The Great Grid Upgrade

Sea Link

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Qualitative Groundwater Risk Assessment

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1. Introduction

1.1 Overview

1.1.1 This preliminary groundwater risk assessment appendix has been produced to inform **Application Document 6.3.3.5 Part 3 Kent Chapter 5 Geology and Hydrogeology**, of the Environmental Statement. This appendix has been prepared to provide baseline information regarding the groundwater (hydrogeology) and a preliminary groundwater risk assessment.

1.1.2 As described in **Application Document 6.3.3.5 Part 3 Kent Chapter 5 Geology and Hydrogeology** of the Environmental Statement the study area for hydrogeology comprises the physical extents of the Order Limits plus a buffer of 500 m.

1.2 Structure of the Appendix

1.2.1 The structure of this assessment is as follows:

- **Chapter 1 Introduction** (this section) – provides an introduction to the assessment and sources of information consulted;
- **Chapter 2 Methodology** – which presents information on the methodology followed in this appendix and the accompanying classification tables;
- **Chapter 3 Abstraction Data** – which contains information received from the relevant authorities regarding abstractions, deregulated abstractions and private water supplies; and
- **Chapter 4 Qualitative Groundwater risk assessment** – which presents an assessment of the groundwater risks of each element of the Proposed Project using a combination of receptor identification and associated sensitivity and magnitude of the potential risk.

1.3 Sources of information

1.3.1 This baseline appendix is informed by a desk-based study of available information, including maps, geological data, data collected from ground investigations and other publicly available data. The following is a list of the key sources of information used to inform the desk study:

- British Geological Survey (BGS) 1:50,000 scale geological mapping (British Geological Survey, 2024);
- BGS Geoindex Viewer (British Geological Survey, 2024);
- BGS Hydrogeological Map of Kent (British Geological Survey , 1970);
- Defra mapped information, via the MAGIC website (Defra, 2024) for Source Protection Zones (SPZ), aquifer designations, hydrological features, groundwater vulnerability, drinking water safeguard zones and statutory designated sites;

- Groundwater abstraction data from the Environment Agency and private water supply information from Thanet District Council; and
- Selected ground investigation data from the interpretative reports undertaken by Mott MacDonald, included as **Application Document 6.3.3.5.C Appendix 3.5.C Ground Investigation Report – Kent** and **Application Document 6.3.3.5.D Appendix 3.5.D Generic Quantitative Risk Assessment – Kent**.

2. Methodology

2.1.1 This risk assessment for groundwater has been based on standard industry guidance provided within the Construction Industry Research and Information Association (CIRIA) report C552, Contaminated Land Risk Assessment (CIRIA, 2001). To determine the risk to the identified receptor, both the probability (Table 2.1) and the degree of harm to a potential receptor (consequence - Table 2.2) are used and the risk estimated using the matrix in Table 2.3. The risk classifications are defined in Table 2.4.

Table 2.1 Classification of probability

Classification	Definition
High likelihood	There is a pollution linkage and an event either appears very likely in the short-term and almost inevitable over the long-term, or there is already evidence at the receptor of harm/pollution.
Likely	There is a pollution linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter-term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 2.2 Classification of consequence

Classification	Examples
Severe	Controlled water effect – short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Equivalent to Environment Agency Category 1 incident (persistent and/or extensive effects on water quality leading to closure of potable abstraction point or loss of amenity, agriculture or commercial value. Major fish kill.
Medium	Controlled water effect – equivalent to Environment Agency Category 2 incident requiring notification of abstractor. Ecological effect – short-term exposure may result in a substantial adverse effect.

Classification	Examples
Mild	Controlled water effect – equivalent to Environment Agency Category 3 incident (short lived and/or minimal effects on water quality). Ecological effect – unlikely to result in a substantial adverse effect.
Minor	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.

Table 2.3 Classification of risk

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High	High	Moderate	Low
	Likely	High	Moderate	Moderate	Low
	Low Likelihood	Moderate	Moderate	Low	Very low
	Unlikely	Low	Low	Very low	Very low

Table 2.4 Risk rating definitions

Risk Classification	Description
Very high	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

3. Abstraction Data

3.1 Licensed and deregulated groundwater abstractions

3.1.1 Information providing licensed groundwater abstractions and deregulated groundwater abstractions has been provided by the Environment Agency in response to a data request. Only one record for a licensed groundwater abstraction has been indicated within the study area and the information is presented in Table 3.1 and the location is shown on **Application Document 6.4.3.5.3 Ground Water Receptors**. Groundwater abstractions have not been indicated within the Order Limits.

Table 3.1 Licenced groundwater abstraction within study area

Abstraction License Number	Purpose	Use	Aquifer	Grid Reference	Approximate Distance from the Order Limits (m)
9/40/04/0029/A /GR	Agriculture	General Farming and domestic	Chalk	TR 3324 6309	10

3.2 Groundwater private water supplies

3.2.1 Information obtained from Thanet District Council indicates that there are no private water supplies located within the study area.

3.2.2 A request for this information was not made to Dover District Council as the works proposed within the area under the jurisdiction of Dover District Council comprises minor works to existing access roads and reconductoring of existing pylons and therefore is unlikely to have any significant effect on groundwater or therefore private water supplies.

4. Qualitative groundwater risk assessment

4.1 Overhead line

4.1.1 Within the Kent Onshore Scheme there are currently proposed to be nine new pylon locations.

Dewatering

4.1.2 Within the sections of overhead line groundwater is expected to be close to the surface due to the proximity to the River Stour. However, it is assumed that the pylons will require a piled foundation solution, as described in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**, and therefore the excavations to facilitate construction of the pylon foundations are expected to be relatively shallow. The pylon bases are likely to have a relatively small overall footprint (approximately 10 m by 10 m) and therefore significant dewatering within these locations is not anticipated. There may be the need for some small scale dewatering of rainwater and groundwater seepages, but these are not considered likely to amount to significant volumes and the risk to groundwater and groundwater receptors from dewatering (changes in groundwater levels or flow pathways) is considered to be very low.

New Flow Pathways

4.1.3 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling or through permeable backfill material, allowing movement of existing contamination or mixing of aquifers. As shown in **Application Document 6.3.3.5.A Appendix 3.5.A Preliminary Contamination Risk Assessment** a worst-case low risk of contamination is anticipated within the Order Limits. Information obtained from the Mott Macdonald Generic Quantitative Risk Assessment (GQRA), contained in **Application Document 6.3.3.5.D Appendix 3.5.D Generic Quantitative Risk Assessment – Kent**, indicates that there were no recorded exceedances of the assessment criteria for a commercial land use within the soils tested. However, the GQRA indicates that exceedances of some potential contaminants were recorded within the groundwater samples from across the site. Therefore, there is considered to be a very low risk of mobilising any existing contamination in soils, through ground disturbance – but there is a moderate risk of mobilising existing contamination in the groundwater (through creation of new flow pathways). However, commitment GH02 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** requires the selection of appropriate piling techniques (to minimize the risk of the mixing of aquifers) and a Foundation Works Risk Assessment to be undertaken at all locations where piling is proposed, and therefore risks associated with creation of new flow/contamination pathways are considered to be very low.

Infiltration and recharge

4.1.4 Effects on infiltration and recharge of groundwater may arise if the permeability of the ground surfaces is changed. However, within the areas of new overhead line the Proposed Project only requires small areas of new hard standing, including for pylon bases. This means that significant changes to infiltration and recharge are not anticipated, and therefore it is considered that there is a very low risk to groundwater and groundwater receptors supported by groundwater or groundwater flow pathways.

4.2 Underground cables (opencut method)

4.2.1 The depth of the trenches for sections of underground cable being constructed via opencut methods are anticipated to be typically 1.5 m depth below ground level (bgl) with the joint bays needing to extend to around 2.0 m bgl as described in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**.

4.2.2 During ground investigations undertaken for the Proposed Project, boreholes were undertaken within the vicinity of the opencut trenches and the ground conditions have been described within the Mott Macdonald Ground Investigation Report, contained in **Application Document 6.3.3.5.C Appendix 3.5.C Ground Investigation Report – Kent**, and a summary reproduced below:

Table 4.1 Summary of ground conditions in proposed areas of opencut trenches

Geological Unit	Typical Description	Depth to base (m bgl)	Thickness (m)
Topsoil	Stiff friable brown to dark brown slightly sandy, slightly gravelly clayey SILT or silty CLAY with frequent roots and rare cobbles.	0.20 – 0.50	0.20 – 0.50
Made Ground (reworked topsoil located within one location in the vicinity of the golf course)	Brown slightly gravelly silty SAND. Gravel is angular to subrounded fine to coarse chalk, sandstone and brick.	0.40	0.40
Tidal Flat Deposits (Western portion of the cable route)	Stiff to very stiff becoming very soft to soft brown mottled light grey becoming bluish grey slightly sandy or slightly gravelly CLAY.	4.50 – 9.50	4.10 – 9.10
Thanet Formation	Stiff to very stiff micaceous sandy clayey SILT or silty CLAY OR Extremely weak to weak grey SILTSTONE	9.80 – 27.00	17.50 – 23.70

Margate Chalk Member – Newhaven Chalk Formation	Structureless chalk recovered as dense to very dense white slightly sandy silty angular to subangular fine to course GRAVEL. Clasts are extremely weak o very weak low to medium density white with occasional black specs of chalk. Matrix is off white.	>29.45*	>5.45*

*Base/thickness not proven

4.2.3 The information presented above indicates that the opencut trenched sections are likely to be located within the Tidal Flat deposits, or where these are not present the Thanet Formation.

4.2.4 Information from the Mott Macdonal Ground Investigation Report in **Application Document 6.3.3.5.C Appendix 3.5.C Ground Investigation Report - Kent** indicates groundwater within the opencut trenched sections is likely to be close to the surface and the trenches are likely to intercept groundwater.

Dewatering

4.2.5 Dewatering is likely to be required within the areas of open cut trenches. The nearest groundwater receptor to the trenched sections, and the only receptor within 500 m of the proposed opencut trenched sections is a groundwater abstraction located at St Nicolas Court Farm, directly to the west of the A256 Richborough Way, and approximately 370 m south of the trenched section. Details pertaining to this abstraction obtained from the Environment Agency indicate that it is abstracting from the chalk aquifer located at depth below the superficial deposits and overlying Thanet Formation and that the purpose of the abstraction is for general agricultural use. Historical borehole logs obtained from the BGS Geoindex (British Geological Survey, 2024) located within the area indicate the top of the chalk is likely to be approximately 28 m bgl and overlain by the Thanet Formation comprising predominantly low permeability clays. It is therefore considered that due to the depth of the abstraction, the overlying low permeability clay and the distance from the opencut section, the dewatering that may be required in the shallow deposits presents a low risk to the abstraction from the chalk aquifer.

New Flow Pathways

4.2.6 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through trenches or permeable backfill material, allowing movement of existing contamination or mixing of aquifers. As shown in **Application Document 6.3.3.5.A Appendix 3.5.A Preliminary Contamination Risk Assessment** a worst case low risk of contamination is anticipated within the Order Limits. Information obtained from the Mott Macdonald GQRA included in **Application Document 6.3.3.5.D Appendix 3.5.D Generic Quantitative Risk Assessment – Kent** indicates that there were no recorded exceedances of the assessment criteria for a commercial land use within the soils tested. However, the GQRA indicates that exceedances of some potential contaminants were recorded within the groundwater samples from across the site. Therefore, there is considered to be a very low risk of mobilising any existing contamination in soils, through ground disturbance but there is a moderate risk of mobilising existing contamination in the groundwater (through creation of new flow pathways).

4.2.7 However, the opencut trenches are unlikely to connect two aquifer units due to the anticipated depth meaning the trenches will remain entirely within either the Tidal Flat deposits or (where not present) the Thanet Sand Formation, and therefore a single aquifer.

4.3 Underground cables (Trenchless crossings)

Introduction

4.3.1 Two trenchless crossings are currently proposed within the Kent Onshore Scheme part of the Proposed Project, as descripted in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**. These comprise two back to back Horizontal Directional Drills (HDD) at the landfall location at Pegwell Bay and then onward underneath the A256 Richborough Way.

Landfall at Pegwell Bay and east of A264 Richborough Way

4.3.2 It is anticipated that the trenchless crossing at the landfall location will be drilled in one section, bringing the offshore cables onshore. The HDD is anticipated to be approximately 940 m in length (running from the west of St Augustine's and Stoneslees Golf Club to seaward of the mean highwater springs mark) as described in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**, and would reach a depth of approximately 18 to 20 m below ground level beneath the golf course and most of the salt marsh but rising to near surface at the landfall location. Therefore, the HDD would intercept any superficial deposits present, the Thanet Formation and the underlying Chalk.

4.3.3 The HDD equipment will then be turned around and the second trenchless crossing will be undertaken under the A264 Richborough Way, to reach a joint bay location where the cable is transitioned to open cut. Therefore, the Pegwell Bay landfall location and the eastern side of the A264 Richborough Way HDD launch pits will be located in the same area.

4.3.4 The HDD does not require dewatering itself, however there is the potential for dewatering to be required at the launch and reception pits depending on the groundwater levels. The depth of the launch and reception pits is likely to be around 2 m below ground level to allow the installation of the joint bay as described in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**.

4.3.5 During the ground investigation a borehole (RedP-BH-8) was undertaken at the location of the landfall of the Pegwell Bay HDD, and a copy of the exploratory hole record for the borehole is contained within the Structural Soils Factual Report (Structural Soil, 2024). A summary of the strata encountered in the borehole is presented in Table 4.2.

Table 4.2 Summary of ground conditions within RedP-BH-8

Geological Unit	Description	Depth to Base (m bgl)	Thickness (m)
Topsoil	Stiff brown slightly gravelly slightly sandy clayey SILT with occasional rootlets.	0.25	0.25
Tidal Flat Deposits	Firm becoming very stiff grey mottled brown slightly sandy clayey SILT or silty CLAY.	7.50	7.25
Thanet Formation	Stiff to very stiff grey silty CLAY becoming a SILTSTONE with depth. Base marked as Bullhead bead comprising silty angular to sub angular GRAVEL of flint.	9.97	2.47
Newhaven Chalk Formation	Very weak, medium density yellowish white CHALK (Grade B2).	23.33	13.36
Seaford Chalk Formation	Weak, high density white mottled light grey CHALK with widely spaced sponge beds. (Grade C2).	>26.00*	>2.67*

*Base not proven

Dewatering

4.3.6 The Ground Investigation Report included within **Application Document 6.3.3.5.C Appendix 3.5.C Ground Investigation Report - Kent** indicates that groundwater within the chalk was recorded at levels between 1.5 m to 1.6 m above Ordnance Datum (AOD) with the ground level at the proposed HDD entry points between 4.0 m and 8.2 m AOD. Therefore, groundwater is unlikely to be intercepted in the launch/reception pit and dewatering of the launch/receptor pits is unlikely to be required.

4.3.7 If unexpected dewatering is found to be required (following detailed design) that wasn't anticipated and included in this assessment, a Hydrogeological Risk Assessment will be required to be undertaken. Commitment GH09 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** secures the requirement for Hydrogeological Risk Assessment.

New Flow Pathways

4.3.8 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through permeable backfill material or through the construction of trenchless crossings, allowing movement of existing contamination or mixing of aquifers.

4.3.9 As shown in **Application Document 6.3.3.5.A Appendix 3.5.A Preliminary Contamination Risk Assessment** a worst case low risk of contamination is anticipated within the Order Limits. Information obtained from the Mott Macdonald GQRA in **Application Document 6.3.3.5.D Appendix 3.5.D Generic Quantitative Risk**

Assessment - Kent indicates that there were no recorded exceedances of the assessment criteria for a commercial land use within the soils tested. However, the GQRA indicates that exceedances of some potential contaminants were recorded within the groundwater samples from across the site. Therefore, there is considered to be a very low risk of mobilising any existing contamination in soils, through ground disturbance – but there is a moderate risk of mobilising existing contamination in the groundwater (through creation of new flow pathways).

4.3.10 The HDD bore is likely to intercept two aquifer units due to the anticipated depth, and has the potential to create a new pathway between the two. Whilst it has been identified that there is a moderate risk of existing contamination in the groundwater, Commitment GH02 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** requires a Foundation Works Risk Assessment (to identify and minimize risks to groundwater) to be undertaken at all locations where trenchless crossings are proposed.

4.3.11 Therefore, risks associated with creation of new flow/contamination pathways are expected to be very low.

Saline intrusion

4.3.12 The proximity of the landfall location to the coast of Pegwell Bay poses a potential risk to groundwater (freshwater) aquifers from saline (seawater) intrusion.

4.3.13 There is generally a natural gradient for groundwater towards the coast, but because seawater is slightly heavier than freshwater, seawater often intrudes to some extent, into aquifers in coastal areas. The dynamic interface between the two waters, known as the saline-freshwater interface (SFI), is affected by movements such as seasonal variations of the groundwater table and daily tidal fluctuations.

4.3.14 The extent of any natural saline intrusion into freshwater aquifers in coastal areas can be affected by groundwater pumping to lower the groundwater level, which can alter the natural hydraulic gradient.

4.3.15 In the area of the Kent landfall location, the published geology is indicated to comprise Undifferentiated Beach and Tidal Flat deposits overlying Thanet Formation and Newhaven Chalk, whilst the site specific ground investigation information indicates the presence of Tidal Flat deposits rather than the Undifferentiated Beach and Tidal Flat deposits The aquifer classifications of the two strata are different, with Undifferentiated Beach and Tidal Flat deposits classified as a Secondary Undifferentiated Aquifer, and the Tidal Flat deposits classified as Unproductive Strata.

4.3.16 A preliminary ground investigation for the proposed Project included borehole RedP-BH-8, close to the landfall location. During the drilling of borehole RedP-BH-8, groundwater was encountered at a depth of 6.5 m bgl, in the strata recorded as Tidal Flat deposits.

4.3.17 As described above, dewatering of the launch and receptor pits for the proposed HDD trenchless crossing at the Kent landfall location is unlikely to be required. Therefore the potential risk of saline intrusion related to dewatering is low.

4.3.18 The proposed HDD bore is anticipated to pass through the SFI, and could create a new flow pathway in which upflow or mixing of saltwater and freshwater could occur. However, the natural groundwater gradient is out towards the coast, and therefore this is likely to limit the extent of any temporary passive (i.e. not driven by active mechanisms such as dewatering) saline intrusion inland. In addition, the HDD bore will

be inclined through the coastal zone and the inclined nature of the HDD bore through the coastal zone is anticipated to further limit the extent of any saline intrusion inland.

4.3.19 In general it is considered that there is a low risk of significant additional (additional to current natural processes) saline intrusion as a result of the proposed Project.

Western side of A256 Richborough Way

4.3.20 The trenchless crossing under the A256 Richborough Way will be approximately 350 m in length and would reach a depth of approximately 10 m bgl.

4.3.21 The HDD does not require dewatering itself, however there is the potential for dewatering to be required at the launch and reception pits depending on the groundwater levels. The depth of the launch and reception pits is likely to be around 2.0 m bgl to allow the installation of the joint bay.

4.3.22 During the ground investigation borehole RedP-BH-11 was undertaken closest to the proposed reception pit location for this trenchless crossing. The location of RedP-BH-11 is located on the opposite side of the A256 however, the published geology is indicated to be the same and the borehole is at a similar elevation as the location of the reception pit. A copy of the borehole log for this location is contained within the Structural Soils Factual Report (Structural Soil, 2024). A summary of the strata encountered in the borehole is presented in Table 3.3.

Table 4.3 Summary of ground conditions within RedP-BH-11

Geological Unit	Description	Depth to Base (m bgl)	Thickness (m)
Topsoil	Stiff brown slightly gravelly very silty fine to medium SAND.	0.30	0.30
Thanet Formation	Generally a Very stiff brownish yellow sandy clayey SILT With occasional beds of loose yellow silty locally very silty fine SAND and SILTSTONE.	>20.45*	>20.15*

*Base not proven

Dewatering

4.3.23 Based on the Ground Investigation Report by Mott Macdonald included as **Application Document 6.3.3.5.C Appendix 3.5.C Ground Investigation Report – Kent** groundwater was not struck in borehole RedP-BH-11. Therefore, dewatering of the launch/receptor pits is unlikely to be required.

4.3.24 If unexpected dewatering is found to be required (following detailed design) that wasn't anticipated and included in this assessment, a Hydrogeological Risk Assessment will be

required to be undertaken. Commitment GH09 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** secures the requirement for Hydrogeological Risk Assessment.

New Flow Pathways

4.3.25 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through permeable backfill material or through the construction of trenchless crossing, allowing movement of existing contamination or mixing of aquifers.

4.3.26 As shown in **Application Document 6.3.3.5.A Appendix 3.5.A Preliminary Contamination Risk Assessment** a worst case low risk of contamination is anticipated within the Order Limits. Information obtained from the Mott Macdonald GQRA included in **Application Document 6.3.3.5.D Appendix 3.5.D Generic Quantitative Risk Assessment - Kent** indicates that there were no recorded exceedances of the assessment criteria for a commercial land use within the soils tested. However, the GQRA indicates that exceedances of some potential contaminants were recorded within the groundwater samples from across the site. Therefore, there is considered to be a very low risk of mobilising any existing contamination in soils, through ground disturbance – but there is a moderate risk of mobilising existing contamination in the groundwater (through creation of new flow pathways).

4.3.27 The HDD bore is unlikely to connect two aquifer units due to the anticipated depth meaning the bore remains entirely within the Thanet Sand Formation. Also, whilst it has been identified that there is a moderate risk of existing contamination in the groundwater, Commitment GH02 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** requires a Foundation Works Risk Assessment (to identify and minimize risks to groundwater) to be undertaken at all locations where trenchless crossings are proposed, and therefore risks associated with creation of new flow/contamination pathways are expected to be very low.

Unplanned losses of drilling fluids

4.3.28 During the process of HDD, unplanned losses of drilling fluids can occur when the drilling bore encounters paths of lower resistance, such as fractures, fissures or voids in the ground, and also when the strength and pressure of the ground overlying a HDD bore is exceeded by the drilling fluid pressures. Unplanned losses of drilling fluids are often known as breakouts or frac outs.

4.3.29 Breakouts/frac outs are most likely to occur when the bore is in close proximity to the ground surface, for example near the launch and reception points of the HDD, and where the strata may have inherent fractures and fissures.

4.3.30 To mitigate the risk of potential breakouts of drilling fluid, a drilling fluid management plan will be developed by the specialist HDD contractor (once appointed) in accordance with commitment GH10 of **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice**. The drilling fluid management plan will be informed by sufficient appropriate ground investigation to provide information on the strata that will be encountered during any HDD, and the nature/properties of the strata.

4.3.31 The drilling fluid management plan will include the following information, as appropriate, the details of which will be added by the selected HDD contractor in response to their understanding of the site specific information.

- detailed and appropriate design of all trenchless crossings including demonstration of a suitable drilling profile and depth to mitigate the risk of breakout;
- description of drilling procedure and demonstration of suitability, including removal of borehole cuttings during drilling;
- annular pressure monitoring; and
- regular walkovers of the drill path to check for visible evidence of breakouts.

4.3.32 The drilling fluid management plan will also include contingency measures for the eventuality that a breakout occurs, to include as a minimum.

- measures to limit the volume of the drilling fluid loss;
- measures to contain the lost drilling fluid;
- measures to remove the lost drilling fluid;
- measures to seal the area of the breakout; and
- measures to provide any remediation, if appropriate.

4.3.33 **Application Document 7.5.2 Offshore Construction Environmental Management Plan** describes that any fluids used for the drilling of the trenchless crossings will be biologically inert and selected from the OSPAR (the Convention for the Protection of the Marine Environment of the North-East Atlantic) List of Substances/Preparations Used and Discharged Offshore which are Considered to Pose Little or No Risk to the Environment (PLONOR).

4.3.34 Commitment GH10 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** requires the provision of a Frac-Out Management Plan to be undertaken at all locations where trenchless crossings are proposed, and therefore risks associated with the unplanned loss of drilling fluids are expected to be low.

4.4 Substation and converter station

Dewatering

4.4.1 Dewatering and discharge are not anticipated to be required at the substation and converter station location as the ground level is proposed to be raised at this location to allow for ground improvement and to facilitate a gravity surface water drainage system.

New Flow Pathways

4.4.2 Ground disturbance during construction could create new groundwater flow pathways, where permeable materials or flow routes are introduced through piling or through permeable backfill material, allowing movement of existing contamination or mixing of aquifers. As shown in **Application Document 6.3.3.5.A Appendix 3.5.A Preliminary Contamination Risk Assessment** a worst case low risk of contamination is anticipated within the Order Limits. Information obtained from the Mott Macdonald GQRA included in **Application Document 6.3.3.5.D Appendix 3.5.D Generic Quantitative Risk Assessment - Kent** indicates that there were no recorded exceedances of the assessment criteria for a commercial land use within the soils tested. However, the GQRA indicates that exceedances of some potential contaminants were recorded within the groundwater samples from across the site. Therefore, there is considered to be a very low risk of mobilising any existing contamination in soils, through ground

disturbance – but there is a moderate risk of mobilising existing contamination in the groundwater (through creation of new flow pathways). However, commitment GH02 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** requires the selection of appropriate piling techniques (to minimize the risk of the mixing of aquifers) and a Foundation Works Risk Assessment to be undertaken at all locations where piling is proposed, and therefore risks associated with creation of new flow/contamination pathways are expected to be very low.

Infiltration and recharge

4.4.3 Effects on infiltration and recharge of groundwater may arise if the permeability of the ground surfaces is changed. However, the project only requires small areas of new hard standing, and these would be designed to meet existing drainage standards as provided for in commitment W12 from **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice**. The small overall footprint of any new hard standing at the substation and converter station and commitment W12 means there is likely to be no significant change to infiltration and recharge, and very low risk to waterbodies supported by groundwater or to groundwater flow pathways.

4.5 Construction Compound within Source Protection Zone

4.5.1 During the design evolution it has become necessary to consider the placement of a temporary construction compound on an area that is within a groundwater source protection zone 1 (SPZ 1). The proposed location of the temporary compound is between the A256 and Sandwich Road, on the east side of Cliffsend and immediately to the south of the roundabout junction between the A256 and A299.

4.5.2 At the compound location, the published geology is indicated to comprise Head deposits overlying the Margate Chalk member (upper chalk).

4.5.3 The compound sits almost centrally within a groundwater SPZ 1, and through thematic meetings with the Environment Agency, it is understood that the abstraction that is protected by the SPZ 1 is currently inactive, but would abstract from the chalk aquifer if it were to be reactivated.

4.5.4 Historical boreholes (BGS) located in the area around the compound, and within the same extent of Head deposits – confirm the presence of up to 4 m of material described predominantly as clay and silt, with some sand, overlying the Chalk.

4.5.5 Temporary construction compounds are required throughout the route to facilitate construction activities. Proposed activities in the temporary construction compound include storage of all materials necessary for the works, site offices, parking and welfare facilities.

4.5.6 Typically, construction of the compound would involve stripping and storage of topsoil, placement of a geomembrane separation layer and geotextile reinforcement layer, followed by compacted stone and in some areas a bituminous surface layer.

4.5.7 It is acknowledged, through the thematic meeting discussions with the EA, that the proposed drainage for this temporary construction compound, and the requirements for storage of materials, is likely to be different from other compounds, due to the location of the compound within the SPZ 1. Therefore, the following list of commitments is considered to be embedded in the design;

- the conceptual ground model will be confirmed through intrusive ground investigation following detailed design;
- there will be no below ground storage of liquids/fuels/chemicals;
- there will be no water abstractions or discharges within this compound; and
- best available techniques will be followed for both construction and operation of this compound. This will include commitments such as using double skinned and/or bunded tanks, drip trays, spill kits etc.

4.5.8 On the basis of the conceptual ground model, the typical construction details and the commitments described above, it is considered that the risk to groundwater quality at this location, from activities related to the temporary construction compound, is low.

5. Conclusion

5.1 General

5.1.1 This Qualitative Groundwater Risk Assessment assesses the potential risks to groundwater levels, quality and flow, from the different elements of the Proposed Project including overhead line, open cut trenches, trenchless crossings, and the substation and converter stations.

5.1.2 For each element of the Proposed Project, the risk assessment assesses the potential risks relating to dewatering, creation of new flow pathways and connection of aquifers, and infiltration and recharge. In addition, preliminary assessments of the construction compound located within a SPZ 1, saline intrusion and unplanned loss of drilling fluids are included in the section on trenchless crossings.

5.2 Dewatering

5.2.1 The risk assessment has concluded that dewatering (requiring lowering of groundwater levels rather than incidental pumping out of surface water ingress into excavations) within the Kent Onshore Scheme is generally unlikely to be required for the overhead line, trenchless crossings, substation and converter station. Therefore, the anticipated risks from dewatering are considered to be negligible.

5.2.2 Dewatering is likely to be required in the open cut trenches, however this risk assessment has concluded that the risk to groundwater receptors is considered to be low.

5.2.3 However, if unexpected dewatering is found to be required (following detailed design) that wasn't anticipated and included in this assessment, a Hydrogeological Risk Assessment will be required to be undertaken. Commitment GH09 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** secures the requirement for Hydrogeological Risk Assessment.

5.2.4 A saline intrusion assessment has also been undertaken which assesses the potential risk of saline intrusion at the landfall location, from dewatering. The assessment concluded that there is a low risk of significant additional (to current natural processes) saline intrusion as a result of the Proposed Project, because dewatering is not anticipated.

5.2.5 However, if unexpected dewatering is found to be required (following detailed design) that wasn't anticipated and included in this assessment, a Hydrogeological Risk Assessment will be required to be undertaken, including an updated saline intrusion assessment. Commitment GH09 in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice** secures the requirement for Hydrogeological Risk Assessment.

5.3 New Flow Pathways

5.3.1 The risk assessment has concluded that at locations where piled foundations are likely to be required, and at locations of trenchless crossings, there is potential for connection

of different aquifer bodies. However, with the implementation of the commitments provided in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice,** the risk of mixing different aquifer bodies is anticipated to be very low.

5.3.2 The assessment has also concluded that with the implementation of the commitments provided in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice,** the risk to groundwater from mobilization of existing contamination and creation of new flow pathways is anticipated to be very low.

5.4 Infiltration and recharge

5.4.1 This risk assessment has concluded that the potential risks to infiltration and recharge of groundwater from the Proposed Project at the converter and substation site and in areas of overhead line is low.

5.5 Unplanned losses of drilling fluids

5.5.1 The risk assessment has concluded that the potential risks from unplanned losses of drilling fluids from the Proposed Project, following implementation of the commitments, such as GH01 and GH10, provided in **Application Document 7.5.3.1 CEMP Appendix A Code of Construction Practice**, the risk to groundwater is anticipated to be low.

5.6 Construction Compound within the Source Protection Zone

5.6.1 This risk assessment has concluded that the risk to groundwater quality at the proposed construction compound in the SPZ 1, from the activities proposed and following implementation of the proposed commitments, is low.

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