface water abstractions within the vicinity of the cable route and converter stations site (1km).

4.5.8 There is a single unlicensed private water supply abstraction within 500m of the direct impact footprint which is administered by RCBC. By definition, this abstraction is not licensed by the EA as it abstracts less than $20m^3$/day. RCBC has provided details of this commercial supply, although it is not known if it is a surface water or groundwater supply. The location of the abstraction is indicated in **Figure 4.3**.

Licensed discharge consents

4.5.9 The EA has provided details of discharge consents in the study area. There is a single discharge consent within the direct impacts footprint (the area in which any physical works will take place) and 19 consents within 500m. The locations of these discharge consents are indicated in **Figure 4.4**. A table has been provided in **Appendix 24A** which summarises the details of each consent. All of the consents relate to sewage processing or disposal.



LEGEND

- Direct Impacts Footprint
- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation
- Borehole

Superficial Geology

- Alluvium
- Beach and Tidal Flat Deposits (Undifferentiated)
- Blown Sand
- Glaciofluvial Deposits, Devensian
- Glaciolacustrine Deposits, Devensian
- Tidal Flat Deposits
- Till, Devensian

Data Source:
Ordnance Survey data © Crown copyright and database right, 2012

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

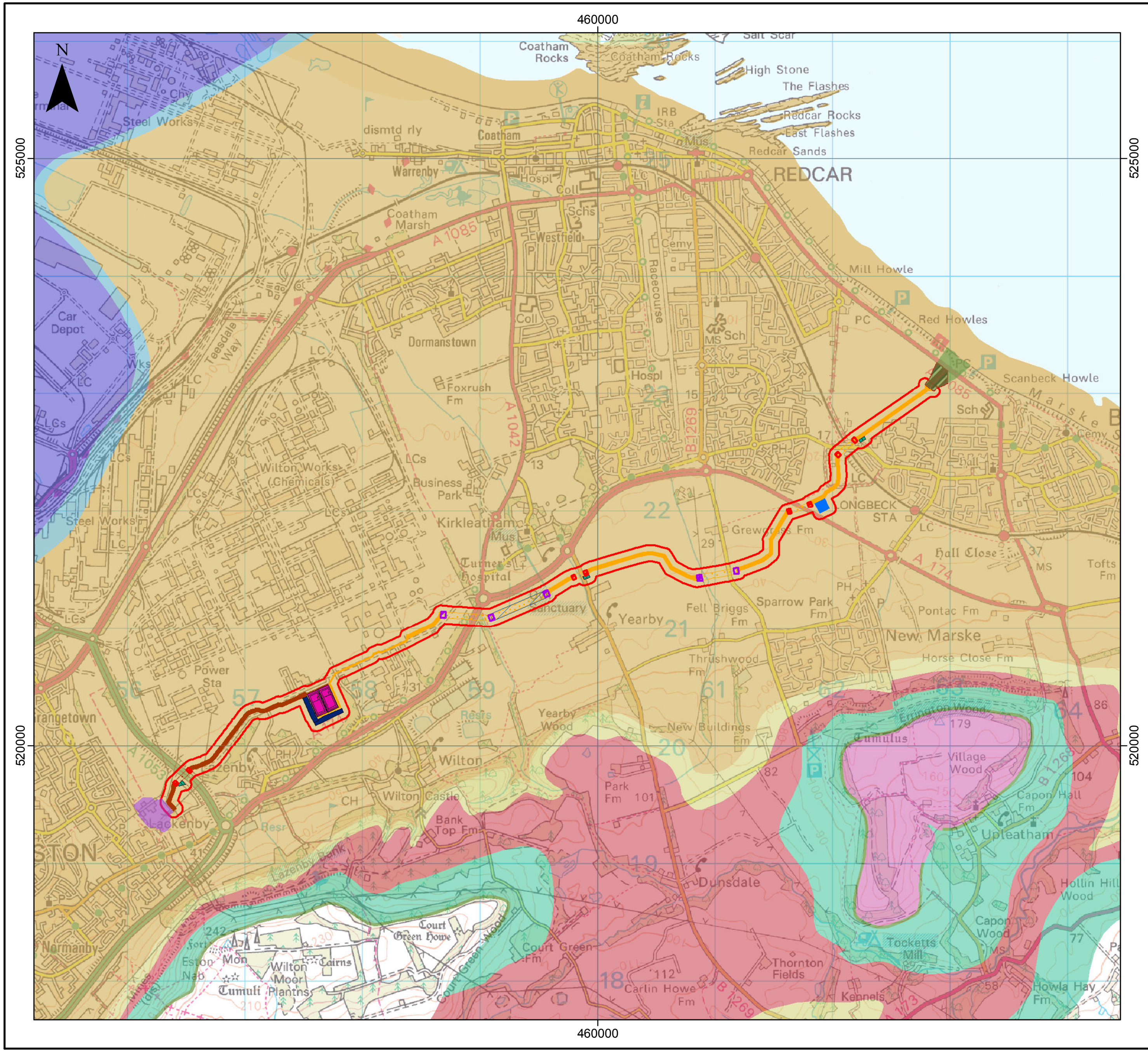
Figure 4.1: Drift Geology

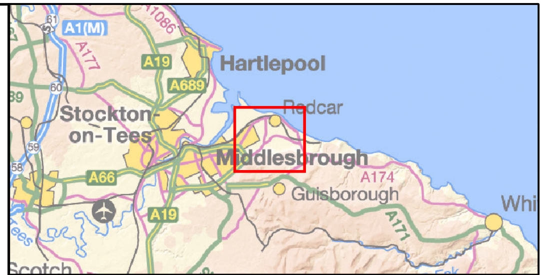
VER	DATE	REMARKS	Drawn	Checked
6	26/07/2013	Draft	SW	DW
7	28/08/2013	Submit for PEI3	SW	DW
9	23/01/2014	Pre-DCO Submission review	SW	DW

DRAWING NUMBER: F-ONL-MA-404

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND





LEGEND

- Direct Impacts Footprint
- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation

Bedrock

- Redcar Mudstone Formation
- Staithes Sandstone Formation
- Cleveland Ironstone Formation
- Whitby Mudstone Formation
- Dogger Formation
- Saltwick Formation
- Mercia Mudstone Group
- Penarth Group

0 — 2 Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2012

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

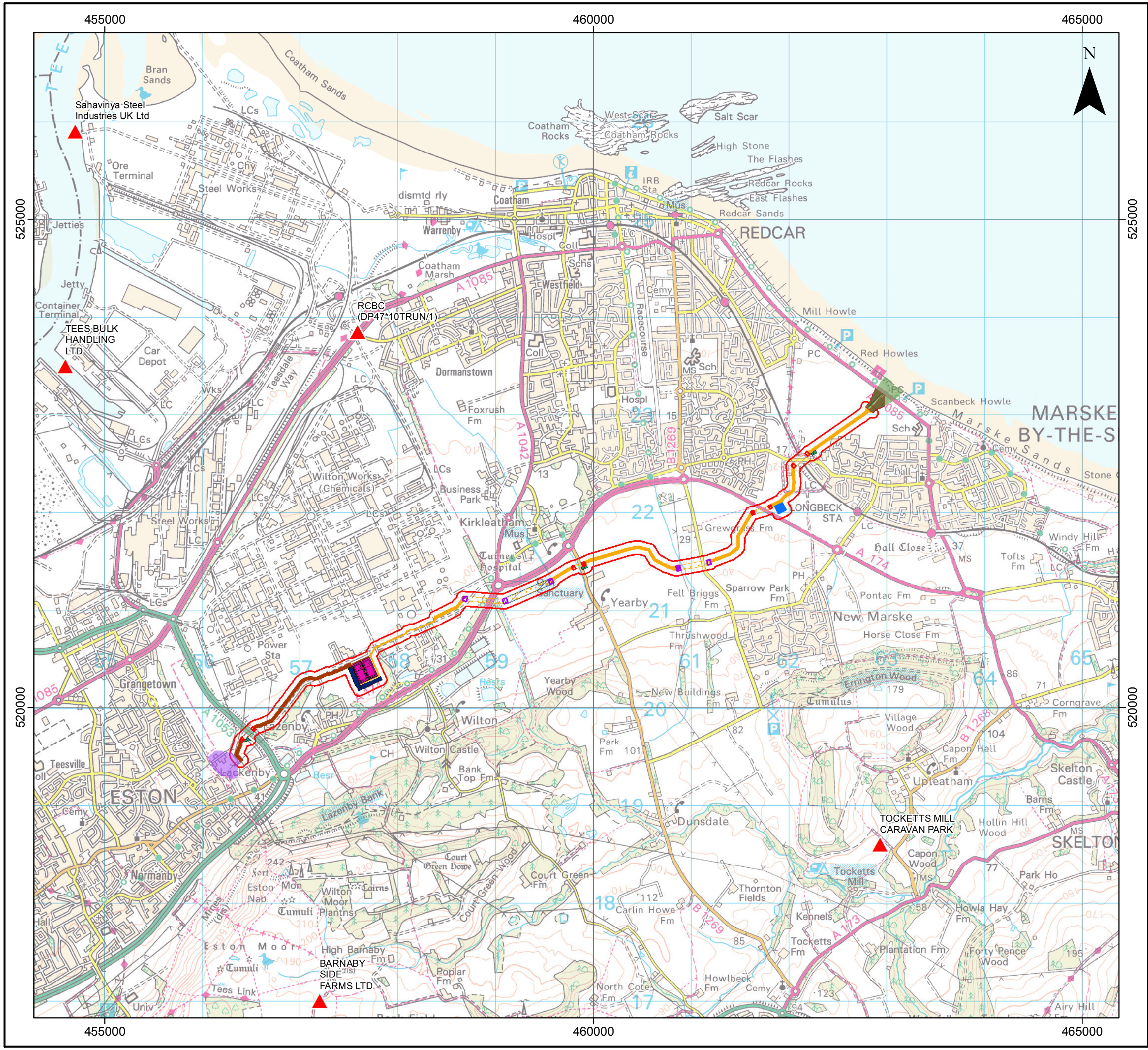
Figure 4.2: Solid Geology

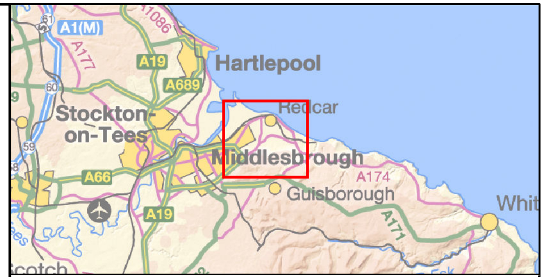
VER	DATE	REMARKS	Drawn	Checked
6	26/07/2013	Draft	SW	DW
7	28/08/2013	Submit for PEI3	SW	DW
9	23/01/2014	Pre-DCO Submission review	SW	DW

DRAWING NUMBER: **F-ONL-MA-405**

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND





LEGEND

- Direct Impacts Footprint
- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation
- Water Abstraction Licences

0 2
Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2012

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

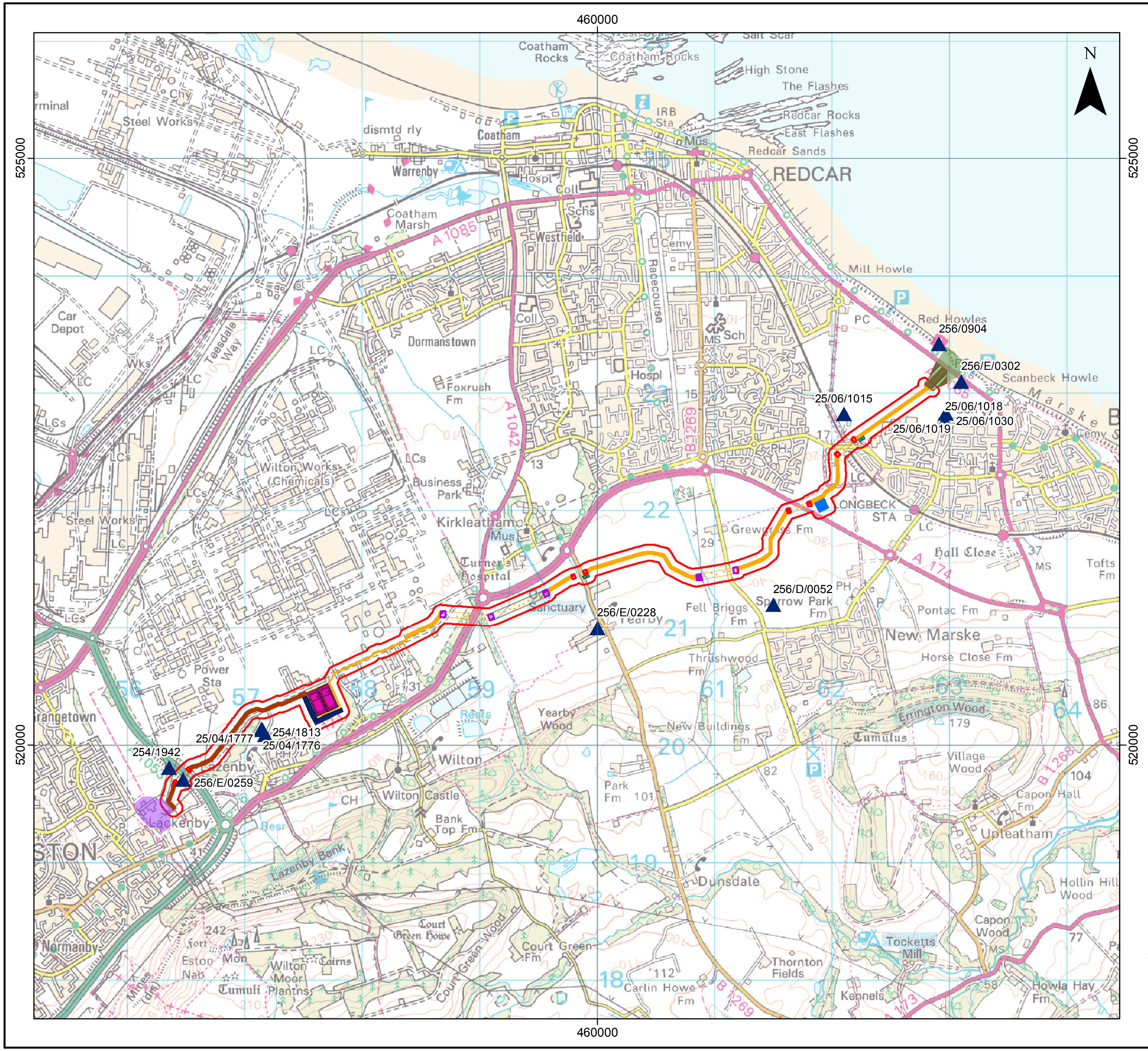
Figure 4.3: Abstractions

VER	DATE	REMARKS	Drawn	Checked
5	10/07/2013	Draft	SW	DW
6	26/07/2013	Draft	SW	DW
8	23/01/2014	Pre-DCO Submission review	SW	DW

DRAWING NUMBER: **F-ONL-MA-406**

SCALE	1:60,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND



LEGEND

- Direct Impacts Footprint
- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation
- Location of discharge consents within 500m of cable route

0 2
Kilometres

Data Source:
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PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 4.4: Discharge consents

VER	DATE	REMARKS	Drawn	Checked
5	10/07/2013	Draft	SW	DW
6	26/07/2013	Draft	SW	DW
8	23/01/2014	Pre-DCO Submission review	SW	DW

DRAWING NUMBER:

F-ONL-MA-407

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

4.6 Water quality

4.6.1 The closest monitoring points for which the EA publishes surface water quality data are over 3km away from the direct impact footprint and relate to the Skelton Beck. The results of the laboratory analysis for the surface water monitoring points is summarised in **Table 4.2**. There is no available data for either Rogers Dike or Mains Dike.

4.6.2 The chemistry of the Tees Mercia Mudstone & Redcar Mudstone groundwater body is classified as 'At Risk' with 2009 Chemical Quality classified as 'Poor' and predicted 2015 Chemical Quality also classified as 'Poor'.

Table 4.2 Surface water quality monitoring points

Sample point name	NGR	Distance (km) from direct impact footprint	Period of data availability	Analytical suites	2009 Grade
Tocketts Mill – Saltburn Gill (Skelton Beck)	X:462760 Y:518100	>3	1990 - 2009	Ammonia Dissolved Oxygen Nitrates Phosphates	Chemistry - C Biology - B Nitrates - 2 Phosphates - 4
Howl Beck - Tocketts Mill (Skelton Beck)	X:462040 Y:518400	>3	1990 - 2009	Ammonia Dissolved Oxygen Nitrates Phosphates	Chemistry - A Biology - / Nitrates - 3 Phosphates - 2

+Data provided by the EA

4.7 Current waste arisings

4.7.1 The land use surrounding the cable route between the landfall and Wilton Complex, A1053 and the existing NGET substation at Lackenby is agricultural. The types of waste from agricultural activities are likely to be dictated on a farm-by-farm basis according to the activities carried out (e.g. there will be a difference in the types of waste produced by a dairy farm compared to arable farming). For example, the types of waste will in general comprise: mixed municipal type waste; plastic packaging (silage wrap, rinsed pesticide containers, bale wrap etc.), small quantities of waste from farm vehicles (motor vehicle batteries, used tyres, used oil etc.); animal medicines; plant matter; surplus milk etc.

4.7.2 The land surrounding the cable route between Wilton Complex and A1053, converter stations site is a mixture of derelict brownfield and arable land. Potential areas of contaminated land have been identified in this section of cable route; these are detailed in Section 4.8 of this chapter. However, these are not operational landfills so they are not considered to be current sources of waste.

4.7.3 Currently, there are no other direct sources of waste arisings identified within the study area.

4.8 Land quality

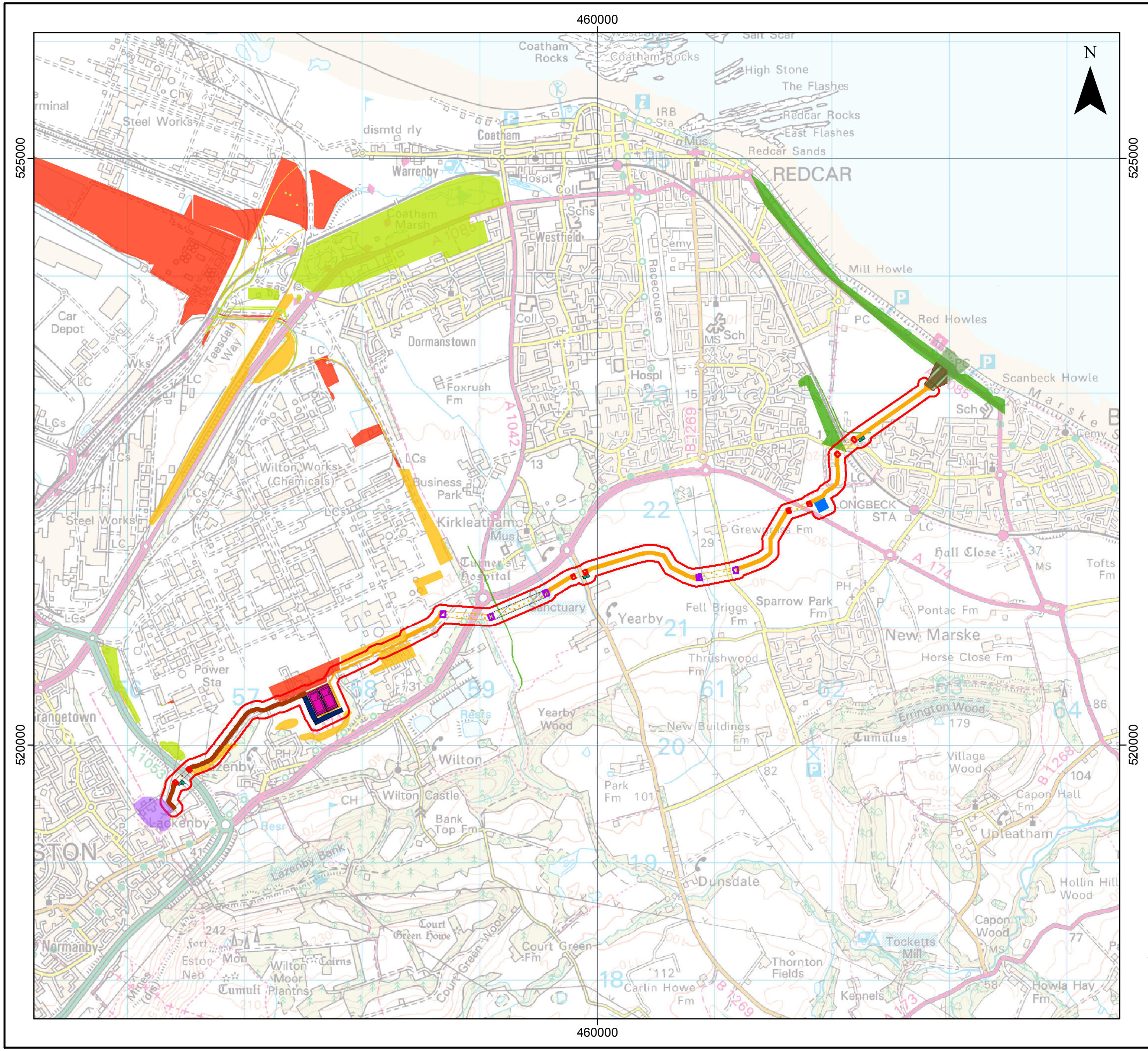
Conceptual site model

4.8.1 As outlined in Section 3.3, as part of this assessment a Land Quality Phase 1 Desk Study has been completed (**Appendix 24A**). A conceptual model of the site was completed as part of the Phase 1 study and a risk assessment undertaken to assess the potential for source-pathway-receptor linkages (contaminant linkages) to be present which may be affected by the proposed development.

Potential Contamination Sources

4.8.2 The Phase 1 Report identified potential sources of contamination, either within the direct impact footprint or the study area, which may affect the proposed development. These comprised railways, hospitals, sewage works, electrical substations, tanks, factories, chemical works, landfills and quarries. The locations of the potential sources of contamination are shown on **Figure 4.5**.

4.8.3 Based on the approach detailed in paragraph 4.8.4, contaminant linkages potentially associated with the sources shown on **Figure 4.5** have been identified. The pollutant linkages have then been assessed for their likely significance and the risk of exposure of sensitive receptors to contamination (see **Appendix 24A**).



LEGEND

- Direct Impacts Footprint
- Teesside A&B cable landfall
- Teesside A&B landfall construction
- Teesside A&B HVDC, Open
- Teesside A&B HVDC,
- Teesside A&B HVAC, Open
- Teesside A&B HVAC,
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation

Historical Contaminated Sites

Risk Rating

- Medium to High
- Medium
- Low to Medium
- Low

0 — 2 Kilometres

Data Source:
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PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 4.5: Sources of contamination

VER	DATE	REMARKS	Drawn	Checked
5	10/07/2013	Draft	SW	DW
6	26/07/2013	Draft	SW	DW
8	23/01/2014	Pre-DCO Submission review	SW	DW

DRAWING NUMBER: **F-ONL-MA-408**

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

Summary of key points in the conceptual site model

4.8.4 The key points within the risk assessment were:

- Human health (Future Users/ Land Owners) is not considered to be a highly sensitive receptor due to the negligible exposure potential (limited time during which site users are likely to come into contact with the soil in the direct impacts footprint);
- Construction workers may be exposed to contamination when project infrastructure is placed in areas of the potential sources of contamination identified in the Phase I Desk Study, and therefore appropriate assessment and mitigation will be required;
- Groundwater is not considered to be a viable receptor where the underlying superficial geology is glacial till as the till provides a protective barrier to the sensitive aquifer beneath (piling activities are discussed in Section 6.2);
- Groundwater is considered to be a viable receptor where the superficial glaciofluvial or glaciolacustrine deposits are present as these may not provide a protective barrier; however, it should be noted there are no SPZs within 1km of the study area (where groundwater quality is particularly sensitive due to proximity to a drinking water supply abstraction);
- Surface waters are considered to be a potential pathway for contaminant migration, as well as sensitive receptors for pollution (**Table 3.1**). Mitigation techniques will be implemented (such as HDD and good site working practices) to ensure that these receptors are not exposed to contamination;
- The locally important geological feature, Red Howles RIG site, is considered to be a highly sensitive receptor that will be affected by direct impact or disturbance at the surface. It lies outside of the direct impact footprint and is not considered to be at risk from the development;
- Project infrastructure placed in areas of the potential sources of contamination may be susceptible to aggressive ground conditions that could degrade metals and concrete and may require assessment and mitigation;
- Where cable trenching passes through any areas of potential contamination, appropriate mitigation must be used to ensure that the proposed cable surrounds will not permit the lateral migration of contaminants; and
- Where cable trenching passes through any of the potential sources of contamination, all backfilling and spoil material will require assessment to demonstrate that it is suitable for use as per the CL:AIRE Development Industry Code of Practice.

4.8.5 The full risk evaluation of all identified sources of contamination and viable contaminant linkages is presented in the Land Quality Phase 1 Desk Study included in **Appendix 24A**. A summary of the viable contaminant linkages with a risk classification greater than low is presented in **Table 4.3**.

Table 4.3 Potential viable pollutant linkages

Source ID	Land use	Pathway	Receptor	Consequence of risk being realised (severity)	Probability of risk being realised (likelihood)	Risk classification	Risk management	Residual risk
100	Factory or works - use not specified large transformers	Shallow Groundwater	Shallow and deep aquifers	Medium	Likely	Moderate / Low Risk	Further information should be gathered into the specific history of this facility including maintenance and monitoring activities	Moderate / Low Risk
101, 102, S13	Factories or works - use not specified	Shallow Groundwater	Shallow and deep aquifers	Medium	Unlikely	Moderate / Low Risk	Further information should be gathered into the specific history of this facility including maintenance and monitoring activities	Moderate / Low Risk
111, 113, 114, 115,	Historic Landfills	Shallow Groundwater	Shallow and deep aquifers	Medium	Unlikely	Moderate / Low Risk	Further information should be gathered into the specific history of this facility including maintenance and monitoring activities	Moderate / Low Risk
		Dermal Exposure / Inhalation	Construction Workers	Medium	Likely	Moderate / Low Risk	Appropriate Personal Protective Equipment PPE and Risk Assessments. Where possible Horizontal Directional Drilling (HDD) should be used to avoid contaminated areas	Moderate / Low Risk

Source ID	Land use	Pathway	Receptor	Consequence of risk being realised (severity)	Probability of risk being realised (likelihood)	Risk classification	Risk management	Residual risk
119, 120	Licenced Landfills	Shallow Groundwater	Shallow and deep aquifers	Medium	Unlikely	Moderate / Low Risk	Further information should be gathered into the specific history of this facility including maintenance and monitoring activities	Moderate / Low Risk
		Dermal Exposure / Inhalation	Construction Workers	Medium	Likely	Moderate / Low Risk	Appropriate Personal Protective Equipment PPE and Risk Assessments. Where possible Horizontal Directional Drilling (HDD) should be used to avoid contaminated areas	Moderate / Low Risk

5 Assessment of Impacts – Worst Case Definition

5.1 Introduction

5.1.1 This section establishes the realistic worst case scenario for each category of impact as a basis for the subsequent impact assessment. For this assessment this involves a consideration of the construction scenarios (i.e. the manner in which the Dogger Bank Teesside A & B projects will be built out), as well as the particular design parameters of each project that define the Rochdale Envelope.

5.1.2 Full details of the range of development options being considered by Forewind are provided within **Chapter 5**. For the purpose of the geology, water resources and land quality impact assessment, the realistic worst case scenarios, taking these options into consideration, are set out in **Table 5.1**.

5.1.3 Only those project details with the potential to influence the level of impact are identified within this assessment. Therefore, if the design parameter is not described, it is not considered to have a material bearing on the outcome of the assessment.

5.1.4 The realistic worst case scenarios identified here are also applied to the Cumulative Impact Assessment. When the worst case scenarios for the project in isolation do not result in the worst case for cumulative impacts, this is addressed within the cumulative section of this chapter (see Section 9) and summarised in **Chapter 33 Cumulative Impact Assessment**.

Construction Phasing Scenarios

5.1.5 **Chapter 5** provides details of the representative construction phasing scenarios associated with the onshore construction of the Dogger Bank Teesside A & B projects.

5.1.6 The specific timing and phasing of the construction of the two projects will be determined post consent, and therefore a Rochdale Envelope approach has been undertaken for the EIA. The key principles that form the basis of the Rochdale Envelope, relating to how the projects will be built are:

- The two projects may be constructed at the same time, or at different times;
- If built at different times, either project could be built first;
- If built at different times, the duration of the gap between the end of the first project to be built, and the start of the second project to be built may vary from overlapping, to up to five years; and
- Partial installation of elements of the second project may be completed during the construction of the first project, e.g. through the use of ducts to provide conduits for a later cable installation.

5.1.7 To determine which construction phasing scenario is the worst realistic case for a given receptor two types of effect exist with the potential to cause a maximum level of impact on a given receptor:

- Maximum duration effects; and
- Maximum peak effects.

5.1.8 To ensure that the Rochdale Envelope incorporates all overarching onshore construction scenarios (as outlined in **Chapter 5**), both the maximum duration effects and the maximum peak effects have been considered for each onshore receptor.

5.1.9 Furthermore, the option to construct each project in isolation is also considered ('Build A in isolation' and 'Build B in isolation'), enabling the assessment to identify any differences between the two projects. The four construction phasing scenarios for Dogger Bank Teesside A & B considered within the assessment for geology, water resources and land quality are therefore:

i. Build A or build B in isolation – either project is considered to have the same impact as the land take footprint will be identical for either project;

ii. Build A and B concurrently – provides the worst 'peak' impact and maximum working footprint;

iii. Build A, gap of up to 5 years, build B (sequential) – provides the worst 'duration' of impact; and

iv. Build A and install conduits for B, gap of up to 5 years, install cables for B in conduits.

5.1.10 For impacts to geology, water resources, land quality, waste and flood risk, whilst the four construction scenarios outlined above are considered to have different impact magnitudes, the variance of the magnitude between the scenarios is not considered to be sufficient to assign a different magnitude classification. Therefore for impacts to geology, water resources, land quality, waste and flood risk, only one scenario has been assessed. This scenario takes into account the maximum 'peak' impact arising from the build Dogger Bank Teesside A & B concurrent scenario and also the maximum 'duration' of impact arising from build Dogger Bank Teesside A & B sequential scenario, details are provided in **Table 5.1**.

5.1.11 The worst case scenario for waste arisings is also defined in **Table 5.1**.

Operation Scenarios

5.1.12 **Chapter 5** provides details of the operational scenarios for Dogger Bank Teesside A & B. Flexibility is required to allow for the following three scenarios:

- Dogger Bank Teesside A to operate on its own;
- Dogger Bank Teesside B to operate on its own, and
- Two projects to operate concurrently.

5.1.13 For impacts to geology, water resources, land quality, waste and flood risk the realistic worst case operational scenario is considered to be both projects in operation at the same time. Details are provided in **Table 5.1**.

Deconmissioning Scenarios

5.1.14 **Chapter 5** provides details of the decommissioning scenarios for Dogger Bank Teesside A & B. Exact decommissioning arrangements will be detailed in a Decommissioning Plan (which will be drawn up and agreed with DECC prior to construction), however for the purpose of this assessment it is assumed that decommissioning of Dogger Bank Teesside A & B could be conducted separately, or at the same time, in which case a sequential decommissioning scenario would be considered worst case. Details are provided in **Table 5.1**.

Table 5.1 Realistic worst case with respect to geology, water resources, land quality waste and flood risk

Impact	Realistic worst case scenario	Rationale
Construction		
Impacts related to geology, hydrology and water resources	Build Dogger Bank Teesside A & B concurrent and Build Dogger Bank Teesside A & B sequential scenario: • Maximum working width of cable route (HVDC cable system) = 36m; • Maximum working width of cable route (HVAC cable systems) = 39m; • Maximum primary compound dimensions = 5000 sq. m; • Maximum intermediate compound dimensions = 784 sq. m; • Maximum site area per converter = 3ha; • Maximum access / site road width = 6m; • Pilling activities will be required during construction of the converter stations; • Maximum construction period of 72 months (sequential build scenario); and • Maximum culvert width = 6m.	Maximum ranges provided within project details. Piling activities represents worst case construction risk via the creation of preferential pathways. Build Dogger Bank Teesside A & B concurrent scenario and Build Dogger Bank Teesside A & B sequential scenario are both considered to represent the worst case impacts. Therefore the worst case aspect from each scenario is taken forward to the assessment. See paragraph 5.1.10.
Impacts related to waste arisings	Build Dogger Bank Teesside A or B in isolation (single project): • Maximum construction period for all onshore construction activities is 36 months; • HVDC and HVAC cable trench of Approximately 8km long, 1.5m wide and 1.5m deep; • One haul road of 6m wide and 350mm deep along the cable route; • Approximately 6 cable jointing bays; • One joint transition bay; ; • Four general construction site compounds (one primary, three intermediate) and 13 HDD compounds; • Quantity of excavated soil generated = 49,790m^3; • Quantity of excavated soil disposed of = 6,300m^3; • Quantity of haul road material required to	Maximum ranges provided within project description.

Impact	Realistic worst case scenario	Rationale
	be disposed of = 21,000m^3; and • Quantity of HDD slurry waste = 420m^3 Both Dogger Bank Teesside A & B built concurrently: • Maximum construction period 36 months; • Two cable trenches of approximately 8km long, 1.5m wide and 1.5m deep; • Two haul roads of 6m wide and 350mm deep along the cable route and site compounds; • Eight general construction site compounds (two primary, six intermediate) and 26 HDD compounds; • 16 cable jointing bays; • Two joint transition bays; • Quantity of excavated soil generated = 99,580m^3; • Quantity of excavated soil disposed of = 12,600m^3; • Quantity of haul road material required to be disposed of = 42,000m^3; and • Quantity of HDD slurry waste = 840m^3.	This concurrent construction scenario will generate higher volumes of excavated soils
Operation		
All impacts	• Both projects in operation at the same time; • Indoor buildings including converter halls and control rooms; • Secondary containment of oil from transformer to be provided in the event of a spillage; • Two full time personnel on site per day; and • Operational period 25 years.	Maximum ranges provided within project details.
Decommissioning		
All impacts	• Buried cable system left in situ; • Dismantling and removal of above ground electrical equipment; • Removal of any building services equipment; • Demolition of the buildings and removal of security fences; and • Landscaping and reinstatement of the site.	

6 Assessment of Impacts During Construction

6.1 Introduction

6.1.1 Reference should be made to **Chapter 5** for information on the activities proposed during the construction phase. However, in summary, the activities considered likely to impact geology, land quality, water resources, flood risk, WFD compliance, and create an impact as a result of waste arisings from construction phase of the project are:

- Construction associated with the onshore transition bays;
- Construction of the HVDC and HVAC onshore cable systems –including open cut trenching and HDD installation techniques;
- Construction of two onshore converter stations;
- Construction of temporary compounds / laydown areas;
- Construction of temporary access tracks;
- Temporary stockpiling of topsoil and other excavated soils;
- Cable laying activities;
- Landscaping activities using excavated material;
- Reinstatement of excavated topsoil and some subsoil to backfill the trenches;
- Enabling works at the existing NGET substation at Lackenby; and
- There are a number of routing constraints along the proposed cable route from the landfall to the substation, via the converter stations. The HDD method will be used to bypass the following infrastructure and features:
  - Roads: A1085, Green Lane, Redcar Road, A174, Grewgrass Lane; A1053 (Greystone Road); B1269 (Fishponds Road);
  - Redcar east to Longbeck railway line;
  - Watercourses: Rogers Dike; Mains Dike;
  - Historic landfills; and
  - Made ground.

Embedded Mitigation

6.1.2 As detailed in **Chapter 6 Assessment of Alternatives** an extensive exercise was undertaken to identify a preferred site for the co-location of two converter stations and the alignment of a HVDC cable route between the landfall and the converter stations, and the alignment of the HVAC cable route between the converter stations and the existing NGET substation at Lackenby. Site selection and micro siting activities that are relevant to this chapter include:

- Co-locating the converter stations away from areas of flood risk;
- Co-locating the converter stations away from areas of landfilling;
- Locating HVDC cable route outside the landfill sites at Wilton Perimeter Mounds; and
- HDD drilling beneath historic landfills in the east of the project area near the landfall, railway and Redcar Road.

6.1.3 In addition to the embedded mitigation outlined above all construction, operational and decommissioning phase activities will be undertaken in line best working practices which will include:

- Construction workers including sub-contractors will follow good site practices and hygiene rules as set out in BS5930:1999+A2:2010 and BS10175:2011;
- Appropriate PPE will be worn by construction workers including sub-contractors and health and safety measures undertaken to mitigate any short term risk during construction;
- Adherence to best practices and guidance to ensure the risk of pollution is minimised including best site management practices, such as those set out in the EA PPG notes, adopted during the operational phase to prevent such spillages and leakages. These are detailed in paragraph 2.3.2; and
- Adherence to the CDM Regulations where applicable.

6.2 Potential impacts on geology and groundwater

6.2.1 The direct impact footprint for the HVDC cable route does not run through any RIGS identified by the Tees Valley RIGS Group. In addition, the drift geology beneath the direct impact footprint is shown to comprise a considerable thickness of clayey till with only one potential area of Glaciofluvial deposits to the far west of the cable route corridor. The till is defined as unproductive strata with low permeability. Its presence is considered to act as a protective cover to the underlying Secondary B aquifer within the solid geology. Therefore geology is considered to be a negligible sensitivity receptor. In accordance with the definitions in **Table 3.1**, the till is considered to be a receptor of negligible sensitivity and the underlying aquifer a receptor of low sensitivity.

6.2.2 With respect to potential impacts, construction activities (as listed above) will include surface excavation, earth moving and implementation of HDD drilling techniques during the cable laying. They will also include site preparation works during the construction of the converter stations. These activities have the potential to disturb the local geology and hydrogeology in the following way:

- Excavation, disturbance of soils, and drilling at depth, has the potential to temporarily open the soil structure and/ or remove some of the protective clay (glacial till) layer, potentially creating pathways for the mobilisation and transmission of contaminants;
- There is a potential for chemically aggressive ground to be present in the form of landfill leachates, or naturally occurring sulphates etc.;

- Spills & leaks of contaminants could affect superficial geology and perched groundwater quality; and
- Piling and HDD activities are not expected to exceed the depth of the glacial till (approximately 10m). However if detailed design requires this depth to be exceeded then further risk assessment (e.g. Pilling Risk Assessment) will be undertaken to assess the risks to the groundwater receptor. Mitigation will be designed where required.

6.2.3 Although classified as a receptor of negligible sensitivity, during the construction of either Dogger Bank Teesside A or B there is the potential that the excavation of trenches, installation of piles and potential contamination spills could have a low magnitude effect on the underlying geology and hydrogeology. Considering the sensitivity of the receptor and the magnitude of effect, prior to any mitigation these are likely to have a **minor impact** on this receptor. As such, mitigation measures in relation to geological and hydrogeological features are detailed in **Table 6.1**.

Table 6.1 Mitigation measures in relation to geological features

Mitigation measures
In order to reduce the impacts to underlying geology from general trenching, piling, drilling and construction activities including spills and leakages to geological features a Construction Environmental Management Plan (CEMP) will be developed in consultation with the contractor and the EA. This will include measures for avoiding the likelihood of spills and leakages, such as: • The implementation of properly designed shoring systems to avoid unstable excavations; • The removal of superficial deposits should be minimised wherever possible; • Storage of oils and fuel within designated areas in impervious storage bunds with a minimum of 110% capacity to contain any leakages of spillages; • Limiting of refuelling activities to designated, impermeably surfaced areas and use drip traps where possible; • Checking and maintain equipment regularly to ensure that leakages do not occur; • Having spill kits available on site at all times; and • Ensuring site inductions are completed for all staff including contractors and sub-contractors; include the above procedures and the locations of spill kits.

6.2.4 The geology and hydrogeology underlying the direct impacts footprint is considered a negligibly sensitive receptor due to its lack of designations, the predominance of non-water bearing strata and the clayey nature of the till which, coupled with its thickness, represents a significant barrier for the vertical migration of contaminants. However, excavation activities have the potential to result in direct low magnitude impacts to this receptor as there will be very minor disturbance of the surface soils**.** With adherence to the above mitigation measures it is therefore considered that there will be a **negligible residual impact** on this receptor.

6.3 Potential impacts on water resources

Surface Water Quality and Licensed Water Abstractions

6.3.1 The HVDC cable route crosses a total of 14 surface water bodies, comprising ditches of varying sizes as outlined in Section 4.4 and shown in **Figure 6.1**. This includes two named drains; Rogers Dike and Mains Dike and other smaller water bodies. None of the water bodies have been designated for ecological value. In addition there are no groundwater source protection zones within the study area and only one low volume unlicensed water abstraction within 500m of the direct impact footprint. For these reasons, water resources are considered to have a low sensitivity (**Table 3.1**).

6.3.2 The construction activities with the potential to disturb the local water resources are outlined as follows:

- Removal of impermeable superficial deposits and surface cover could increase the potential for erosion of soil particulates discharging to water resources. The effect is likely to be of low magnitude given the anticipated extent of surface cover removal at any one time, be temporary in the fact it will be limited to the construction period and reversible in that water quality would recover following cessation of any discharge;
- Spills and leaks of contaminants directly into surface waters could adversely affect the water quality and chemical and ecological status of surface water features. The effect is likely to be localised to the areas where potential contaminants are to be stored (construction compounds), temporary (limited to construction period), reversible (water quality would recover) and of low magnitude (given anticipated volume of potentially contaminating materials);
- The requirement may exist to dewater excavations when rainfall or surface water runoff has to be removed or shallow perched groundwater is encountered. There is the risk that dewatering of trenches may lead to the discharge of potentially contaminated water or sediment laden runoff entering nearby surface watercourses or surface water features. The effect is likely to be temporary (limited to open excavations within the construction period), reversible (water quality would recover) and of low magnitude (given anticipated potential dewatering volumes and lack of identified contamination sources);
- In addition and as outlined previously HDD techniques will be used to drill underneath all large watercourses including but not limited to: Rogers Dike and Mains Dike. This will reduce the impacts to surface watercourses, reinstatement required and the amount of waste spoil produced. However, there is still the risk that bentonite used as part of the process could pollute surface watercourses. The effect is likely to be temporary (limited to the drilling programme) reversible (water quality would recover) and of low magnitude (given proposed amounts of bentonite used in the HDD process);
- For smaller or temporary surface water crossings, techniques utilised will include open excavations, diversions and / or over-pumping in the construction of the onshore cable systems. As this will involve working in

water, there is potential for surface waters to be impacted by the input of sediment; the crossing of vehicles; spillages of fuel, oil, chemicals and concrete. Cement based products, such as concrete and grout can be highly alkaline and corrosive and can have a detrimental effect upon water quality and fish. If the material were to enter the river, there is the risk that aquatic vegetation could be smothered and any contaminants which could be present in river bed sediments potentially mobilised. Considering these impacts are likely to be very localised and temporary, the magnitude of these impacts is likely to be low; and

- Sediment may also enter watercourses / water bodies as a result of the excavation of trenches intercepting existing land drains. The potential impacts of uncovering land drains during excavation works has the potential to result in sediment laden runoff to be transported downstream impacting the water quality of downstream receptors. Further information on the presence of land and field drains is presented in **Chapter 26 Land Use and Agriculture**. It is considered that any adverse effects are likely to be temporary and localised and the magnitudes of these impacts are therefore likely to be low.

6.3.3 Although the sensitivity of the receptors are low, the above impacts are likely to have a localised, short lived and reversible low magnitude effect on the quality of the water resources. As such, the following mitigation measures in relation to surface waters and water abstractions are detailed in **Table 6.2**.

Table 6.2 Mitigation measures in relation to surface water quality (excavation and stockpiling)

Mitigation measures
In order to mitigate the potential impacts to surface water quality where crossing or working near water courses: • Entry into water will be avoided where possible; • All cables will be installed beneath the active channel bed; • The top of the crossing will be kept below the top of the adjacent bank level to ensure that in the event of high flows, the water will overtop the obstruction, rather than resulting in impoundment and localised flooding; • Temporary crossings will be appropriately sized to maintain flow patterns and sediment conveyance, and avoid unnecessary changes to the hydromorphology of the watercourses; • No culverts are planned as temporary crossings of watercourses. Clear span bailey bridges (or similar) will be used in preference to avoid impacts to the hydromorphology of the watercourses. Adherence to best practices and guidance to ensure the risk of pollution is minimised (see section 2); • A temporary haul road bridge should be constructed if repeated crossings are required; • If cement etc. Is likely to be batched on site a suitable area should be designated and located at an appropriate distance from the watercourse; • Works will be thoroughly planned and controlled in order to minimise the risk of pollution; • In areas where there is likely to be large quantities of silt generated, straw bales or sediment traps will be placed in the watercourse downstream to help filter out any silts; • Where the water flow is high, water will be over pumped during construction to prevent flooding upstream; • Adherence to best practices and guidance to ensure the risk of pollution is minimised; • If there is a requirement for dewatering of excavations, water will be pumped out and passed through a settlement tank or lagoon to allow suspended solids to settle out before being discharged to an

Mitigation measures
appropriate location; and • Appropriate treatment methods will be adopted prior to discharge of the water from any land drains uncovered during the construction phase.
In order to mitigate the potential impacts to surface water quality where stockpiling is used: • Where earthworks are undertaken, soil and water will be managed with sufficient care to prevent surface water run-off; • Stockpiles will be designed and positioned in order to minimise erosion, pollution of watercourses or increase flooding; and • All stockpiling will be undertaken at a safe distance from watercourses.
In order to mitigate the potential impacts to surface water quality where HDD is used: • In accordance with best practice, the HDD will commence at a safe distance from the edge of the each watercourse. The distance will be agreed with the EA prior to commencement of the works; • The process of HDD involves the use of bentonite (used as a lubricating agent and grout); in order to reduce the risk of pollution of surface waters and / or break out in the river bed the use of these materials will be carefully controlled; • In order to reduce the likelihood of pollution from bentonite and / or grout when working near rivers, hydrophobic (water repelling) grout and quick setting mixes will be used; and • If cement etc. is likely to be batched on site a suitable area will be designated and located at an appropriate distance from the watercourse.

6.3.4 The water resources in proximity to the direct impacts footprint are considered to be a low sensitivity receptor. However, excavation activities have the potential to result in direct low magnitude impacts to this receptor. With adherence to the above mitigation measures it is therefore considered that there will be a **negligible residual impact** on these water resources.

Water Framework Directive Compliance Assessment

Surface Water

6.3.5 As outlined in Section 6.3 the HVDC and HVAC cable routes cross 14 surface water bodies, including drains and dikes.

6.3.6 The water bodies identified within the study area as having the potential to be impacted by construction activities which need to be considered in terms of WFD compliance have been summarised in Table 1.2 provided in **Appendix 24E**. However it should be noted that this assessment takes into account not only the specific watercourses referred to in Table 1.2, but also minor surface watercourses that the cable route crosses. These are summarised in **Table 6.3**.

Table 6.3 Summary of surface water body crossings

Crossing+	Section of route	Comments	Proposed crossing method
W01 – Long Beck	HVDC Cable route	Landfall envelope	HDD
W08	HVDC Cable route	Adjacent to A174	HDD

Crossing[+]	Section of route	Comments	Proposed crossing method
W09	HVDC Cable route	Small field ditch	Open Trench
W10	HVDC Cable route	Small field ditch	Open Trench
W11 – Rogers Dike	HVDC Cable route	Significant watercourse located in narrow gully	HDD
W13	HVDC Cable route	Adjacent to Fishponds Road, B1269	HDD
W14 – Mains Dike	HVDC Cable route	In the vicinity of the A174	HDD
W16	South Avenue surface water drain	Drain from Wilton Works	HDD
W18	HVDC Cable route	Exact location / route of drain may have been altered as part of previous development at the site.	Open Trench
W19	HVAC Cable route	Exact location / route of drain may have been altered as part of previous development at the site.	Open Trench
W21	HVAC Cable route	Exact location / route of drain may have been altered as part of site development	Open Trench
W23 – Kettle Beck	HVAC Cable route	Adjacent to A1053 eastern side of embankment	HDD
W24	HVAC Cable route	Adjacent to A1053 western side of embankment	HDD
W27	HVAC Cable route	West of roundabout at A174 and A1047	HDD

[+] Dogger Bank Teesside, Cable System Design – Desktop Study, Ramboll November 2012

6.3.7 Proposed crossing techniques are included in **Table 6.3**. As outlined previously HDD techniques will be used to pass underneath the larger watercourses and watercourses adjacent to roads. This will occur below the active bed level of each watercourse (i.e. the area that is regularly reworked by geomorphological processes and which provides habitat for aquatic invertebrates and macrophytes) and, once installed, the cable and housing will not protrude into the bed. This means that HDD crossings are unlikely to impact upon the hydromorphological quality elements supported in the water bodies. They are also unlikely to have a physical impact on the biological quality of the river.

6.3.8 The use of HDD techniques will reduce the impacts to water bodies during the construction phase by reducing the levels of reinstatement and amount of waste spoil produced. The use of bentonite in the process does present a potential pollution risk to surface watercourses, with the potential to cause a short term temporary impact to the physico-chemical and biological quality elements.

6.3.9 Minor surface watercourses, including small drains, will be crossed using a technique known as dry open cut. The watercourses will be dammed to allow the cable to be installed in an open trench, and the water flow will be maintained by over-pumping during the construction of the onshore cable systems.

6.3.10 The installation of the HVDC and HVAC cables at minor river crossing points where HDD techniques are not proposed has the potential to alter the hydromorphology of the watercourses, by disrupting flow conveyance and sediment transport, and cause localised disruption to the natural bed and bank habitats. The likelihood of this occurring is dependent on the method of installation, size of the crossing in relation to the watercourse, and whether any parts of the cable are proud of the natural bed. It is proposed that the cables will be situated below the active bed of the channel and as such the potential impact to the watercourse minimised.

6.3.11 To provide a continuous access route along the length of the cable route, it will be necessary to install temporary crossings. Where temporary river crossings are required there is the potential for surface waters to be impacted and/or pollution to water bodies by sediment; the crossing of vehicles; spillages of fuel, oil, chemicals and concrete. Cement based products, such as concrete and grout can be highly alkaline and corrosive and can have a detrimental effect upon water quality and fish. If the material were to enter the river, there is the risk that aquatic vegetation could be smothered and any contaminants within the river bed sediments potentially mobilised.

6.3.12 The installation of temporary river crossings has the potential to alter the hydromorphology of the watercourses, by creating impoundment, disrupting flow conveyance and sediment transport, and causing localised disruption to the natural bed and bank habitats. The likelihood of this occurring is dependent on the method of installation, number of crossings on a particular watercourse and the size of the crossing in relation to the watercourse. Any impact from the installation of the temporary river crossings is likely to be short term and unlikely to lead to permanent deterioration in water body status. Article 4(6) of the WFD states that temporary deterioration in the status of a water body will not be in breach of the WFD if all practicable steps are taken to prevent further deterioration and measures taken will not compromise the recovery of the quality of the water body once the temporary change in conditions is over.

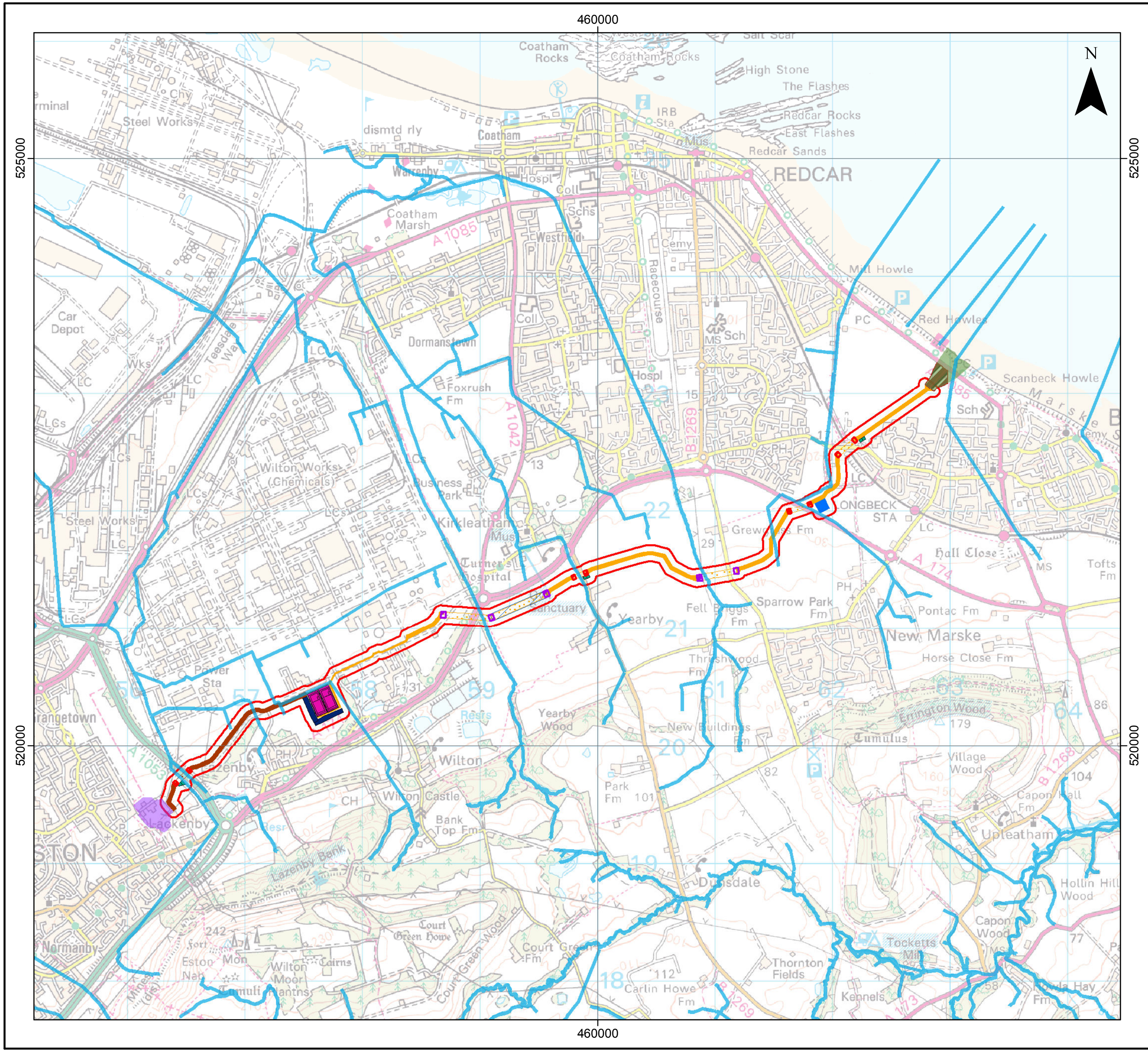
6.3.13 Based on the information provided above it is considered that the installation of the cable route (HVDC and HVAC) has the potential to cause deterioration in water body status, either temporarily due to the installation of temporary river crossings, general maintenance activities, or permanently due to the installation of the cables. Chemical impacts could lead to deterioration in physico-chemical quality with the potential for direct and indirect impacts on biology. Change to the physical channel (i.e. by exposed cable housings) can impact on hydromorphology, again with the potential for direct and indirect impacts on biology. Mitigation measures in order to prevent deterioration and / or further deterioration (with respect to temporary impacts) are presented in **Table 6.2**.

6.3.14 If these mitigation measures are fully implemented, there is unlikely to be any temporary deterioration of the water body status that is in breach of the WFD or permanent impacts upon the status of surface water bodies arising from the proposed works. It is therefore considered that there will be **no deterioration in the status of water body GB103025072660 (Redcar Coastal Area)**, and that the scheme is compliant with the requirements of the WFD.

Groundwater

6.3.15 In addition to the above effects there is a risk that the underlying groundwater may be impacted by general construction activities, such as spillages of fuel, oils or chemicals. Potentially contaminative material may leach into the underlying soils and enter the groundwater, potentially leading to pollution. Given that fuels, oils and chemicals will be stored on site during the construction phase, it is considered likely that spillages and leakages may occur, if the spillages are significant and over a prolonged period of time they may lead to deterioration in water body status.

6.3.16 However, if mitigation measures as outlined in **Table 6.2** are followed, including the incorporation of impervious storage bunds to contain any leakages or spills should they occur and refuelling activities to be undertaken in designated areas comprising impermeable surfaces then any potential sources of contamination (i.e. spills and leaks) are unlikely to impact the sensitive receptor due to the pathway being severed. Based on the inclusion of these precautionary measures it is considered that there will be **no deterioration in the status of water body GB40302G701300 (Tees Mercia Mudstone and Redcar Mudstone)** arising from the proposed works. Dogger Bank Teesside A & B are therefore considered to be compliant with the requirements of the WFD.



LEGEND

- Direct Impacts Footprint
- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation
- River Network

0 2
Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2012

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 6.1: River crossings

VER	DATE	REMARKS	Drawn	Checked
5	10/07/2013	Draft	SW	DW
6	26/07/2013	Draft	SW	DW
8	23/01/2014	Pre-DCO Submission review	SW	DW

DRAWING NUMBER: **F-ONL-MA-409**

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

6.4 Potential impacts on land quality

Construction Workers

6.4.1 Construction workers are considered to be a high sensitivity receptor due to the proximity in which they are required to work with potentially contaminated soils and surface water. The majority of the cable route passes through agricultural land which is considered to present a low risk to the health of construction workers. However, a number of potential sources of contamination (historic and current) have been identified within the study area as detailed in Section 4.

6.4.2 During the construction phase, excavation of trenches and hand dug pits through potentially contaminated soil or waste could impact upon the health of construction workers via direct contact, ingestion or physical contact with contaminants that are present at or near the surface or inhalation of airborne particles, ground gases and vapours which may be present on site. Potential historic and current sources of land contamination are shown on **Figure 4.5**.

6.4.3 There are two known historical landfill sites within 500m of the HVAC cable route on the Wilton complex (refer to Section 4.8). The precise nature of the material used to infill at this location is not known. Therefore as above, these sites may contain a variety of contaminants depending on the nature of the material. Landfill sites also have the potential to produce landfill leachate and landfill gases (depending upon the types of waste that were deposited), with the potential to migrate and impact nearby receptors, where pathways exist.

6.4.4 For sensitive features along the cable route, HDD techniques will be used to pass the cable underneath the feature without coming into contact with or impacting on the sensitive features. The locations where HDD is planned include landfill sites, certain roads, rivers and the railway line. The implementation of this technique will reduce the risk to the health of construction workers from potential made ground, waste materials, ground gas and/ or leachates in embankments and landfills. Subsequently the overall risk rating in these areas of the cable route is reduced.

6.4.5 Although the potentially contaminative sites along the cable route and within the converter stations site are infrequent and it is not expected that soils will be highly contaminated, the risk remains that there will be areas of unsuspected contamination. In general however, the likelihood of contact with contamination is low, and any adverse effects are likely to be temporary, therefore the magnitude of these impacts prior to mitigation is likely to be **low**.

6.4.6 The mitigation measures in relation to potential impacts to construction workers are considered in **Table 6.4**.

Table 6.4 Mitigation measures in relation to potential impacts to construction workers

Mitigation measures
In order to mitigate the potential effects associated with the excavation of potentially contaminative soil or waste: • Gas risks will be considered and mitigated for all construction workers including sub-contractors whenever there is a requirement to enter confined spaces as part of the construction works, this will be managed through the Construction Phase Health and Safety Plan; • If any visual or olfactory evidence of contamination is identified during the construction phase, work will stop immediately, the contaminated materials will be stockpiled separately and a qualified Environmental Consultant contacted; and • Special care will be taken in areas identified as possible landfills and areas adjacent to roads, drains etc. where embankments are present or point source contamination may have occurred (e.g. run-off from roads).

6.4.7 Construction workers are considered to be a high sensitivity receptor due to the proximity in which they are required to work with potentially contaminated soils and surface water. However with adherence to the above mitigation, it is anticipated that the magnitude of any potential impact will be reduced to negligible and as such there will be a **negligible** residual impact on the health and safety of construction workers.

Soil

6.4.8 Given the characteristics of the soils as described in Section 4.4 of **Chapter 26**, the sensitivity of the receptor is considered to be **high**.

6.4.9 There is a risk that soil quality may be impacted by general construction activities, such as spillages of fuel, oils or chemicals, potentially leading to contamination of soil, resulting in it being unsuitable for future use and subsequently classified as a waste when removed. Given that fuels, oils and chemicals will be stored on site during the construction phase, for activities including refuelling of machinery, it is considered likely that some spillages and leakages may occur. The effect is likely to be localised to the areas where potential contaminants are to be stored (construction compounds), temporary (limited to construction period), and of low magnitude (given anticipated volume of potentially contaminating materials). Mitigation measures in relation to soil quality are detailed in **Table 6.5**.

Table 6.5 Mitigation measures in relation to soil quality (general construction activity impacts)

Mitigation measures
In order to reduce the risk of impacts from general site activities including spill and leakages to soil a Construction Method Statement will be produced by the contractor and a **Construction** Environmental Management Plan (**C**EMP) will be developed in consultation with the contractor and the EA. The **C**EMP will include measures for avoiding the likelihood of spills and leakages, such as: • Store oils and fuel within designated areas above ground and in impervious storage bunds with a minimum of 110% capacity to contain any leakages or spillages, in addition storage areas will be regularly inspected to identify any leak or spills; • Limit refuelling activities to designated, impermeable surfaced areas and use drip traps where possible; • Check and maintain equipment regularly to ensure that leakages do not occur;

Mitigation measures
• Have spill kits available on site at all times; and • Ensure site inductions for all staff, to include the above procedures and the locations of spill kits.

6.4.10 Soils are considered to have a high sensitivity, however with adherence to the above mitigation measures the magnitude of the potential impacts with respect to soil will be reduced to negligible and a **negligible** residual impact on soils along the cable route and at the converter station site is anticipated.

6.5 Potential construction impacts (waste management)

Single project (Dogger Bank Teesside A or B)

6.5.1 A summary of the onshore construction activities that are likely to generate waste arisings is provided in Section 6.1. The paragraphs below describe the main areas of the scheme where soil arisings are predicted to occur. A summary of all estimated arisings is provided in **Table 6.6**.

Cable trench

6.5.2 One of the major components of the construction works is the excavation of an open cut trench for a total of approximately 8km. The HVDC cable system is approximately 6km long between the joint transition bay and the onshore converter station. The HVAC cable system is approximately 2km long from the converter station to the existing NGET substation at Lackenby located to the west of the A1053**.**

6.5.3 The expected width of the trench is 1.5m; and the proposed depth of the trench is 1.5m. The profile of the trench is likely to comprise an upper layer of topsoil and a lower layer of subsoil consisting of soil and stones. The depth of topsoil has been estimated to average approximately 0.15m across the whole of the cable route. However the actual depth of topsoil is expected to vary across the cable route and converter stations site. It is likely that the topsoil layer will be uncontaminated along the majority of the cable route, with the possible exception of areas near the identified historic landfills and potential sources of contamination. All of the clean topsoil is anticipated to be reinstated on site and it will not be waste where this is the case. Any topsoil that is contaminated and unsuitable for reinstatement will be waste. This is likely to be removed from the site for disposal. If it is required to be sent off-site, the appropriate reuse/recycling/recovery or disposal options will be selected in accordance with the waste hierarchy.

6.5.4 The lower layer of soil and stones (‘subsoil’) that will be excavated from the trenches is anticipated to be non-hazardous based on the information available at the current time. However, there are potential areas of contamination associated with historic landfills and other potential sources of pollution that may be encountered. A list of potential sources of contamination is provided in the Land Quality Phase 1 Desk Study (**Appendix 24A**) and Section 4.2.

6.5.5 It is anticipated that the majority of the excavated subsoil will be reinstated back into the trenches, and where this is the case, the reinstated material is not waste. However, the material around the cable systems needs to be thermally resistive. The cable systems will be placed at the bottom of the trench. Where the local subsoil is not considered to be thermally resistive, it will need to be replaced by stabilised material, normally cement bound sand, to a depth of 0.5m from the base of the trench. In the worst case scenario, all of the subsoil from the lower 0.5m of the trenches will need to be replaced by cement bound sand. Cable covers will be located at a depth of 0.5m from the base of the trench.

6.5.6 The estimated volume of excavated material from the single project is provided in **Table 6.6**. It is estimated that there will be approximately 6,000m^3 of surplus subsoil. It may be possible to demonstrate that the surplus material is not waste when it is reused elsewhere on-site, for example as landscaping material at the converter stations site, if the principles of the CL:AIRE Code of Practice (CoP) are followed prior to reuse. The reuse of excavated material (where it has been determined as suitable for use) on site promotes the waste hierarchy, so it is actively encouraged. If the material is not used on-site and is sent off-site, it will be waste when it is exported from the site.

6.5.7 As a precautionary approach, it is estimated that a proportion of the waste subsoil may be unsuitable for reuse and recycling either on site or off site, for example because of unexpected contamination. On this basis it is estimated that approximately 10% may require treatment/disposal. This allows for an estimated volume of 600m^3 of surplus subsoil requiring either treatment (pending recycling or recovery) or disposal at an appropriately permitted landfill.

Cable joint bays

6.5.8 The cables splay out from the flat spaced arrangement at the cable joint bays. As such, the cable trench will need to be wider at the joint bays in order to allow the cables to be suitably spaced when joined. There is predicted to be a total of nine cable joint pits (six in the HVDC, two in the HVAC and one joint transition bay at landfall) per trench, therefore a total volume of approximately 752m^3 will be excavated.

6.5.9 It is anticipated that most of this material will be reinstated; however, selected sand back-fill or cement bound sand that has the appropriate thermal resistivity properties, will be required to replace the lower layer of the cable joint bays. The surplus soil will need to be removed from site as waste unless it can be reused on-site in accordance with the CL:AIRE CoP. If it is required to be sent off-site, the appropriate reuse/recycling/recovery or disposal options will be selected in accordance with the waste hierarchy.

6.5.10 It is estimated that there will be approximately 301m^3 of surplus excavated material from the cable joint bays. It may be possible to demonstrate that the surplus material is not waste when it is reused elsewhere on-site, if the principles of the CL:AIRE CoP are followed prior to reuse.

6.5.11 As a precautionary approach, it is estimated that approximately 10% of surplus material may require disposal. This allows for a predicted volume of 30m^3 of excavated material requiring either treatment (pending recycling or recovery) or disposal at an appropriately permitted landfill.

Horizontal Directional Drilling (HDD)

6.5.12 The HDD method will be used to cross major roads, the railway line and water courses. A list of routing constraints that will be crossed using HDD method is provided in Section 6.1. The HDD process will produce waste bentonite sludge and displaced soil and stones. These wastes are classified as non-hazardous and will require off-site disposal. It is estimated that a total of 420m^3 of HDD sludge will be produced from Dogger Bank Teesside A or B.

Topsoil from construction corridor

6.5.13 To create access / haul roads and carry out construction activities along the cable route it is anticipated that 0.15m topsoil will be stripped back, stockpiled and protected during storage whilst the construction work progresses. The ground will be reinstated to its former condition following the construction phase. Stripping back topsoil is estimated to create 22,200m^3 of excavated topsoil for Dogger Bank Teesside A or B (based on 18m wide construction corridor for the HVDC cable route and 20m construction corridor for the HVAC cable route, 0.15m depth). The topsoil is predicted to be reinstated, so there will be no waste topsoil arising from this activity. **Chapter 26** discusses measures for management of excavated topsoil.

Access / haul road

6.5.14 It is anticipated that the sub-base of the temporary haul road will be constructed using imported hardcore material and placed to a depth 0.35m. At the end of construction works, the temporary haul road is expected to be removed. However, it is possible that some of the haul road could be left in-situ. The removal of the temporary haul road is predicted to create approximately 16,800m^3 of re-usable hardcore material (based on two 6m wide, 0.35m depth and total length of approximately 8km). It is anticipated that all of the removed hardcore material can be re-used or recycled off-site.

Converter station

6.5.15 The foundation works for the new converter stations and associated infrastructure, including access roads, will require the excavation of topsoil and subsoil. All of the topsoil that is removed will be stored then reinstated either directly or as part of the landscaping design at the converter stations. It is not considered waste if it is directly reinstated. However, if it is reused as part of the landscape design at the converter stations, it is waste unless the CL:AIRE Code of Practice is followed.

6.5.16 The subsoil that is excavated may be suitable for use within the design at the converter station where it has the appropriate physical and chemical properties and the use of the material will not cause harm to human health or the environment. The reuse of excavated material will be in accordance with the principles of the CL:AIRE CoP. If the material is not used on-site and is sent off-site, it will be waste when it is exported from the site.

6.5.17 It is predicted that the excavated subsoil will be reused on-site for landscaping or general fill where possible.

6.5.18 **Table 6.6** provides a summary of the predicted waste arisings from a single project.

Table 6.6 Summary of waste arisings from a single project

Description of activity	Total volume (m^3)	Waste management
Cable trench		
Excavated topsoil to a depth of 0.15m.	1,690	On-site reuse
Excavated subsoil at a depth of 0.85m above the cable cover.	9,560	On-site reuse
Excavated subsoil at a depth of 0.5m below cable covers - replaced by cement bound sand.	5,630	Offsite reuse, recycling or/ disposal*
Joint transition bay		
Excavated soil from joint transition bay that will be reinstated	60	On-site reuse
Excavated soil from joint transition bay that will require off-site disposal	40	Offsite reuse, recycling or/ disposal*
Six cable joint bays		
Excavated soil from cable jointing bays that will be reinstated.	380	On-site reuse
Excavated soil from cable jointing bays that will require off-site disposal.	50	Off-site reuse, recycling or/ disposal*
HDD Slurry		
Waste Slurry produced from this activity.	420	Offsite disposal
Topsoil		
Excavated topsoil (0.15m depth) stripped along the construction corridor.	20,250	On-site reuse
Excavated topsoil (0.15m depth) stripped from site compounds.	4,460	On-site reuse
Access/haul road		
Removal of the material (hardcore) used for construction of haul road.	21,000	Off-site reuse or/ recycling*
Converter station		
Topsoil (0.15m depth) stripped off from converter station.	3,780	On-site reuse

Description of activity	Total volume (m^3)	Waste Management
Subsoil excavated for converter stations.	5,580	On-site reuse; or Off-site reuse, recycling or/ disposal*

* The appropriate off-site waste management option will be determined by the contractor in accordance with the waste hierarchy.

6.5.19 The surplus subsoil requiring off-site waste management (whether recycling, recovery, treatment or disposal) will be tested to classify it as hazardous or non-hazardous waste as appropriate. An assessment to identify the most appropriate off-site waste management option will be made in accordance with the waste hierarchy. All waste excavated material that is required to be sent off-site, must be sampled and analysed to enable it to be classified as hazardous or non-hazardous waste.

6.5.20 Any subsoil found to be hazardous, will be stockpiled separately from any non-hazardous stockpiles. If any material is classified as hazardous waste, the site will be registered as a hazardous waste producer and the hazardous waste consignment note procedures will be followed.

6.5.21 The wastes that are not suitable for off-site re-use or recycling will either be sent for treatment or disposed at an appropriate class of landfill, i.e. hazardous waste can only be landfilled in a hazardous waste landfill. The appropriate waste acceptance criteria testing will be carried out where relevant (for landfill disposal).

6.5.22 All facilities receiving any waste from the site must hold a valid environmental permit. All materials removed from the site will be transferred in accordance with the requirements of the waste duty of care.

Excess / out of specification construction materials

6.5.23 There are likely to be different types of excess or out of specification material. Some will be inert e.g. bricks; some will be non-hazardous e.g. plastic, or metal; and some may be hazardous, e.g. sealants and resins; fuel oil etc.

6.5.24 Excess materials are not waste and can be reused on other projects. Out of specification or damaged construction materials that do not comply with technical requirements for use will be removed from the site and dealt with appropriately, ideally by returning them to the manufacturer. If these materials require off-site disposal, they are waste and will require disposal in accordance with legislative requirements.

Packaging

6.5.25 Some equipment and construction materials will also be delivered in or on packaging (e.g. plastic wrapping, wooden pallets, cardboard etc.). The packaging will be returned to the suppliers with the delivery vehicle where possible, as a means to help the suppliers achieve their obligations under the Producer Responsibility Obligations (Packaging Waste) Regulations 2007 (as amended) and to achieve the highest possible option (waste prevention) according to the waste hierarchy. Packaging that cannot be returned to the supplier will be reused on-site where possible or sent off-site for recycling.

Grid connection at existing NGET substation at Lackenby

6.5.26 The onshore HVAC cable route will run from the converter stations site to the existing NGET substation at Lackenby. There will be minimal excavation required at the substation for the connection works. This is predicted to comprise non-hazardous concrete road and made ground with lower layers of soil and stones. There is a possibility that some of the excavated made ground and subsoil material may be contaminated with mineral oils. The excavated material will need to be tested to classify it as hazardous or non-hazardous waste as appropriate.

Site clearance

6.5.27 Site clearance along the cable routes and from the converter station site is likely to produce waste vegetation. This is likely to include the removal of trees and shrubs, branch trimmings, plants and grass cuttings etc. It is predicted that approximately 10 tonnes of biodegradable waste will be generated from site clearance activities.

Site workers

6.5.28 Other non-hazardous wastes produced during the construction programme will include general waste and toilet waste from site workers at the site compound. All of the toilet waste produced will be sent for off-site treatment.

6.5.29 The general waste produced by the workers will be similar in composition to mixed municipal waste i.e. household waste. Almost all of the predicted waste arisings will be solid waste; therefore the potential for harm to human health and the environment is low.

6.5.30 The site construction compounds will be set up to maximise recycling opportunities and fulfil the highest possible option according to the waste hierarchy by segregating the dry recyclable waste generated for the duration of the works where possible. The level of recycling / separate collection will depend on the amount of available space at the site compound and the containment and storage methods employed by the contractor.

Summary

6.5.31 The construction of the Dogger Bank Teesside A or B is predicted to generate approximately 49,790 m^3 (62,238 tonnes, using WRAP's conversion factor $1m^3$ = 1.25 tonnes) of excavated soils. It is predicted that this material is likely to be non-hazardous given the context of the current land use. However, there may be isolated areas of contaminated material, for example at the site of historic landfills; or in the event of an unexpected contamination hotspot. It is possible that excavated material from the contaminated areas may be classified as hazardous waste, depending upon the degree of contamination.

6.5.32 It is predicted that there will be large excavated volumes of waste subsoil; and potentially, a small proportion of this could be hazardous waste. The potential magnitude of this effect is considered to be high if unmitigated, using the assessment criteria provided in Section 3.4.

Concurrent build construction scenario

6.5.33 The assessment of the potential construction phases in Section 5.1 identified that the concurrent build construction phase was predicted to be the worst case scenario with respect to waste arisings. This section predicts the impacts of waste arisings in accordance with this scenario; and identifies appropriate mitigation measures to reduce the potential impacts of waste arisings.

6.5.34 This construction scenario will have two stages. Stage 1 is the construction of the first project. Stage 2 is the installation of the cable system for the second project.

6.5.35 The waste types produced from this construction scenario are expected to be similar in nature to the waste types produced from a single project. However, the amount of excavated waste will be approximately double the volume of the waste that is predicted to be produced from a single project.

6.5.36 **Table 6.7** provides a summary of the predicted waste arisings anticipated for the concurrent build construction scenario.

Table 6.7 Summary of waste arisings from the concurrent construction phase scenario

Description of activity	Total volume (m^3)	Waste management
Cable trench		
Excavated topsoil to a depth of 0.15m.	3,380	On-site reuse
Excavated subsoil at a depth of 0.85m above the cable cover.	19,120	On-site reuse
Excavated subsoil at a depth of 0.5m below cable covers - replaced by cement bound sand.	11,260	Offsite reuse, recycling or/ disposal*
Joint transition bay		
Excavated soil from joint transition bays that will be reinstated.	120	On-site reuse
Excavated soil from joint transition bays that will require off-site disposal.	80	Offsite reuse, recycling or/ disposal*
Cable joint bays		
Excavated soil from cable jointing bays that will be reinstated.	760	On-site reuse
Excavated soil from cable jointing bays that will require off-site disposal.	100	Off-site reuse, recycling or/ disposal*
HDD		
Waste Slurry produced from this activity.	840	Offsite disposal
Topsoil		
Excavated topsoil (0.15m depth) stripped along the construction corridors.	40,500	On-site reuse
Excavated topsoil (0.15m depth) stripped from site compounds.	8,920	On-site reuse
Access/haul roads		
Removal of the material (hardcore) used for construction of haul roads.	42,000	Off-site reuse or/ recycling*

Description of activity	Total volume (m^3)	Waste management
Converter stations		
Topsoil (0.15m depth) stripped off from converter stations.	7,560	On-site reuse
Subsoil excavated for converter stations.	11,160	On-site reuse; or Off-site reuse, recycling or/ disposal*

* The appropriate off-site waste management option will be determined by the contractor in accordance with the waste hierarchy.

6.5.37 As provided in **Table 6.7**, the construction of Dogger Bank Teesside A & B as per the concurrent build construction scenario will generate 99,580m^3 (124,475 tonnes, using WRAP's conversion factor 1m^3 = 1.25 tonnes) of excavated soils. The cable routes will be constructed in parallel along the same route; therefore, it is expected that the majority of waste materials generated will still be non-hazardous. However, as with the single project construction above, there is the potential for some excavated material to be classified as hazardous waste as a result of any isolated areas of contamination. The potential magnitude of this effect is considered to be high if unmitigated, using the assessment criteria provided in Section 3.4.

6.5.38 The proposed mitigation measures in relation to waste are detailed in **Table 6.8**.

Table 6.8 Mitigation measures in relation to waste

Mitigation measures
• The waste hierarchy will be used to determine the most sustainable option for all wastes that are generated on-site; • Topsoil will be stored separately from subsoil. The stockpile dimensions will be designed such that they do not result in erosion, pollution of watercourses or increased flooding In order to reduce the impact to the topsoil and subsoil through stockpiling; • Sustainable procurement methods, e.g. just in time delivery and just enough quantity of raw materials, will be used to minimise the amount required to be stored on-site; thereby lowering the risk of potential waste arisings from out of specification or excess materials; • Waste packaging will be returned to suppliers where possible; • All topsoil will be reinstated wherever possible; • Waste subsoil that will be sent off-site will be segregated from subsoil suitable for reinstatement on-site; • Suitable local schemes will be identified where possible, as appropriate receiving sites to encourage the off-site reuse of surplus subsoil – this promotes the waste hierarchy and will reduce vehicle emissions caused by longer journeys; • All other wastes for off-site waste management will be stored in skips or other impermeable containers, preferably with lids (all waste liquid containers must have a lid); • Plastic, paper and card, metal and other dry residual wastes will be segregated in different containers in the contractor's compound to maximise dry-recyclable collection where possible; • Any hazardous wastes will be stockpiled or stored separately from any non-hazardous stockpiles; • Stockpiles of soil will be covered or stored in bunded areas or up-gradient from drains and control waters or stored in impermeable containers (e.g. Skips), to prevent pollution from run-off; • The CL:AIRE CoP will be followed to demonstrate that excavated material is not waste at the point of reuse. Where the CoP cannot be followed, the use of waste material will be covered by an environmental permit, or appropriate exemption from environmental permitting (e.g. re-use of waste hardcore for temporary roads); • Stockpiles of excavated soil will not be stored for more than 12 months; and

Mitigation measures
• A SWMP will be prepared to monitor wastes arisings on-site. This will also promote sustainable waste management practices by maximising waste prevention, re-use and recycling for material destined for off-site waste management. This will actively discourage sending waste to landfill.

6.5.39 The introduction of the above mitigation measures and sustainable waste management practices specified in **Table 6.8** are predicted to divert 99% of material from landfill or other disposal options. However, there will still be waste arisings from the development that are predicted to require off-site disposal or recovery, including a small proportion likely to require disposal to landfill.

6.5.40 The magnitude of this effect is high (based on the predicted quantity of non-hazardous waste); and given that the quantity of waste sent for disposal has been reduced as described above, there remains a temporary **minor adverse** residual impact, using the assessment criteria provided in **Table 3.5**.

Potential effects on nearby waste facilities

Single project

6.5.41 It is estimated that the construction of Dogger Bank Teesside A or B will require 11% of total waste arisings to be sent for off-site waste management for reuse or recycling or disposal.

6.5.42 Construction of Dogger Bank Teesside A or B is estimated to generate 21,800m^3 of hardcore from removal of temporary haul road, 10 tonnes of biodegradable waste from site clearance works, 420m^3 of the HDD sludge, small volumes of excess out of specification materials, packaging waste and municipal solid waste from the site compounds. These wastes will require off-site waste management for reuse or recycling or disposal.

6.5.43 A list of waste management facilities located within 20 mile distance from the cable route is provided in **Table 6.9**. This list is compiled from a GIS based search tool that is available on EA's Waste Directory website (www.wastedirectory.org.uk).

6.5.44 There are 10 waste management facilities (material recycling facilities and waste transfer stations) identified within a 20 mile distance from the cable route that accept excavated topsoil, subsoil and rubble, biodegradable waste for reuse or recycling. There is also a landfill site located within 20 mile distance that accepts hazardous (subject to meeting waste acceptance criteria of the landfill site) and non-hazardous waste.

6.5.45 Given that there is a wide range of facilities available in the area to accept the waste generated from Dogger Bank Teesside A or B construction works, the magnitude of the effect on waste management facilities is considered to be low.

Table 6.9 List of waste management facilities within 20 miles from the proposed cable route

Name of facility	Waste types accepted	Distance from the proposed development (miles)
Material Recycling Facilities or Waste Transfer Stations		
1st Choice Skip Hire Northeast Ltd	Topsoil, subsoil, Green waste, Fuel Oil, Lubricating Oil	3
Skip Freight	Topsoil, subsoil, Green waste,	5
Alab Environmental Services Ltd	Topsoil, subsoil,	6
C & L Autos	Topsoil, subsoil, Fuel Oil, Lubricating Oil	6
R Newcomb & Sons Ltd	Topsoil, subsoil,	8
T P Skip Hire Ltd	Topsoil, subsoil,	8
J & B Recycling	Topsoil, subsoil, Green waste,	9
Jewson Ltd	Topsoil, subsoil,	10
Mr James Campbell	Green waste	11
Skippy Waste Services	Topsoil, subsoil,	12
Landfill site		
Port Clarence Landfill Site	Hazardous and Non-hazardous waste landfill	12

Concurrent build scenario

6.5.46 Building the two projects concurrently will generate approximately twice the volume of waste as a single project. However the total waste arisings that are predicted to require off site waste management will be the same overall percentage (11%).

6.5.47 Construction of Dogger Bank Teesside A & B is estimated to generate 42,000m^3 of hardcore from removal of temporary haul roads, 10 tonnes of biodegradable waste from site clearance works, 840m^3 of the HDD sludge, small volumes of excess out of specification materials, packaging waste and municipal solid waste from the site compounds. These wastes will require off-site waste management for reuse or recycling or disposal.

6.5.48 Given that there is a wide range of facilities available in the area to accept the waste generated from Dogger Bank Teesside A & B construction works, the magnitude of the effect on waste management facilities is considered to be low.

6.6 Potential impacts (flood risk)

6.6.1 The assessment of the potential construction phases in Section 5.1 identified that the maximum ‘peak’ impact arise from the build Dogger Bank Teesside A & B concurrent scenario and the maximum ‘duration’ of impact arise from build Dogger Bank Teesside A & B sequential scenario. With respect to flood risk Dogger Bank Teesside A & B build sequentially will increase the potential duration of the exposure to flood risk. The converter stations site is not located within a fluvial floodplain and therefore the possibility of increased flood risk is limited (**Appendix 24B**) and as such the receptor sensitivity is low. In addition, the activities associated with the construction of the cable route will not result in any increased impermeable surface and is considered to result in a low magnitude effect. As such the potential for increased flood risk during construction is considered to be **negligible**.

6.6.2 National Grid has confirmed that the enabling works proposed for their site are to be contained within the building extensions on the existing site. As the existing site is entirely within Flood Zone 1, the potential for increased flood risk during construction at the National Grid site is also considered to be **negligible**.

7 Assessment of Impacts During Operation

7.1 Introduction

7.1.1 This section describes the potential impacts during the operational phase of the onshore aspects of Dogger Bank Teesside A & B, with respect to potential impacts to geology, water resources and land quality; impacts caused by waste; and flood risk. This section also assesses the WFD compliance of the scheme during its operational phase. Reference should be made to **Chapter 5** for full details of the operational phase; however, in summary, the activities considered likely to cause waste arisings and / or impact the geology, water resources and land quality are:

- The presence of roads, buildings and hardstanding at the converter stations site causing increased run-off;
- Gas build up in confined spaces within the converter stations; and
- General site activities at the converter stations, such as routine monitoring and maintenance activities.

Geology, Water Resources, Land Quality (Human Health) and Water Framework Directive Compliance

7.1.2 There are no perceived operational impacts on the WFD surface and groundwater bodies. It is therefore considered that there will be **no deterioration in the status of water body GB103025072660 (Redcar Coastal Area) and GB40302G701300 (Tees Mercia Mudstone and Redcar Mudstone)**, and that the scheme is compliant with the requirements of the WFD.

7.1.3 Occasional routine maintenance works will be required during the operational phase; however, this access will be via jointing bays, and therefore will not result in any ground disturbance or associated impacts. The converter stations site have been sited outside of any Groundwater SPZ and assessed to be compliant with the requirements of the WFD, and as such no post-construction surface or groundwater monitoring is proposed.

7.1.4 In the event of a cable failure, it may be necessary to re-excavate the cable trench and replace / repair the faulty cable along limited stretches. If repair works are required, the mitigation measures outlined for the construction phase activities in Section 6 will be adhered to, in order to reduce or minimise any potential impacts to an acceptable level.

7.1.5 It is likely that machinery will be used and will require potentially polluting materials for their operation and maintenance to be stored and used on the converter stations site during its operation (e.g. fuel and oil). Therefore, there is a risk that leakages and spillages could result in pollution of the soil, surface waters and groundwater. However, the frequency and duration of such activities is likely to be minimal, the quantities of fuel and oils used will be small and the impacts unlikely to be sufficient to cause deterioration in the status of either the surface or groundwater body (low magnitude).

7.1.6 The transformers will require below ground oil interceptors. Oil shall be contained within a bund, pass through a flame trap, and be held in a double lined underground oil containment facility. Rain water that collects in the oil containment facility shall be pumped out by an oil sensing Bund Water Control Unit, through a Full Retention Class 1 Oil Separator designed in accordance with BS EN 858, before discharging to the general site drainage system. The buried cable system will not contain any oil during the operational phase.

7.1.7 The converter stations will be unmanned, however due to the requirement for general ad hoc maintenance at the sites; personnel / maintenance engineers will be required to visit the site. Welfare facilities will be provided on site including clean water and toilets. As such there will be a requirement to manage any associated waste water / sewage discharges.

7.1.8 Mitigation measures in relation to general maintenance activities, including the provision of appropriate welfare facilities at the converter stations are detailed in **Table 7.1**.

Table 7.1 Mitigation measures in relation to general maintenance activities at the converter station site

Mitigation measures
• At the converter stations, where it is not possible to store potentially contaminative materials off-site, arrangements will be made for storage in secure, bunded areas above ground level; • Procedures will be put in place for identifying and reporting spillages or leakages either at the converter stations or during maintenance activities along the cable routes, and consideration given to the storage of containment equipment (e.g. absorbent matting, plastic sheeting etc.) on site etc.; • The integrity of hardstanding at the converter stations and the drainage network will be inspected regularly to ensure that damage to either do not result in the creation of a potential pathway by which contaminants could either enter groundwater or surface waters; • Oil separators will need to be regularly inspected and maintained (emptied) when appropriate; and • A Package Treatment Plant solution to manage all wastewater / sewage originating from the converter stations will be located on site, any discharges associated with this will be agreed by the EA prior to operation.

7.1.9 With adherence to the above mitigation, and based on the previously defined magnitude and sensitivity, it is anticipated that there will be a **negligible residual impact** on soil, surface waters and / or groundwater during the operation of Dogger Bank Teesside A & B.

7.1.10 In addition, based on the inclusion of these precautionary measures it is considered that there will be **no deterioration in the status of water body GB40302G701300 (Tees Mercia Mudstone and Redcar Mudstone) or GB103025072660 (Redcar Coastal Area)** arising from the operational phase. The proposed scheme is therefore considered to be compliant with the requirements of the WFD.

Gas Risk

7.1.11 A number of confined spaces are expected within the proposed buildings / structures; within the converter stations. Human entry will be possible and required throughout the lifetime of the project for monitoring and maintenance purposes. As there are two known historic landfills within 500m of the proposed converter stations site, and given that the precise nature of the material in the landfill sites is not known (Section 4.3), there is the potential for hazardous gas to migrate via permeable strata and accumulate in confined spaces and / or buildings on site. Considering that no high risk potential sources of contamination have been identified in the direct impact footprint and the low permeability of the superficial till deposits, the magnitude of the impact is likely to be **low**. However maintenance workers are considered to be a highly sensitive receptor therefore mitigation measures in relation to gas risk at the converter station are detailed in **Table 7.2**.

Table 7.2 Mitigation measures in relation to potential gas risk at the converter station sites

Mitigation measures
• All buildings / foundations with confined spaces should be designed and built with gas venting / protection measures as a precautionary measure, in-line with current building regulations where applicable; and • Gas risks will be considered for all maintenance workers whenever there is a requirement to enter confined spaces. This should be managed through health and safety risk assessments.

7.1.12 With adherence to the above mitigation, and based on the previously defined magnitude and sensitivity it is anticipated that the will be a **negligible** residual impact on construction workers during operation.

7.2 Potential impacts (flood risk)

7.2.1 The converter stations are not located within a fluvial floodplain and therefore they will not reduce floodplain storage or affect fluvial flow routes. The sensitivity of this receptor is therefore considered to be negligible. Within the FRA (**Appendix 24B**), implications on pluvial flooding are also considered to be **negligible**.

7.2.2 Approximately two-thirds of the each converter station's operational area will be roofed (valve hall and control building) and will represent an impermeable surface for surface water. The remainder of the area includes the external AC yard and access tracks and roads. A proportion of this area will be permeable and surfaced with gravel where not supporting structural foundations. The current site is unspecified greenfield land, therefore the converter stations will result in an increase in impermeable area compared to current use at the site; any consequent increase in run-off will have to be mitigated to ensure no increase in flood risk elsewhere in accordance with the requirements of the NPPF.

7.2.3 In order to manage the surface water run-off from the converter stations, an adequate drainage system will be required. An initial allowable discharge rate of

16.2 litres/second (l/s) for the site is estimated based on best practice. The surface water drainage system will be based on a 1 in 100 storm event plus an allowance of 30% for climate change. It may be necessary to allow for storage of surface water either above or below ground to facilitate attenuation of runoff to ensure that it runs off at the required rate. Details of attenuation (if required) will be finalised through the detailed design process.

7.2.4 Based on the proposed allowable discharge rate of 16.2 l/s for the site and the impermeable area of the converter stations, calculations of the following surface water storage which will be required to achieve greenfield run off rates (until the detailed design is finalised, ranges of potential attenuation volume requirements are given; the final figure will depend on drainage design and configuration) have been made:

- 1 in 30 year – between 550m^3 and 800m^3;
- 1 in 100 year – between 750m^3 and 1100m^3; and
- 1 in 100 year + 30% Climate Change – between 1050m^3 and 1550m^3.

Although the sensitivity of the receptor is negligible there is the potential for low magnitude impacts and, as such, receptor mitigation measures in relation to flood risk are detailed in **Table 7.3**.

Table 7.3 Mitigation measures in relation to flood risk at the converter stations site

Mitigation measures
• A suitable drainage system will be developed with sufficient volume to attenuate the 1 in 100 year (plus climate change) volumes. As such, a negligible residual impact is predicted for increased surface water flooding during the operation of Dogger Bank Teesside A & B; • Any impermeable area associated with the National Grid works will in turn require an adequate drainage system to manage the surface water runoff. The form of this mitigation is to be confirmed by National Grid as part of their development proposals for the enabling works; and • The buried cable systems will be fully underground, and crossed watercourses will be fully reinstated; therefore there will be no residual flood risk issues associated with the cable route.

7.2.5 With adherence to the above mitigation, and based on the negligible sensitivity and low magnitude impacts, it is anticipated that the will be a **negligible** residual impact on flood risk during operation

7.3 Potential impacts (waste management)

Cable route

7.3.1 The cables will be insulated and protected, however, occasional routine maintenance works to the cable systems may still be required during the operational phase. Waste arisings are expected to be very small. In the event of a cable failure, it may be necessary to excavate the cable trench to repair/replace faulty cable. If this is required, the worst case will require the excavation of the cable trench between joint bays to remove the cable system. It is predicted that approximately 2,250m^3 of excavated soil will be generated.

7.3.2 Waste excavated material that cannot be returned to the trench will be sent for off-site waste management in accordance with the waste hierarchy. It is anticipated that the cable system will be technically assessed to see if it can be reused; and will be recycled if not. If repair works are required, the waste management mitigation measures proposed for stockpiling material during the construction phase (**Table 6.9**) of the works will be adhered to, in order to reduce or minimise any possible impacts.

7.3.3 The magnitude this effect is medium (based on the predicted quantity of non-hazardous waste); and assuming that the quantity of waste sent for disposal will be reduced by following the construction stage mitigation measures provided in **Table 6.9**, there remains a temporary **negligible** residual impact, using the assessment criteria provided in **Table 3.5**.

Converter stations site

7.3.4 The servicing of equipment in the converter stations site is likely to give rise to small quantities of liquid hazardous waste (used oil), solid hazardous waste (oil-contaminated wipes, absorbent, fluorescent tubes, flat screen monitors etc.) and non-hazardous waste (waste electrical and electronic equipment). The pollution potential of liquid hazardous wastes is high, even if they are produced in small amounts. It is predicted that less than 1 tonne of hazardous waste will be generated at any given time during operation.

7.3.5 Where hazardous wastes are produced these will be managed in accordance with the requirements of the hazardous waste regulations and the waste duty of care. Where maintenance works are required, the mitigation measures proposed for waste management during the construction phase (**Table 6.9**) of the works will be adhered to, in order to reduce or minimise any possible impacts to an acceptable level.

7.3.6 The magnitude of this effect is low (based on the predicted quantity of hazardous waste); and assuming that the quantity of waste sent for disposal will be reduced by following the construction stage mitigation measures provided in **Table 6.9**, there remains a temporary **negligible** residual impact, using the assessment criteria provided in **Table 3.5**.

8 Assessment of Impacts During Decommissioning

8.1 Introduction

8.1.1 This section describes the potential impacts of the decommissioning of the onshore aspects of Dogger Bank Teesside A & B with regards to impacts of geology, water resources and land quality; and impacts caused by waste; and flood risk.

Cable route

8.1.2 There are **no impacts** during the decommissioning phase of the works. There are currently no statutory requirements for decommissioned cables to be removed and it is likely that removal of the cables would bring about further environmental impacts. Therefore at present it is assumed that the cables will be left *in situ* and this will be reviewed over the design life of the project.

Converter stations

8.1.3 Impacts from decommissioning are anticipated to be similar to those identified for construction activities, see Section 6.

8.1.4 The decommissioning of the converter substation is likely to create significant quantities of non-hazardous and inert construction and demolition waste, mainly comprising excavated hardstanding, building waste and excavated soil. The mitigation measures proposed for waste management during the construction phase of the works (**Table 6.9**) are equally applicable for the decommissioning phase, and will reduce or minimise any possible impacts.

9 Cumulative Impact Assessment (CIA)

9.1 Cumulative Impact Assessment (CIA) strategy and screening

9.1.1 This section describes the CIA for geology, water resources, land quality, waste and flood risk, taking into consideration other plans, projects and activities. A summary of the CIA is presented in **Chapter 33**.

9.1.2 Forewind has developed a strategy for the assessment of cumulative impacts in consultation with statutory stakeholders. Details of the approach to CIA adopted for this ES are provided in **Chapter 4**.

9.1.3 The strategy recognises that data and information sufficient to undertake an assessment will not be available for all potential projects, activities, plans and/or parameters, and seeks to establish the confidence in the data and other information that is available.

9.1.4 In its simplest form the strategy involves consideration of whether impacts on a receptor can occur on a cumulative basis between the onshore elements of Dogger Bank Teesside A & B and other activities, projects and plans for which sufficient information regarding location and scale exist.

9.2 Onshore CIA

9.2.1 The onshore projects, activities and plans relevant to geology, water resources, land quality and waste are presented in **Table 9.1** along with a screening exercise to identify whether there is sufficient confidence in the project details to take these forward to the assessment. Flood risk with respect to the Dogger Bank Teesside A & B schemes relates only to surface water runoff. As runoff associated with each development site is restricted to the greenfield runoff rate identified for the existing undeveloped site, cumulative impact has not been considered further.

Table 9.1 Cumulative impact assessment screening for geology, water resources, land quality and waste

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Commercial plant	Tees Renewable Energy Plant	Expected operational in 2015	Present - 2015	>2km	High	High	No due to distance from direct impact footprint
Underground cable	Tees Renewable Energy Plant underground cable	In construction	Present – 2015	0	High	High	Yes
Pipeline	York Potash Project	In planning	No indication	1km	Medium	Medium	Yes
Anemometry Mast	Anemometry Mast at The Wilton Centre	Planning permission granted. Construction to be completed within 3 years	Construction must begin within 2013 - 2016	0m	High	High	No due to different project attributes
Terminal	Northern Gateway Terminal	Outline permission given in 2007. October 2012 decision: Grant Reserved Matters	No indication	>2km	Medium - High	Medium - High	No due to distance from direct impact footprint

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Pipeline	Breagh Pipeline	Planning permission granted, April 2012, development must begin within 3 years.	Present - 2015	>3km	High	High	No due to distance from direct impact footprint
Erection of residential buildings	Two storey 2, 3 and 4 bedroom dwelling houses and garages	Public consultation ends March 2013	No indication	>2km	Medium - High	Medium - High	No due to distance from direct impact footprint
Single pole installation	Installation of single pole to house transformer unit (application submitted under section 37 of the electricity act 1989)	Public consultation end February 2013	Construction must begin within 2013 - 2016	>3km	Medium - High	Medium - High	No due to distance from direct impact footprint
Redevelopment of residential buildings	Redevelopment comprising the erection of 288 dwellings and ancillary works (amended scheme)	Granted planning permission	Construction must begin within 2013 - 2016	>2km	High	High	No due to distance from direct impact footprint

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Demolition	Demolition of various buildings	Granted deemed consent February 2013	Construction must begin within 2013 - 2016	<500m	Medium - High	Medium - High	No due to distance from direct impact footprint
Erection of residential buildings	Erection of 6 dwellings	Granted planning permission	Construction must begin within 2013 - 2016	<1km	High	High	No due to distance from direct impact footprint
Power station	Teesside Power Station	Permission not required December 2012	No indication	<500m	Medium	Medium	No due to expected construction completion date
Erection of residential buildings	Three storey 72 bedroom care home	Granted planning permission March 2013	Construction must begin within 2013 - 2016	>3km	High	High	No due to distance from direct impact footprint
Commercial plant	Screening opinion request for new biomass import facility	EIA not required, November 2012	No indication	<2km	Low - Medium	Low - Medium	No insufficient information
Commercial plant	Screening opinion for proposed potash processing plant	Insufficient info in planning application, November 2012	No indication	>3km	Low - Medium	Low - Medium	No insufficient information

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Erection of commercial buildings	Two storey management block with associated 92 space car park	Planning permission granted December 2012. Development must begin within 3 years.	2012 - 2015	<1km	High	High	No due to distance from direct impact footprint
Offshore wind farm onshore electrical connection	Dogger Bank Teesside C & D	Application expected in 2015	2016	0 (m) (intersects project)	High	High	Yes
Onshore renewables	Scoping request for two wind turbines	Scoping Opinion requested	Five month construction period but unknown date	0m	High	High	Yes
Onshore renewables	One wind turbine	Public consultation ended on 20 November 2013	Unknown	130m	High	High	Withdrawn
Waste Treatment facility	Teesport Waste Treatment Facility	Planning permission granted 11 December 2013	Construction must begin between 2013-2016	>3km	High	High	No due to distance from direct impact footprint

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Commercial plant	Elring Klinger (GB) Ltd Extension to factory	Planning permission granted 22 October 2013 Development to begin within 3 years of permission	Construction must begin between 2013-2016	670m	High	High	No due to distance from direct impact footprint
Demolition of a Power station	Teesside Power Plant	Permission not required (decision made on 26 June 2013)	From approximately 2 October 2013 to 30 September 2014	200m	Low	Low	Yes
Power Plant	Earthly Energy Group: Anaerobic power plant	Planning permission granted 24 July 2013 Development to begin within 3 years of permission	Construction must begin between 2013-2016	>2km	High	High	No due to distance from direct impact footprint

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Onshore renewables	Erection of single wind turbine, maximum height 80m (Elring Klinger)	Planning permission granted 6 June 2013 Development to begin within 3 years of permission.	Construction must begin between 2013-2016	590m	High	High	No due to distance from direct impact footprint
Waste water	Northumbrian Water: Effluent main pipe	Planning permission granted 29 August 2013 Development to begin within 3 years of permission.	Construction must begin between 2013-2016	>2km	High	High	No due to distance from direct impact footprint
Onshore renewables	Bankfield Wind Farm	Public consultation ends 30 November 2013	Unknown	>2km	High	High	No due to distance from direct impact footprint
Onshore renewables	Land at Court Green Farm: Single wind turbine	Public consultation end date 2 September 2013	Unknown	>2km	High	Medium-High	No due to distance from direct impact footprint

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Residential	Change to house type: Substitution of 30 approved house types of planning permission with 28 new house types, boundary treatments and associated landscaping	Planning permission granted 2 August 2013	Construction must begin between 2013-2016	>2km	High	Medium-High	No due to distance from direct impact footprint
Residential	Four bungalows: Yew Tree Care Centre	Planning permission granted 1 July 2013 Development to begin within 3 years of permission	Construction must begin between 2013-2016	1.4km	High	High	No due to distance from direct impact footprint
Residential	1000 Dwelling development	Public consultation end date 26 November 2013	Unknown	1.4km	High	High	No due to distance from direct impact footprint
Agricultural	Erection of agricultural building	Planning permission granted 5 July 2013	Construction must begin between 2013 – 2016	0m	High	Medium	Small scale project, no cumulative impacts anticipated.

Type of project	Project title	Project status	Predicted construction period	Distance from Dogger Bank Teesside A & B	Confidence in project details	Confidence in project data	Carried forward to cumulative impact assessment
Residential development	Development of 14 two storey detached dwellings	Planning permission granted 4 November 2013. Development to begin within 3 years of permission	Construction must begin between 2013-2016	1.1km	High	Medium	No due to distance from direct impact footprint

9.2.2 The onshore impacts identified during the construction of Dogger Bank Teesside A & B that could result in cumulative impacts are:

- Impact of spills and disturbance to water courses effecting water quality may have a **minor adverse** impact;
- Impact of spills to shallow topsoil effecting land quality may have a **minor adverse** impact; and
- Generation of waste arising that may need to removed, including some destined to be disposed at landfill resulting in a temporary **minor adverse**.

9.2.3 Given the nature of the impacts discussed within this chapter, only similar projects (e.g. large scale development or buried linear developments) are likely to result in cumulative impacts. Given this, the three projects of consideration here are the Tees Renewable Energy Plant Underground Cable, York Potash Project, Dogger Bank Teesside C & D offshore wind farm onshore cable connection, the demolition of the Teesside Power Station and the Onshore Renewables project.

Tees Renewable Energy Plant Underground Cable

9.2.4 RCBC has granted the planning permission for MGT Teesside Ltd to construct and operate a 300MW biomass power station at Teesside. As part of the proposals, MGT Teesside Ltd will be laying an underground cable system to connect its proposed power station with the existing NGET substation at Lackenby. The proposed underground cable system will run along the southern side of the Wilton Complex to achieve connection at Lackenby. According to the MGT Teesside website, the proposed plant will enter into commercial operation in 2015. The current published programme for Dogger Bank Teesside A & B is that it will enter into the construction phase in 2015. As such, the construction programme of the cable connection for the biomass power plant is likely to overlap with the construction Dogger Bank Teesside A & B, based on current knowledge of the schemes. The potential impacts of the underground cable are considered to be similar to those identified within this chapter. These worst case scenarios are summarised below in **Table 9.2** and the likely cumulative impact assessed.

Table 9.2 Summary of cumulative impacts – Tees Renewable Energy Plant Underground Cable

Impact	Realistic worst case scenario	Cumulative impact
Construction		
Impacts related to geology, hydrology and water resources	Both Dogger Bank Teesside A & B and the Tees Renewable Energy Plant Underground Cable constructed concurrently	If mitigation measures detailed in this chapter are applied to both projects the residual impacts identified are not anticipated to change.
Waste	Both Dogger Bank Teesside A & B and the Tees Renewable Energy Plant Underground Cable constructed concurrently	If the projects are constructed concurrently, this will increase the total waste arisings, thereby

Impact	Realistic worst case scenario	Cumulative impact
		causing an increased **adverse impact**. However, by following the construction stage mitigation measures provided in **Table 6.9**, there remains a **temporary minor adverse** residual cumulative impact, using the assessment criteria provided in **Table 3.5**. The assessment identified a range of waste management facilities in the area to accepted wastes generated.
Flood Risk	Negligible impact	None
Operation		
All impacts	Negligible Impacts	None
Decommissioning		
All impacts	As construction phase	None

York Potash Project

9.2.5 The pipeline will be located down the eastern edge of Wilton Complex, then south east, and will cross the Dogger Bank Teesside A & B cable route to the east of Wilton Complex. The pipeline consists of two 625mm bore steel pipes to transport potash ore 45km from new potash mine south of Whitby to new processing plant on Teesside. A working width of 45m will be required for installation. Further information on the construction schedule for the pipeline is not available at the time of writing. An assumption can be made that typically, it takes between 12-18 months following submission for consent to be granted. Therefore, there is the potential for the construction phase to overlap with Dogger Bank Teesside A & B.

Table 9.3 Summary of cumulative impacts – York Potash Project

Impact	Realistic worst case scenario	Cumulative impact
Construction		
Impacts related to geology, hydrology and water resources	Both Dogger Bank Teesside A & B and the York Potash Project constructed concurrently	If mitigation measures detailed in this chapter are applied to both projects the residual impacts identified are not anticipated to change.

Impact	Realistic worst case scenario	Cumulative impact
Waste	Both Dogger Bank Teesside A & B and the York Potash Project constructed concurrently	If the projects are constructed concurrently, this will increase the total waste arisings, thereby causing an increased **adverse impact**. However, by following the construction stage mitigation measures provided in **Table 6.9**, there remains a **temporary minor adverse** residual cumulative impact, using the assessment criteria provided in **Table 3.5**. The assessment identified a range of waste management facilities in the area to accepted wastes generated.
Flood Risk	Negligible impact	None
Operation		
All impacts	Negligible Impacts	None
Decommissioning		
All impacts	As construction phase	None

9.2.6 The worst case scenario will be the construction of the York Potash Project and the Dogger Bank Teesside A &/or B onshore cable route at the same time. This will have to consider the logistical aspects of the point where both routes cross. There is currently no information available from the York Potash Project to be able to identify the likely magnitude and significance of the impacts of waste arising from this project. The construction activities for the potash pipeline are likely to generate significant quantities of excavated material, like the cable route for Dogger Bank Teesside A & B. If this is the case there is likely to be a cumulatively **minor adverse** impact as both will be seeking to identify suitable off-site waste management options (including landfill) for surplus excavated material at the same time, thus increasing the cumulative amount of waste requiring suitable management options.

Dogger Bank Teesside C & D

9.2.7 Dogger Bank Teesside C & D is part of Forewind's second stage of development of the Dogger Bank Zone. This will comprise two wind farms, each with a maximum installed capacity of 1.2GW. A section of the proposed onshore cable route for Dogger Bank Teesside C & D will run in parallel to the Dogger Bank Teesside A & B.

9.2.8 The potential impacts of the Dogger Bank Teesside C & D are considered to be similar to those identified within this chapter. The anticipated cumulative impacts with Dogger Bank Teesside C & D are dependent on the timing of the construction phases. The worst case scenario for each impact has been described in this chapter and depends on whether the construction phase is concurrent or sequential. These worst case scenarios also apply to the construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D project either concurrently or sequentially. These worst case scenarios are summarised below and the likely cumulative impact assessed.

Table 9.4 Summary of cumulative impacts – Dogger Bank Teesside C & D

Impact	Realistic worst case scenario	Cumulative impact
Construction		
Impacts related to geology, hydrology and water resources	Both Dogger Bank Teesside A & B, Dogger Bank Teesside C & D constructed concurrently	If mitigation measures detailed in this chapter are applied to both projects the residual impacts identified are not anticipated to change.
Waste	Both Dogger Bank Teesside A & B, Dogger Bank Teesside C & D constructed concurrently	If the projects are constructed concurrently, this will increase the total waste arisings, thereby causing an increased **adverse impact**. However, by following the construction stage mitigation measures provided in **Table 6.9**, there remains a **temporary minor adverse** residual cumulative impact, using the assessment criteria provided in **Table 3.5**. The assessment identified a range of waste management facilities in the area to accepted wastes generated.
Flood Risk	Negligible impact	None
Operation		
All impacts	Negligible Impacts	None
Decommissioning		
All impacts	As construction phase	None

Teesside Power Station

9.2.9 This project includes the demolition of eight off heat recovery system generator exhaust stacks and is located off the A1053, Greystone Road. Planning permission is not required for this project and the following comment was made on the planning application :

"The exhaust stacks to be demolished are located within a predominately industrial area. It is not considered the demolition of the exhaust stacks and retention of the other equipment on the site will have not a significantly detrimental effect on the surrounding area. The proposed method of demolition and restoration of the site is considered to be acceptable. Prior Approval of the Local Planning Authority is not therefore required".

9.2.10 It is therefore not considered likely that the works will have a cumulative impact on any of the receptors identified within this chapter.

Table 9.5 Summary of cumulative impacts – Teesside Power Station

Impact	Realistic worst case scenario	Cumulative impact
Construction		
Impacts related to geology, hydrology and water resources	Both Dogger Bank Teesside A & B, and Teesside Power Station demolition occurring concurrently	If mitigation measures detailed in this chapter are applied to both projects the residual impacts identified are not anticipated to change.
Waste	Both Dogger Bank Teesside A & B, and Teesside Power Station demolition occurring concurrently	If the projects are constructed concurrently, this will increase the total waste arisings, thereby causing an increased **adverse impact**. However, by following the construction stage mitigation measures provided in **Table 6.9**, there remains a **temporary minor adverse** residual cumulative impact, using the assessment criteria provided in **Table 3.5**. The assessment identified a range of waste management facilities in the area to accepted wastes generated.
Flood Risk	Negligible impact	None
Operation		
All impacts	Negligible Impacts	None
Decommissioning		
All impacts	As construction phase	None

Scoping Request for two wind turbines

9.2.11 This project involves the installation of two wind turbines within land 680m west of Yearby and 650m north of Wilton.

9.2.12 At this stage, very little project information concerning the construction programme or timing has been made available. Therefore an assumption has been made that the construction programme will overlap with Dogger Bank Teesside A & B.

9.2.13 Considering that the project falls inside the footprint of Dogger Bank Teesside. The potential types of impacts of two turbines are considered to be similar to those identified within this chapter. The anticipated cumulative impacts with turbine project are dependent on the timing of the construction phases. The worst case scenario for each impact has been described in this chapter and depends on whether the construction phase is concurrent or sequential. These worst case scenarios also apply to the construction of Dogger Bank Teesside A & B and the turbine project either concurrently or sequentially. These worst case scenarios are summarised below and the likely cumulative impact assessed.

Table 9.6 Summary of cumulative impacts – Turbine Project

Impact	Realistic worst case scenario	Cumulative impact
Construction		
Impacts related to geology, hydrology and water resources	Both Dogger Bank Teesside A & B, and Turbine Project constructed concurrently	If mitigation measures detailed in this chapter are applied to both projects the residual impacts identified are not anticipated to change.
Waste	Both Dogger Bank Teesside A & B, and Turbine Project constructed concurrently	If the projects are constructed concurrently, this will increase the total waste arisings, thereby causing an increased **adverse impact**. However, by following the construction stage mitigation measures provided in **Table 6.9**, there remains a **temporary minor adverse residual cumulative impact**, using the assessment criteria provided in **Table 3.5**. The assessment identified a range of waste management facilities in the area to accepted wastes generated.
Flood Risk	Negligible impact	None
Operation		
All impacts	Negligible Impacts	None
Decommissioning		
All impacts	As construction phase	None

9.2.14 There is potential for the projects Dogger Bank Teesside A & B, Dogger Bank Teesside C & D, the York Potash Project, the Tees Renewable Energy Plant Underground Cable, the demolition of the Teesside Power Station and the Wind Turbines project to be constructed at the same time. During the construction phase, the four projects are likely to generate a large volume of excavated materials. It is anticipated that the majority of excavated material could be reused onsite (particularly in relation to the Dogger Bank Teesside A & B, Dogger Bank Teesside C & D projects); however some of this material from all projects is predicted to require removal from the sites for off-site disposal. Cumulatively, this could have a greater negative impact on the local waste management facilities that accept these types of waste for reuse, recycling or disposal, than any single project in isolation. However, it is not possible to predict the overall significance given the lack of information about the York Potash Project.

10 Summary

10.1 Summary

10.1.1 This chapter of the ES has assessed the potential impact of Dogger Bank Teesside A & B on the baseline geology, water resources, land quality, waste and flood risk.

10.1.2 **Table 10.1** provides a summary of the potential impacts to geology, water resources, land quality, waste and flood risk arising from the realistic worst case scenarios set out in Section 5 of the chapter.

10.1.3 The main impacts are associated with the construction phase of Dogger Bank Teesside A & B. However, residual impacts are assessed as **minor adverse** or lower. These are considered acceptable given the temporary nature of the impacts, encountered during construction only. During operation only negligible impacts are identified. The impacts during decommissioning will be similar to those during construction and will be subject to a decommissioning plan and associated EIA at the relevant time.

Table 10.1 Summary of predicted impacts of Dogger Bank Teesside A & B on geology, water resources, land quality, waste and flood risk

Description of impact	Key mitigation measures	Residual impact (worst case scenario)
Construction phase		
Discharge of contaminants to surface geology, soils and shallow groundwater	• Good operational practices should be adopted in the construction phase; and • Store oils and fuel within designated areas in impervious storage bunds with a minimum of 110% capacity to contain any leakages of spillages.	**Negligible**
Surface run off and sediment or contaminant discharge to watercourses	• Entry into water will be avoided where possible; • A temporary haul road bridge should be constructed if repeated crossings are required; • Straw bales and sandbags will be incorporated to prevent silty runoff entering the watercourse; • Silt traps will be used when required to prevent silt polluting downstream reaches of the watercourses; • Specific consideration of the Water Resources Act 1991 (and associated Land Drainage Byelaws 1980) will be required where the cable corridor passes within 8m of a main river; • If cement etc. is likely to be batched on site a suitable area should be designated, located at an appropriate distance from the watercourse; • Adherence to best practices and guidance to ensure the risk of pollution is minimised; • Where earthworks are undertaken, soil and water will be managed with sufficient care to prevent surface water run-off; and • Stockpiles will be designed and positioned in order to minimise erosion, pollution of watercourse or increase flooding.	**Negligible**
Dewatering of groundwater to surface water	• If there is a requirement for dewatering of excavations, water will be pumped out and passed through a settlement tank or lagoon to allow suspended solids to settle out before being discharged to an appropriate location; and • Appropriate treatment methods will be adopted prior to discharge of the water from any land drains uncovered during the construction phase.	**Negligible**

Description of impact	Key mitigation measures	Residual impact (worst case scenario)
HHD beneath watercourses	• In accordance with best practice, the HDD will commence at a safe distance from the edge of the each watercourse. The distance will be agreed with the EA prior to commencement of the works; • The process of HDD involves the use of bentonite (used as a lubricating agent and grout); in order to reduce the risk of pollution of surface waters and / or break out in the river bed the use of these materials should be carefully controlled; • In order to reduce the likelihood of pollution from bentonite and / or grout when working near rivers, hydrophobic (water repelling) grout and quick setting mixes should be used; • If cement etc. is likely to be batched on site a suitable area should be designated and located at an appropriate distance from the watercourse; and Adherence to the CDM Regulations where applicable.	**Negligible**
Impacts on construction workers and future site operators	• Construction workers including sub-contractors will follow good site practices and hygiene rules as set out in BS5930 and BS10175:2011; • Appropriate PPE will be worn by construction workers including sub-contractors and health and safety measures undertaken to mitigate any short term risk during construction; • Gas risks will be considered for all construction workers including sub-contractors whenever there is a requirement to enter confined spaces as part of the construction works, this will be managed through the Construction Phase Health and Safety Plan; and • All construction works should be undertaken following best practice and in-line with the eCDM Regulations.	**Negligible**
Generation of waste arisings	• The waste hierarchy will be used to determine the most sustainable option for all wastes that are generated on-site; • Suitable local schemes will be identified where possible, as appropriate receiving sites to encourage the off-site reuse of surplus subsoil – this promotes the waste hierarchy and will reduce vehicle emissions caused by longer journeys; • Any hazardous wastes will be stockpiled or stored separately from any non-hazardous stockpiles; • The CL:AIRE CoP will be followed to demonstrate that excavated material is not waste at the point of reuse. Where the CoP cannot be followed, the use of waste material will be covered by an environmental permit, or appropriate exemption from environmental permitting (e.g. re-use of waste hardcore for temporary roads); and • A SWMP will be prepared to monitor wastes arisings on-site. This will also promote sustainable waste management practices by maximising waste prevention, re-use and recycling for material destined for off-site waste management. This will actively discourage sending waste to landfill.	**Minor adverse**

Description of impact	Key mitigation measures	Residual impact (worst case scenario)
Operational phase		
Contamination impacts on of geology, water resources and human health	• Best site management practices, such as those set out in the EA's PPG notes, will be adopted during the operational phase to prevent such spillages and leakages.	**Negligible**
Exposure to gas risk at the convertor station	• All buildings / foundations with confined spaces should be designed and built with gas venting / protection measures as a precautionary measure, in-line with current building regulations where applicable; and • Gas risks will be considered for all maintenance workers whenever there is a requirement to enter confined spaces. This should be managed through health and safety risk assessments.	**Negligible**
Flood Risk	• A suitable drainage system will be developed with sufficient volume to attenuate the 1 in 100 year (plus climate change) volumes. As such, a negligible residual impact is predicted for increased surface water flooding during the operation of Dogger Bank Teesside A & B; • Any impermeable area associated with the National Grid works will in turn require an adequate drainage system to manage the surface water runoff. The form of this mitigation is to be confirmed by National Grid as part of their development proposals for the enabling works; and • The buried cable systems will be fully underground, and crossed watercourses will be fully reinstated; therefore there will be no residual flood risk issues associated with the cable route.	**Negligible**
Decommissioning phase		
Discharge of contaminants to surface geology and soils	• As per construction phase.	**Negligible**
Surface run off and sediment or contaminant discharge to watercourses	• As per construction phase.	**Minor adverse**

Description of impact	Key mitigation measures	Residual impact (worst case scenario)
Dewatering of groundwater to surface water	• As per construction phase.	**Minor adverse**
HDD beneath watercourses	• As per construction phase.	**Minor adverse**
Impacts on construction workers and future site operators	• As per construction phase.	**Negligible**
Generation of waste arisings	• As per construction phase.	**Minor adverse**

11 References

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