West Winch Housing Access Road

Environmental Statement Chapter 14: Appendix 1: Climate Resilience

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Glossary of Abbreviations and Defined Terms

Abbreviations

Abbreviation	Description
CCRA	Climate Change Risk Assessment
NPPF	National Planning Policy Framework
IEMA	Institute of Environmental Management and Assessment
DMRB	Design Manual for Roads and Bridges
ISO	International Organization for Standardization
UKCP18	UK Climate Projections 2018
UKHSA	UK Health Security Agency
CRI	Climate Risk Indicators
STARS	Sustainable Transport and Regeneration Scheme

Glossary

Term	Definition
Met Office heatwave	A UK heatwave threshold is met when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold. As per the Met Office, the threshold for the local area is 27°C.
RCP	Representative Concentration Pathway (emissions scenario). The numbers refer to the effect of increased emissions on the earth's energy balance by 2100 (RCP8.5 therefore means an additional 8.5 W/m^2 of radiative forcing due to greenhouse gases)

1 Introduction

1.1.1 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (**Ref: 14.1.1**) require: "A description of the likely significant effects of the project on climate (for example, the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change."

1.1.2 This appendix reports the outcome of the assessment of likely significant effects arising from the Proposed Scheme in terms of the vulnerability of the Proposed Scheme to climate change, i.e., the climate change resilience and adaptation assessment.

1.1.3 The appendix (and its associated figures and tables) is intended to be read as part of the wider Environmental Statement (ES).

2 Legislative framework, Policy and Guidance

2.1 Legislative Framework

2.1.1 The applicable legislative framework is summarised as follows:

- Climate Change Act 2008 (2050 Target Amendment) Order 2019 (**Ref: 14.1.2**): The Climate Change Act 2008 sets targets for reducing the UK's impacts on climate change and the need to prepare for its impacts. The Act requires a Climate Change Risk Assessment to be used to assess the risks from the impact of climate change to the UK. The first UK Climate Change Risk Assessment (CCRA) was presented to Parliament in an Evidence Report in 2012, with the second presented in 2017 and most recent third assessment in 2021. The aim of the Evidence Report is to assess the urgency of further action to tackle current and future risks, and realise opportunities, arising for the UK from climate change. The Act also requires the production of a

national adaptation plan for the UK Government to implement to be ready for the challenges of climate change.

- National Planning Policy Framework (2021) (**Ref: 14.1.3**): The National Planning Policy Framework (NPPF) 2021 sets out the Government's planning policies for England and how these are to be applied. Guidance relating to ways to minimise vulnerability and improve resilience to climate change impacts is mainly set out in Section 14 "Meeting the Challenge of Climate Change, Flooding and Coastal Change". Within paragraph 8, the document confirms that the purpose of the planning system is to contribute to the achievement of sustainable development, which includes economic, social and environmental dimensions.

Policy

2.1.2 The applicable policy documents are summarised as follows:

- Climate Change Adaptation policy information 2021 (**Ref: 14.1.4**): The policy paper lays emphasis on the role of climate adaptation to reduce negative consequences of climate change in the UK and gives a description of the initiatives by the UK government for building preparedness and improving resilience to climate change impacts. These include UK Climate Change Risk Assessment, National Adaptation Programme, Adaptation Reporting Power, UK Climate Projections 2018 and the UK Climate Resilience Programme.
- Borough Council of King's Lynn and West Norfolk Climate Change Policy (**Ref: 14.1.5**): In October 2020, the council adopted a Climate Change Policy. The policy aims to encourage all sectors in the district to adapt to the likely impacts of climate change in addition to their mitigation efforts. This would involve government measures that help to address the local impact of climate change and the development of plans and council projects that will improve adaptation on a district and council level.

- Norfolk County Council Climate Strategy (**Ref: 14.1.6**): Climate adaptation is one of the focus areas of the Climate Strategy which suggests building resilience across the local services provided by the council and adapting infrastructure through nature-based and engineering solutions.
- Sustainable Transport and Regeneration Scheme (STARS) (**Ref: 14.1.7**): Working with Borough Council of King's Lynn and West Norfolk, the STARS scheme of Norfolk County Council aims to:
  - Transform the historic Southgates area;
  - Improve the outdated gyratory road system;

2.1.3 The focus of STARS is to improve bus and active travel by making it more sustainable, thereby benefitting the environment and people's health. The scheme also seeks to reduce the dominance of traffic, particularly in the aforementioned areas.

Guidance

2.1.4 The following guidance documents have been used during the preparation of this chapter:

- Institute of Environmental Management and Assessment (IEMA) EIA Guide to Climate Change Resilience and Adaptation 2020 (**Ref: 14.1.8**): The guidance note sets out key procedural steps to integrate climate change resilience and adaptation into the EIA process. The climate resilience assessment methodology adopted for the Proposed Scheme is in line with the IEMA guidance.
- National Highways DMRB LA 114 Climate (**Ref: 14.1.9**): This document establishes the requirements for assessing and reporting the effects of climate on highways. Since this project is a highways scheme, the significance criteria assessment in Section 3 of LA 114 provides a useful methodology which has been adopted within this assessment.

- ISO 14091:2021 Adaptation to climate change - Guidelines on vulnerability, impacts and risk assessment (**Ref: 14.1.10**): This document suggests how to assess the risks associated with the potential impacts of climate change. It gives an understanding of vulnerability and how to develop a sound risk assessment taking into account both present and future climate change risks.

3 Consultation, Scope, Methodology and Significance Criteria

3.1 Consultation Undertaken to Date

3.1.1 No consultation has been required to inform the assessment of the resilience of the Proposed Scheme to climate change impacts.

Scope of the Assessment

3.1.2 The scope of this assessment has been established through a previously undertaken scoping process.

3.1.3 This section reiterates the evidence base for scoping out elements of the Proposed Scheme for further assessment at the ES stage.

Elements scoped out of the assessment

3.1.4 The elements shown in Table 3.1 are not considered to be affected significantly due to future changes in climate variables and have therefore not been considered within this assessment.

Table 3.1 – Elements scoped out of the assessment

Element scoped out	Justification
Construction phase Sea level rise; Storm surge and storm tide; Change in annual average precipitation; Change in annual average temperature; Solar radiation; Soil moisture; Runoff; Soil stability.	Assessed as low vulnerability at the scoping stage (Appendix 1.1).
Operation phase Solar radiation	Assessed as low vulnerability at the scoping stage (Appendix 1.1).

Elements scoped into the assessment

Construction Phase

3.1.5 The following elements are considered to have the potential to give rise to likely significant effects during construction of the Proposed Scheme and have, therefore, been considered within this assessment:

- drought;
- extreme precipitation events (including snow, hail);
- extreme temperature events; and
- gales and extreme wind events.

Operation Phase

3.1.6 The following elements are considered to have the potential to give rise to likely significant effects during operation of the Proposed Scheme and have, therefore, been considered within this assessment:

- sea level rise;
- storm surge and storm tide;

- change in annual average precipitation;
- drought;
- extreme precipitation events (including snow, hail);
- change in annual average temperature;
- extreme temperature events;
- gales and extreme wind events;
- soil moisture;
- runoff; and
- soil stability

Extent of the Study Area

3.1.7 The study area for the Climate Change Resilience assessment relates to the impact of climate change on the Proposed Scheme (rather than the impact of the Proposed Scheme on climate). As such, the study area for the Proposed Scheme is the land within the site boundary.

Method of Baseline Data Collation

Desk Study

3.1.8 The climate change resilience assessment is a desk-based assessment undertaken using climate data for current and future baselines.

3.1.9 The current baseline for the Climate Change Resilience Assessment is based on historic climate data obtained from the Met Office records (**Ref: 14.1.11**) for the closest meteorological weather station to the Proposed Scheme (Marham, approximately 13 km east from the Proposed Scheme) and the Met Office Regional Climate Profile for East England. Since the Proposed Scheme lies in the East Anglia district of the East England region, the Met Office climate data for East Anglia district has been used to inform the current baseline for the East England region for a more precise estimate. Key findings

from the State of the UK Climate Report (**Ref: 14.1.12**) have also been included.

3.1.10 For future baseline, the UKCP18 (**Ref: 14.1.13**) projections have been used to analyse future changes in a range of climate variables that may affect the resilience of the Proposed Scheme to climate change. The Climate Risk Indicators (CRI) (**Ref: 14.1.14**), developed as part of the UK Climate Resilience Programme, have been used to inform this assessment. The CRI utilises the UKCP18 projections and allows for a range of climate related indicators to be assessed. The CRI data for the local authority of King's Lynn and West Norfolk has been used to inform this assessment.

Site Visit and Surveys

3.1.11 No site survey has been undertaken in relation to the Climate Change Resilience assessment for the Proposed Scheme. All data has been collected through desk-based study.

Assessment Methodology

3.1.12 The Climate Change Resilience assessment at the ES stage has been undertaken using an approach based on the IEMA guidance (**Ref: 14.1.8**), DMRB LA 114 (**Ref: 14.1.9**) and professional judgement.

3.1.13 Th assessment considers the climate trends for the 2030s (2020-2049), the 2050s (2040-2069) and 2080s (2070-2099). The 2030 time slice is considered appropriate to assess the construction phase (due to commence in 2025 for a period of 2 years). The 2050s and 2080s time slices are considered appropriate to the operational phase which has a design life of 60 years. Climate projections do not currently extend beyond 2099.

Significance Criteria

3.1.14 The significance level attributed to each effect has been assessed based on the 'likelihood' of the event to occur and the 'consequence' of its potential impact on the Proposed Scheme. Likelihood and consequence have been qualitatively assessed using the descriptions in Table 3.2 and Table 3.3,

sourced from DMRB LA114 (**Ref: 14.1.9**) and have been refined to align with the context of the Proposed Scheme.

3.1.15 'Likelihood' is an indication of how frequently a climate related event (hazard) occurs during the lifetime of the Proposed Scheme; it is determined as per the definitions in Table 3.2. The definitions for the description of likelihood are as per the DMRB LA114 methodology (**Ref: 14.1.9**) but have been refined to align with the context of the Proposed Scheme. Likelihood is a function of climate projections over the lifespan of the Proposed Scheme and the frequency of the climatic event in relation to the asset's design life.

Table 3.2 – Likelihood definitions

Measure of Likelihood	**Description**
Very high	The event occurs multiple times during the lifetime of the project; e.g., approximately annually.
High	The event occurs several times during the lifetime of the project; e.g., approximately once every five years.
Medium	The event occurs limited times during the lifetime of the project; e.g., approximately once every 15 years.
Low	The event occurs occasionally during the lifetime of the project; e.g., once in 60 years.
Very low	The event may occur once during the lifetime of the project.

3.1.16 'Consequence' is an indication of the severity of the effect or impact. It is determined by the extent to which an asset is resilient to the potential impacts of climate change and takes into account the embedded risk mitigation measures. Table 3.3 describes the criteria for measurement of consequence for a scheme. The definitions for the description of consequence are as per the DMRB LA 114 methodology (**Ref: 14.1.9**) but have been amended to align with the scale and nature of the Proposed Scheme.

Table 3.3 – Consequence definitions

Measure of Consequence	Description
Negligible	No infrastructure damage, minimal adverse effects on health, safety and the environment or financial loss. Little change to service and disruption lasting less than one day.
Minor adverse	Localised infrastructure disruption or loss of service. No permanent damage, minor restoration work required: disruption lasting less than 1 day. Small financial losses and/or slight adverse health or environmental effects.
Moderate adverse	Limited infrastructure damage and loss of service with damage recoverable by maintenance or minor repair. Disruption lasting more than 1 day but less than 1 week. Moderate financial losses. Adverse effects on health and/or the environment.
Large adverse	Extensive infrastructure damage and severe loss of service. Disruption lasting more than 1 week. Early renewal of infrastructure 50-90%. Permanent physical injuries and/or fatalities. Major financial loss. Significant effect on the environment, requiring remediation.
Very large adverse	Permanent damage and complete loss of service. Disruption lasting more than 1 week. Early renewal of infrastructure >90%. Severe health effects and/or fatalities. Extreme financial loss. Very significant loss to the environment requiring remediation and restoration.

3.1.17 The likelihood and consequence have been combined to assess the significance of effects on receptors, as shown in Table 3.4. The assessment is qualitative and based on expert judgment from knowledge of similar schemes, engagement with the wider project team and a review of relevant literature.

Table 3.4 – Significance rating matrix

Likelihood / Consequence rating	Negligible consequence	Minor adverse consequence	Moderate adverse consequence	Large adverse consequence	Very large adverse consequence
Very high likelihood	Not significant	Significant	Significant	Significant	Significant
High likelihood	Not significant	Significant	Significant	Significant	Significant
Medium likelihood	Not significant	Not significant	Significant	Significant	Significant
Low likelihood	Not significant	Not significant	Not significant	Significant	Significant
Very low likelihood	Not significant	Not significant	Not significant	Not significant	Significant

4 Baseline Conditions

4.1.1 To align with the requirements of EIA Regulations 2017 (**Ref: 14.1.1**), and the Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation from IEMA (**Ref: 14.1.8**), the Climate Change Resilience Assessment has been undertaken to consider the resilience of the Proposed Scheme to climate change.

4.1.2 The IEMA EIA Guide to Climate Change Resilience and Adaptation (**Ref: 14.1.8**) identifies the need for the baseline to consider:

- The current climate baseline (defined by historic climate conditions) to provide an indication of past vulnerability; and
- The future climate baseline (short term extremes and long-term variation) to assess a project's vulnerability to climate change.

4.2 Current baseline

4.2.1 This section includes the climate trends over the past three decades (1991-2020) for temperature, precipitation (rain and snow), wind and storms, humidity and solar radiation, thus providing an understanding of how recent climate trends have impacted the location of the Proposed Scheme. This is presented for both the UK national context as well as the local climate, as represented by Marham weather station (approximately 13 km east from the Proposed Scheme).

UK Context

4.2.2 According to the latest State of the UK Climate Report **(Ref: 14.1.12),** the UK's climate is changing, with recent decades being warmer, wetter and sunnier than the 20th century. The Report highlights that the UK has warmed at a broadly consistent (but slightly higher) rate than the observed change in global mean temperature. The key findings from the latest 2022 report are:

- All the top ten warmest years for the UK in the series from 1884 have occurred this century.
- The most recent decade (2013–2022) has been on average 0.3°C warmer than the 1991–2020 average and 1.1°C warmer than 1961–1990.
- The most recent decade (2013–2022) had 4% and 7% fewer days of both air and ground frost, respectively, compared to the 1991–2020 average, and 15% and 18% fewer compared to 1961–1990.
- The most recent decade (2013–2022) had 3% fewer heating degree days per year on average compared to 1991–2020, and 12% fewer compared to 1961–1990.
- Five of the ten wettest years for the UK since 1836 have occurred this century.
- For the most recent decade (2013–2022), UK winters have been on average 10% wetter than 1991–2020 and 25% wetter than 1961–1990.
- Widespread and substantial snow events have occurred in 2021, 2018, 2013, 2010 and 2009, but their number and severity have generally declined since the 1960s.
- For the most recent decade (2013–2022) UK winters have been 3% sunnier than 1991–2020 and 14% sunnier than 1961–1990. UK springs have been 6% / 16% sunnier.
- The UK annual mean wind speed from 1969 to 2022 shows a downward trend, consistent with that observed globally. However, this series must be interpreted with some caution. Changes in instrument type, station network size, station exposure, and choice of metric used mean that interpreting trends in storminess from UK wind speed data is not straightforward due to the limitations of available data.

Local Context

Precipitation – Rainfall

4.2.3 Average seasonal rainfall for Marham weather station, East England, and for the UK, for the period 1991-2020, is presented in Table 4.1 (**Ref: 14.1.11**). It shows that the average rainfall for the weather station is more than that for East England, but less than that for the UK for both summers and winters.

Table 4.1 – Long-term average cumulative seasonal rainfall (mm) (1991-2020) for Marham, East England, and the UK

Season	Marham	East England	UK
Summer (June, July, August)	182.3 mm	166.5 mm	253.4 mm
Winter (December, January, February)	157.7 mm	154.9 mm	344.9 mm

4.2.4 A recent, notable extreme rainfall event in Norfolk was in August 2020, when over 150mm rainfall in four hours was measured. This was accompanied by a major thunderstorm and ranked amongst the highest historic extreme rainfalls in the UK **(Ref: 14.1.15)**.

Precipitation – Snow and Ice

4.2.5 Snowfall is closely linked with temperature, with falls rarely occurring if the temperature is higher than 4°C. For snow to lie for any length of time, the temperature normally has to be less than this (**Ref: 14.1.16**). The average number of days with snow lying on ground for Marham weather station over the baseline (1991-2020) is 5 to 10 days per year (**Ref: 14.1.11).** This is relatively lower as compared to the East England region for which the average number of days with snow lying ranges from 6 to 15 days per year (**Ref: 14.1.16**).

4.2.6 In February 2012, heavy snowfall occurred in Norfolk with temperatures reaching -4°C. The Met Office issued a warning for icy patches on untreated roads causing travel disruption (**Ref: 14.1.17**).

Temperature

4.2.7 In East England, temperature shows both seasonal and diurnal variations with January and February being the coldest months. Table 4.2 shows the long-term average seasonal mean temperature for Marham, East England, and the UK between 1991–2020 (**Ref: 14.1.11**). The average temperature at Marham weather station is slightly lower than East England but higher than the UK, for both summers and winters.

Table 4.2 – Long-term average mean seasonal temperature (°C) (1991–2020) for Marham, East England, and the UK

Season	Marham	East England	UK
Summer (June, July, August)	16.6°C	16.7°C	14.6 °C
Winter (December, January. February)	4.4°C	4.8°C	4.1 °C

4.2.8 Just as extreme cold can impact daily life, as identified in paragraph 14.1.4.8 extreme heat can also have negative consequences. In 2022, Norfolk witnessed the devastating impact of extreme heat and wildfires. Twenty homes were destroyed, and the countryside, natural landscapes and wildlife were harmed (**Ref: 14.1.18**). In June 2023, temperatures reached over 30°C in Norfolk. The UK Health and Security Agency (UKHSA) issued a 'yellow alert' heat health warning, thereby pointing to the need to protect the vulnerable population that could be impacted by the rising temperatures (**Ref: 14.1.19**).

4.2.9 Average seasonal sunshine hours at Marham weather station, East England, and the UK for the period 1991-2020 is presented in Table 4.3 (**Ref: 14.1.11**). The table shows that the weather station receives greater sunshine hours than the UK average but lesser than that of the East England region.

Table 4.3 – Long-term average seasonal sunshine (hours) (1991–2020) for Marham, East England, and the UK

Season	Marham	East England	UK
Summer (June, July, August)	597 hours	598 hours	507 hours
Winter (December, January. February)	187 hours	194 hours	162 hours

Wind

4.2.10 Eastern England is one of the more sheltered parts of the UK, since the windiest areas are to the north and west, closer to the track of Atlantic storms. In general, the strongest winds are associated with the passage of deep depressions across or close to the UK. The frequency and strength of these depressions is greatest in the winter half of the year, especially from December to February, and this is when mean speeds and gusts (short duration peak values) are strongest (**Ref: 14.1.16**).

4.2.11 Table 4.4 shows the mean seasonal wind speed at Marham weather station, and for East England and the UK (**Ref: 14.1.11**).

Table 4.4 – Long-term average mean seasonal wind speed at 10 m (knots) (1991–2020) for Marham, East England, and the UK

Season	Marham	East England	UK
Summer (June, July, August)	8.1 mph	7.2 mph	8.0 mph
Winter (December, January. February)	10 mph	9.0 mph	10.5 mph

4.2.12 In January 2018, more than 4,000 homes were left without power in Norfolk after severe gales blasted East England. Gusts of up to 83mph (134km/h) saw trees blown over, causing problems for motorists and disrupting rail services. Wind damage led to the closure of 29 schools across the county (**Ref: 14.1.20**).

Humidity

4.2.13 The relative annual average humidity in the Proposed Scheme location is 80-82% (**Ref: 14.1.11**).

Sea Level Rise and Flooding

4.2.14 The Proposed Scheme site is located approximately 11 km from the seacoast and around 1.3 miles from the River Great Ouse. Figure 4.1 shows the extent of flooding from rivers or the sea for the Proposed Scheme location (**Ref: 14.1.21**). The Proposed Scheme does not lie in a flood prone area and hence, at present, is not at risk from coastal or fluvial flooding.

Figure 4.1 – Flood risk from sea level rise for the proposed scheme

4.2.15 Figure 4.2 shows the flood risk from surface water for the Proposed Scheme location (**Ref: 14.1.21**). The Proposed Scheme, at present, does not lie in an area at risk from flooding due to surface runoff (pluvial flooding).

Figure 4.2– Flood risk from surface water runoff for the proposed scheme

4.2.16 The Proposed Scheme site is not shown to be at risk from coastal flooding in the EA mapping or local Preliminary or Strategic Flood Risk Assessments.

Soil moisture and stability

4.2.17 The topsoil moisture, considering 0-15cm soil depth, has been estimated to be 30-35% for the Proposed Scheme location. The soil type falls in the category of acidic, base-rich sandy and loamy soil (**Ref: 14.1.22**).

Future baseline

4.2.18 In alignment with paragraph 14.1.3.2, the future climate has been presented using the CRI tool (**Ref: 14.1.14**), for the 2030s (2020-2049), the 2050s (2040-2069) and 2080s (2070-2099) to identify the anticipated climate conditions. These projections are provided against the model reference period of 1981-2010 and the current baseline of 1991-2020 (**Ref: 14.1.11**) as an indication of change from the reference period.

4.2.19 Climate change is projected to lead to warmer wetter winters and hotter drier summers, with an increase in the intensity and frequency of extreme events such as heatwaves, drought, extreme rainfall leading to flash flooding, storms

and wind events. The information presented in this section illustrates how the climate may evolve at the site of the Proposed Scheme by the end of the century.

Temperature and rainfall

4.2.20 Table 4.5 provides temperature, rainfall and other heat and water related climate indicators for the Proposed Scheme for the model reference (1981-2010), current baseline (1991-2020) and future climate (2030s, 2050s and 2080s). The table shows the 50th (10th to 90th) percentile values for RCP8.5 (anomalies and absolute values). Key terminologies used in Table 4.5 have been defined below:

- Met office heatwave: A UK heatwave threshold is met when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold. As per the Met Office, the threshold for the local area is 27°C.
- Road accident risk: Days with minimum temperature below 0°C.
- Road melt risk: Days with maximum temperature above 25°C.
- Heat stress: Days with shade Wet Bulb Globe Temperature (WBGT) above 25°C.
- Wildfire events: Days with Met Office Wildfire Index at the Very High Fire Severity level or above.
- Soil moisture: Potential soil moisture deficit measured by the maximum difference between accumulated rainfall and potential evaporation.

Table 4.5 - Temperature, rainfall and other climate indicators for the Model Reference (1981-2010), current (1991-2020) and future climate (2030s, 2050s and 2080s) for RCP8.5 (anomalies or absolute values) showing the 50th (10th to 90th) percentile values (Ref: 14.1.11) (Ref: 14.1.14)

Climate variable	Projection type	Model reference (1981-2010)	Current baseline (1991-2020)	RCP8.5 2030s	RCP8.5 2050s	RCP8.5 2080s
Average summer temperature	Anomalies	16.3°C	16.7°C	+1.4 (+0.6 to +2.1)°C	+1.9 (+0.9 to +2.9)°C	4.6 (+2.4 to +7.0)°C
Average winter temperature	Anomalies	4.0°C	4.8°C	+1 (+0.1 to +1.9)°C	+1.7 (+0.7 to +2.8)°C	+3 (+1.4 to +4.9)°C
Min winter temperature	Anomalies	0.8°C	1.2°C	+0.9 (+0.02 to +1.9)°C	+1.7 (+0.5 to +3)°C	+3 (+1.1 to +5.2)°C
Max summer temperature	Anomalies	21.2°C	21.6°C	+1.5 (+0.6 to +2.5)°C	+2.7 (+1.05 to +4.5)°C	+5.2 (+2.2 to +8.4)°C
Average summer rainfall	Anomalies	170.1 mm	182.3 mm	-9.4 (-24.1 to +5.2)%	-18.9 (-36.5 to +0.04)%	-29.6 (-50.8 to -5.8)%
Average winter rainfall	Anomalies	148.1 mm	157.7 mm	+4.2 (-1.6 to +10.4)%	+8.5 (-0.4 to +18.4)%	+16.1 (+2.9 to 31.1)%
Met office heatwave (events per year)	Absolute values	0.8	0.9	+1.8 (+1.2 to +2.6)	+2.9 (+1.6 to +4.4)	+4.7 (+2.9 to +6.3)
Road accident risk (days per year)	Absolute values	48.7	46.5	+35.2 (+27 to +44.2)	+26.9 (+18.7 to +37.5)	+16.4 (+8.7 to +29.1)
Road melt risk (days per year)	Absolute values	16.5	18.0	+27.4 (+20.9 to +35.8)	+39.4 (+25.3 to +56.7)	+66.4 (+39.2 to +96.4)
Heat stress (days per year)	Absolute values	0.1	0.2	+0.8 (+0.3 to +1.8)	+2.6 (+0.7 to +6.4)	+9.7 (+2.8 to +24.8)
Wildfire events (days per year)	Absolute values	29.4	32.3	41.4 (29.7 to 56.5)	52.6 (32.9 to 77.4)	74.6 (42 to 107.9)
Soil Moisture (% change)	Anomalies	30-35	31-36	-5.9 (-10.9 to 1.3)	-8 (-14.6 to -1.2)	-10.8 (-16 to -3.3)
SPEI (proportion of time)	Absolute values	0.06	0.07	0.13 (0.07 to 0.22)	0.21 (0.09 to 0.33)	0.32 (0.14 to 0.44)

Snow

4.2.21 With regards to future changes, rising winter temperatures are likely to reduce the amount of precipitation that falls as snow in winter. Snowfall data is unavailable for the probabilistic projections (25km), however both the regional (12km) and the local (2.2km) show a decrease in both falling and lying snow across the UK for the period of 2061-2080 relative to the 1981-2000 baseline (**Ref: 14.1.13**).

Humidity

4.2.22 Table 4.6 provides the projected percentage change in relative humidity for the Proposed Scheme during the summer and winter months, shown as the 50th (10th to 90th) percentile values (**Ref: 14.1.13**).

Table 4.6 – Projections for relative humidity (percentage change anomaly) at 1.5m for the proposed scheme

Season	2030s	2050s
Summer (June, July, August)	-1.31 (-5.66 to 2.34)%	-2.39 (-6.94 to +1.52)%
Winter (December, January, February)	-0.22 (-2.1 to +1.84)%	-0.24 (-2.22 to +1.79)%

Wind

4.2.23 UKCP18 depicts a wide spread of future changes in mean surface wind speed, however, there is large uncertainty in projected changes in circulation over the UK and natural climate variability contributes to much of this uncertainty. It is therefore difficult to represent regional extreme winds and gusts within regional climate models.

4.2.24 Central estimates of change in mean wind speed for the 2050s are small in all ensembles runs (<0.2ms^{-1}). A wind speed of 0.2ms^{-1} (approximately 0.4 knots) is small compared with the typical magnitude of summer mean wind speed of about 3.6–5.1ms^{-1} (7 – 10 knots) over much of England. Seasonal changes at individual locations across the UK lie within the range of –15% to +10% (**Ref: 14.1.23**).

4.2.25 In terms of storms, the analysis presented is a summary of expected changes in storm patterns under a changing climate. A storm is defined by the Met Office as a wind event measuring 10 or higher on the Beaufort scale (equivalent to a wind speed of 24.5m/s or 55mph).

4.2.26 Studies **(Ref 14.1.24)** relating to future projections of storms suggest that climate driven storm changes are less distinct in the northern than southern hemisphere. However, such is the wide range of inter-model variation, robust projections of changes in storm track are not yet possible and there is low confidence in the direction of future changes in the frequency, duration or intensity of storms affecting the UK.

Sea level rise

4.2.27 The Proposed Scheme is located approximately 11 km from the seacoast and around 1.3 miles from the River Great Ouse. Sea level projections at the closest marine projections data point (Figure 4.3), range from 0.16m in the 2030s to 0.58m in the 2080s, considering the median values. Table 4.7 below depicts the projected sea level rise for the 2030s, 2050s and 2080s using UKCP18 marine projections data.

Figure 4.3 – Coastal location (grid) selected for marine projections for the proposed scheme

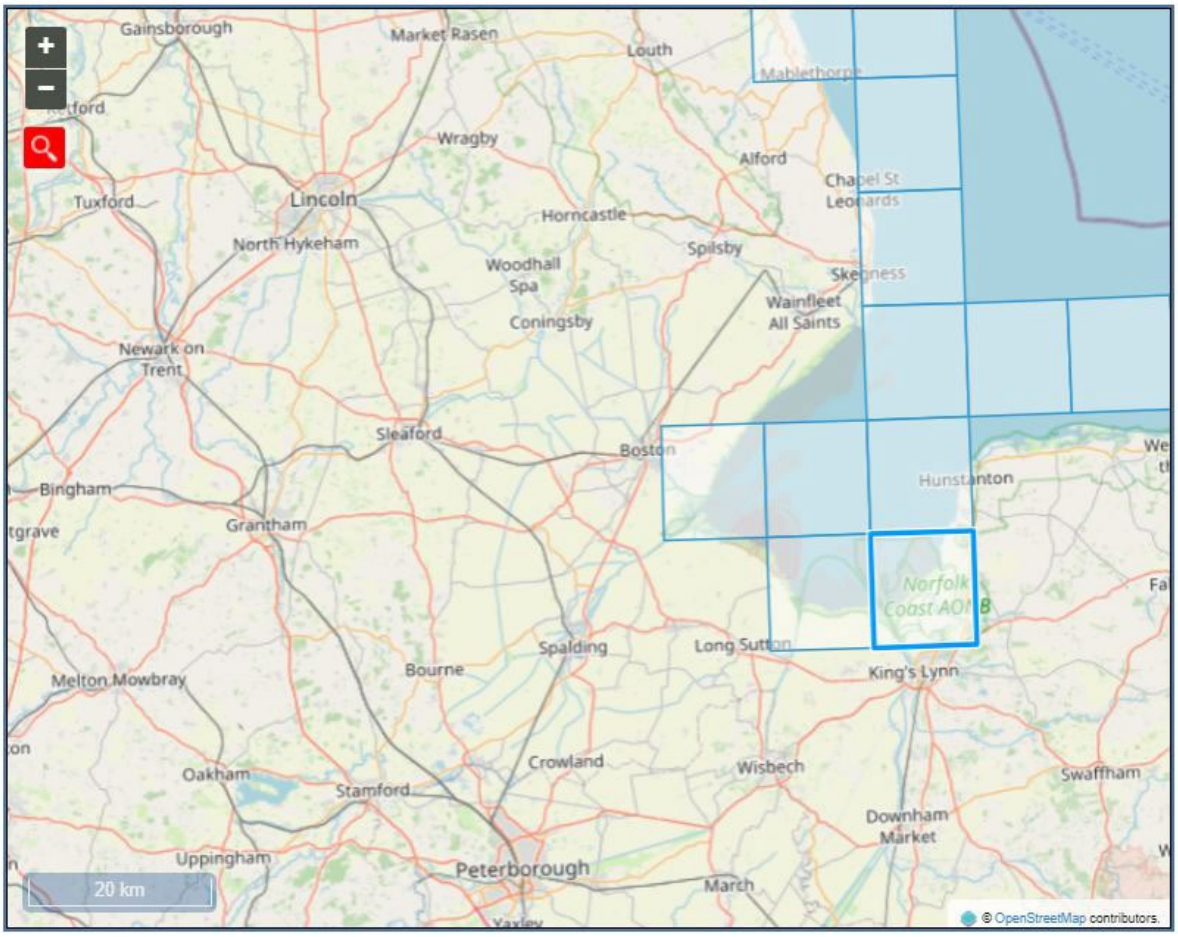

Table 4.7 - Sea level rise projections (m) presented as 50th percentile (10th percentile to 90th percentile) for the Proposed Scheme (Ref: 14.1.11)

2030s	2050s	2080s
0.16 (0.13 to 0.2) m	0.3 (0.24 to 0.38) m	0.58 (0.44 to 0.75) m

4.2.28 Due to the distance of the Proposed Scheme from the coastline and flood risk being low for the location (Sections 4.2.14 and 4.2.15), it is anticipated that storm surge is unlikely to affect the Proposed Scheme.

Soil moisture and stability

4.2.29 Based on UKCP18 climate projects, the change in susceptibility of shrink-swell and the associated changes in soil moisture are likely to be 'improbable'

during the 2030s and 'possible' during the 2070s for the Proposed Scheme (**Ref: 14.1.25**).

4.3 Design and Embedded Best Practice Mitigation Measures

4.3.1 The assessment of effects takes into account confirmed measures and mitigation embedded in the Proposed Scheme's design, as provided by the design team and topic specialists. Although such measures are based on the preliminary design, it is assumed that these will be fully implemented as part of the detailed design or as part of reserved matters applications.

4.3.2 To reduce the risk of climate change during construction, a CEMP will be undertaken. This CEMP will consider the following measures to enhance resilience during this stage.

- Ensure site and compound drainage infrastructure has sufficient capacity to withstand extreme rainfall events.
- Ensure that site drainage and any access roads used during construction are monitored during periods of heavy rainfall.
- Ensure appropriate traffic management measures are put in place to avoid areas of potential flooding.
- Cover or fence stockpiles to prevent wind whipping, screen or fully enclose activities which have high potential for dust production, remove potential dust producing materials from site as soon as practicable.
- Cover materials piles with waterproofing and where possible, store outside areas at high risk of flooding.
- Ensure emergency response procedures are active on site to, in the event of flooding, minimise disruption and damage.
- Ensure there is a process for the monitoring of weather and issuing weather warnings to staff where appropriate.

- Ensure emergency response procedures are active on site to, in the event of snow and ice, ensure that roads and surfaces are gritted and cleared of snow.
- Ensure welfare facilities are in place and sufficiently cooled.
- Periodic rest breaks to be taken during the hottest part of the day.
- Provide shade for workers in exposed areas.
- Ensure workers use personal protective equipment to reduce exposure to UV radiation – light coloured, long-sleeved clothing, sun cream, sun hats. Similarly, for extremely low temperatures during winters, provision of insulated clothing including gloves, caps, jackets, boots, etc. to the construction personnel is necessary.
- Reviewing wind speed before commencing any work at height and ceasing work at height during storms.
- Ensure all temporary infrastructure such as lighting and fencing are secured.

4.3.3 Table 4.8 sets out the design and embedded best practice mitigation measures that address climate risks in the operation phase of the Proposed Scheme.

Table 4.8 – Embedded mitigation measures against climate change for the proposed scheme

Climate hazard	Climate variable	Embedded mitigation	Evidence of commitment
Precipitation	Change in annual average precipitation; Extreme precipitation events; Runoff	• Emergency response procedures on site to, in the event of flooding, minimise disruption and damage; • Traffic management measures are put in place avoiding areas of potential flooding; • Appropriate choice of materials to be considered at detailed design stage.	Traffic and transport Planning
Precipitation	Change in annual average precipitation; Extreme precipitation events; Runoff	• The drainage system is to be designed to attenuate for all storm events up to and including the 1 in 100-year return period event with an additional 40% allowance for climate change in line with EA and Lead Local Flood Authority guidelines; • Conveyance systems are to be designed not to flood in the 1 in 30-year event plus 40% climate change, with any exceedance being directed away from the proposed road, dwellings or any areas of congregation.	Flood Risk Assessment
Precipitation	Change in annual average precipitation; Drought; Extreme precipitation events; Snow, lightning, hail; Runoff	• Planting to include drought tolerant/moisture tolerant species; • Landscaping will take into account the local variations in topography and hydrology; • A landscape maintenance strategy produced by the contractor will cater to adequate maintenance of plants against changes in weather patterns.	This is reflected in the location of planting within the Landscape Design drawings and Specification.
Precipitation	Change in annual average precipitation; Drought; Extreme precipitation events; Snow, lightning, hail; Runoff	• Detailed design to consider flood levels (post flood mitigation design); • Potential effects of groundwater level changes to be considered as part of cutting slope analysis along with close collaboration with drainage team; • For both cutting and embankment slopes, consideration to be given to the effects of precipitation and potential for an increase Ru value. Ru is the pore pressure ratio which is used as a parameter to represent the pore water pressure condition in assessing slope stability; • Road pavements to be designed as per the equilibrium/long term modulus values, taking into account the groundwater levels and how these may change over the design life.	Geotechnical Design Report

Climate hazard	Climate variable	Embedded mitigation	Evidence of commitment
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, lightning, hail; Runoff	• Equipment will be suitably weatherproofed so as to ensure that coatings on columns are suitable for resisting extremes of rain, and column doors will be suitably waterproofed to ensure that sustained periods of rain do not damage the equipment; • CMS to be used wherever possible to continuously monitor the condition of equipment and determine if it has been affected by climate change.	Detailed design and specifications
Temperature	Change in annual average temperature; Extreme temperature events	• Planting to include scorching/drought tolerant species; • A landscape maintenance strategy produced by the contractor will cater to adequate maintenance of plants against changes in weather patterns.	Landscape Design drawings and Specification
Temperature	Change in annual average temperature; Extreme temperature events	• Tactile paving surfaces to be used at pedestrian crossings to support end user safety during icy/slippery conditions; • Appropriate choice of materials to be considered at detailed design stage.	Traffic and transport planning
Temperature	Change in annual average temperature; Extreme temperature events	• LED luminaires with wide temperature tolerances will be specified, to be able to handle increases and decreases in temperature; • Equipment will be suitably weatherproofed so as to ensure that coatings on columns are suitable for resisting extremes of heat, and column doors will be suitably protected to ensure that sustained periods of heat do not damage the equipment; • CMS to be used wherever possible to continuously monitor the condition of equipment and determine if it has been affected by climate change.	Detailed design and specifications
Wind	Gales and extreme wind events	• Trees will be suitably staked/supported until they are well established.	Landscape Design drawings and Specification
Wind	Gales and extreme wind events	• A regular maintenance regime will be deployed as outlined in the SuDS Management and Maintenance plan as required by the CEMP to ensure the continued efficiency operation of SuDS devices.	Flood Risk Assessment (FRA) / Sustainable urban Drainage Systems (SuDS) Maintenance and Management Schedule
Wind	Gales and extreme wind events	• Wind load information to be considered for the structure.	Geotech and Structures
Wind	Gales and extreme wind events	• ‘Self-cleaning’ luminaires to be used where possible, avoiding luminaires where debris can be caught on the top surface of the luminaire.	Detailed design and specifications

Climate hazard	Climate variable	Embedded mitigation	Evidence of commitment
Soil texture	Soil moisture/stability	• Detailed design to consider the potential effects on piezometric level and the potential for erosion of embankments; • Road pavements and drainage to be designed to be flexible to cope with shrink-swell of cohesive subgrades; • Detailed design to consider the potential for desiccation of clay soils and the potential for this to affect infiltration into the slopes. Dependent on geotechnical investigation and foundation design approach, the effects of future changes in piezometric level in pile design to be considered at detailed design stage; • Suitable compaction soils to be placed as part of earthworks (or suitable treatment of existing soils) to minimize the risk of inundation or collapse settlements.	Geotechnical Design Report

5 Sensitive receptors

5.1.1 The scope of the assessment includes the construction period and design life of the key components of the Proposed Scheme as follows:

- Construction phase will span over a period of 2 years, starting from 2025 and is expected to end in 2027. Sensitive receptors in the construction phase include:
  - construction compounds and working areas; and
  - construction workers.
- Operation period is expected to be around 60 years. Sensitive receptors in the operation phase include:
  - road and junctions (including footway/cycleway);
  - landscaping;
  - drainage infrastructure;
  - earthwork and foundation;
  - street furniture and lighting; and
  - end users.

6 Assessment of Potential Effects, Mitigation and Residual Effects

6.1.1 Future climate change is likely to result in potential effects on the Proposed Scheme components, particularly the sensitive receptors.

6.1.2 Table 6.1 presents the assessment of significance of effects by considering the consequence and the likelihood of the potential effects of climate change during the construction phase of the Proposed Scheme, taking into account the embedded mitigation measures detailed in Table 4.8.

Table 6.1 – Assessment of significance of effects from climate change during the construction and operation phase of the proposed scheme

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Construction Construction compounds and working areas	Flooding of construction compound and working areas due to extreme precipitation events.	Low	Moderate adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Construction Construction compounds and working areas	Damage to equipment and materials from heavy rains.	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Construction Construction compounds and working areas	Delays to the construction process due to prolonged rainfall.	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Drought	Construction Construction workers	Increase in dust during periods of low rainfall.	Low	Negligible	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Operation Road and junctions (including cycleway/footway)	Deterioration and formation of cracks in roads and pavements from extreme precipitation.	Medium	Minor adverse	Not significant

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Operation Road and junctions (including cycleway/footway)	Damage or formation of potholes from freeze-thaw action.	Low	Moderate adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Operation Drainage infrastructure	Prolonged dry periods may lead to drying out and cracking of earthworks and soils, subsidence and greater amounts of dust which can have an impact on drainage infrastructure.	Low	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Operation Drainage infrastructure	Existing drainage infrastructure overwhelmed leading to surface water flooding and siltation.	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Operation Drainage infrastructure	Lifespan reduction of concrete drainage pipes due to increased runoff flow.	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Snow, hail; Runoff	Operation Earthwork and foundation	Undermining of foundations and infrastructure through the washout of soil particles by flowing water (derived from both fluvial and pluvial processes)	Medium	Minor adverse	Not significant

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Precipitation	Change in annual average precipitation; Drought	Operation Earthwork and foundation	Desiccation and crack formation during drought periods, which can allow increased percolation from subsequent rainfall.	Low	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Runoff	Operation Earthwork and foundation	Wetter winters and extreme rain events may destabilise exposed soils, impact slope stability and increased soil erosion or subsidence of exposed earthworks / slopes.	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Drought Extreme precipitation events; Runoff	Operation Landscaping	Damage to / loss of planted landscaping and habitat (from flooding or from drought conditions).	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Runoff	Operation Street furniture and lighting	Faults in lighting equipment from increased rainfall intensity.	Medium	Minor adverse	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Runoff	Operation Street furniture and lighting	Colour fading or damage to the finish or protective coating on furniture from heavy rain.	Medium	Negligible	Not significant
Precipitation	Change in annual average precipitation; Extreme precipitation events; Runoff	Operation End users	Access routes for end users may be impeded by flooding.	Medium	Minor adverse	Not significant
Precipitation	Snow, hail	Operation End users	Loss of traction, skidding and collisions due to snow.	Low	Moderate adverse	Not significant

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Precipitation	Snow, hail	Operation End users	Damage to road surface due to melting snow causing vehicles to be driven at lower speeds.	Low	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Construction Construction compounds and working areas.	Deformation and melting of materials.	Low	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Construction Construction compounds and working areas.	Overheating of machinery.	Low	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Construction Construction compounds and working areas.	Failure or disruption of plant and equipment.	Low	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Construction Construction workers	Unsafe working conditions (heatstroke, UV levels).	Low	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Construction Construction compounds and working areas; Construction workers.	Delays to the construction process.	Low	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation Road and junctions (including cycleway/footway)	Expansion of materials resulting in damage or increased fatigue, structural integrity loss and increased maintenance.	Medium	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation Road and junctions (including cycleway/footway)	Melting and deformation of roads from extreme temperatures resulting in damage.	Medium	Minor adverse	Not significant

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Temperature	Change in annual average temperature; Extreme temperature events	Operation Road and junctions (including cycleway/footway)	Extreme cold events can cause slippery surfaces and deterioration of road surfaces (from freeze-thaw action).	Low	Moderate adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation Landscaping	Damage to / loss of planted landscaping and habitat from extreme temperatures.	Medium	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation Landscaping	Longer growing season, more vigorous vegetation growth in spring and autumn resulting in increased maintenance.	Medium	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation Street furniture and lighting	Colour fading or damage to the finish or protective coating on furniture.	Medium	Negligible	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation Street furniture and lighting	Damage to lighting equipment from extreme heat.	Medium	Minor adverse	Not significant
Temperature	Change in annual average temperature; Extreme temperature events	Operation End users	Risk of heat exhaustion / heat stroke to end users.	Medium	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Construction Construction workers	Unsafe working conditions.	Low	Moderate adverse	Not significant
Wind	Gales and extreme wind events.	Construction Construction workers	Increase in dust.	Low	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Construction Construction compounds and working areas	Damage to plant and equipment.	Low	Minor adverse	Not significant

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Wind	Gales and extreme wind events.	Construction Construction compounds and working areas; Construction workers	Delays to the construction process.	Low	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Operation Road and junctions (including cycleway/footway)	High winds reduce roadway capacity by obstructing lanes or roads with drifting snow and wind-blown debris, such as tree limbs.	Medium	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Operation Landscaping	Damage to plants and trees from winds and storms.	Medium	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Operation Street furniture and lighting	High winds may damage furniture and lighting.	Medium	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Operation End users	Uprooted trees from high wind and storms pose a risk to end users and can cause access issues.	Medium	Minor adverse	Not significant
Wind	Gales and extreme wind events.	Operation End users	Wind-blown snow, dust and smoke can impact mobility by reducing visibility distance, thereby increasing the risk of accidents.	Medium	Minor adverse	Not significant
Soil texture	Soil moisture / stability	Operation Drainage infrastructure	Increased erosion due to extreme weather along shoulders can cause surface water drainage pipes to become clogged with debris.	Medium	Minor adverse	Not significant
Soil texture	Soil moisture / stability	Operation Earthwork and foundation	Subsidence risk in shrinkable cohesive soils (shrink–swell).	Low	Minor adverse	Not significant
Soil texture	Soil moisture / stability	Operation Earthwork and foundation	Warmer wetter winters can cause rebound of soil moisture levels, leading to swelling.	Low	Minor adverse	Not significant
Soil texture	Soil moisture / stability	Operation Earthwork and foundation	Changes in pore pressure due to prolonged wet or dry periods can lead to a loss of stability and failure of structure.	Low	Minor adverse	Not significant

Climate hazard	Climate variable	Receptors	Potential effect	Likelihood	Consequence	Risk
Soil texture	Soil moisture / stability	Operation Landscaping	Changes in soil moisture can lead to increase or decrease in the water requirement of plants, resulting in changes in maintenance regimes.	Low	Minor adverse	Not significant
Soil texture	Soil moisture / stability	Operation Landscaping	Decline in soil moisture can adversely impact plant health.	Low	Moderate adverse	Not significant

6.1.3 As per Table 6.1, for the Proposed Scheme, none of the potential effects from risks related to climate change have been found to be 'significant'. Hence, no additional mitigation is required from the perspective of climate adaptation for the Proposed Scheme. However, regular repair and maintenance regimes are recommended for the receptors, particularly in the aftermath of extreme weather events.

7 Assumptions and Limitations

7.1.1 There is currently no agreed industry methodology that should be applied for assessing the vulnerability under the EIA Regulations. Therefore, an approach has been developed and applied in this assessment based on existing best practice and professional experience.

7.1.2 The UKCP18 projections have been used to infer future changes in a range of climate variables that may affect the vulnerability of the Proposed Scheme to climate change. At the time of writing, these represent the most up-to-date representation of future climate in the UK.

7.1.3 The Climate Risk Indicators, developed as part of the UK Climate Resilience Programme, have been used to infer this assessment. As such there are inherited limitations and uncertainties within the data. Further information on the methodology used to produce this data can be found in 'Changing climate risk in the UK: a multi-sectoral analysis using policy-relevant indicators' (**Ref: 14.1.26**). The Climate Risk Indicators utilise UKCP18 projections. At the time of writing, these represent the most up-to-date representation of future climate in the UK.

7.1.4 There are inherent uncertainties associated with climate projections and they are not predictions of the future. It is possible that future climate will differ from the future baseline climate against which the resilience of the Proposed Scheme has been assessed, depending on global emissions over the next century. A 'high' emissions scenario (RCP 8.5) using the 2080s time slice (2070–2099, the longest temporal scale available through UKCP18) has been

used to develop the baseline against which vulnerability has been assessed. This is consistent with the precautionary principle (i.e., 'worst case' scenario).

7.1.5 Any further research, analysis or decision-making should take account of the accuracies and uncertainties associated with climate projections. It is also important to note that the analysis is based on selected observational data, the results of climate model ensembles and a selected range of existing climate change research and literature available at the time of assessment. Any future decision-making based on this analysis should consider the range of literature, evidence and research available at that time and any changes to this.

7.1.6 The embedded mitigation provided by the design engineers and topic specialists is based on the preliminary design of the Proposed Scheme and may alter as the design progresses. Where embedded mitigation measures note that adaptation aspects will be addressed at detailed design stage, it is assumed that this will be sufficiently addressed based on the climate projections detailed in this chapter (or as subsequent climate data is published) as the detailed design is progressed.

7.1.7 The list of potential effects of climate change on the Proposed Scheme identified in the assessment is not exhaustive. The assessment attempts to cover the major effects in the construction and operation phase of the Proposed Scheme. It is understandable that there will be more such effects which are not direct and hence, have not been covered within the scope of the assessment.

8 Summary

8.1.1 The climate resilience assessment reports the likely significant effects arising for the Proposed Scheme in terms of its vulnerability to climate change, i.e., the climate change resilience and adaptation assessment. The assessment aligns with the requirements of EIA Regulations 2017 (**Ref: 14.1.1**), and the Environmental Impact Assessment Guide to: Climate Change Resilience and

Adaptation from the Institute of Environmental Management and Assessment (IEMA) (**Ref: 14.1.8**).

8.1.2 The current climate baseline includes the climate trends over the past three decades (1991-2020) for temperature, precipitation (rain and snow), wind and storms, humidity and solar radiation obtained majorly from the Met Office records (**Ref: 14.1.11**). For future baseline, the UKCP18 (**Ref: 14.1.13**) projections have been used to analyse future changes in a range of climate variables that may affect the resilience of the Proposed Scheme to climate change. The future climate has been presented using the CRI tool (**Ref: 14.1.14**), for the 2030s (2020-2049), the 2050s (2040-2069) and 2080s (2070-2099) to identify the anticipated climate conditions under the worst-case scenario, i.e., RCP8.5. These projections are provided against the model reference period of 1981-2010 and the current baseline of 1991-2020 (**Ref: 14.1.11**) as an indication of change from the reference period.

8.1.3 The baseline findings reveal that the Proposed Scheme is likely to experience hotter, drier summers and warmer, wetter winters with more extreme weather such as heatwave events and rising sea levels, which coincide with the Met Office key messaged of UKCP18.

8.1.4 In accordance with DMRB LA 114 methodology (**Ref: 14.1.8**), the 'likelihood-consequence' approach has been used to assess the significance of effects of climate change on the Proposed Scheme, while taking into account embedded mitigation obtained on consultation with the various topic specialists.

8.1.5 For the Proposed Scheme, none of the potential effects from risks related to climate change have been found to be 'significant'. Hence, no additional mitigation is required from the perspective of climate adaptation. However, regular repair and maintenance regimes are recommended for the receptors, particularly in the aftermath of extreme weather events.

9 References

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