A38 Derby Junctions

TR010022

Volume 6

6.3 Environmental Statement Appendices

Appendix 14.1: Climate Resilience Baseline

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

March 2019

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A38 Derby Junctions Development Consent Order 202[ ]

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Appendix 14.1 Climate Resilience Baseline

Executive summary

A review of relevant information sources was undertaken to establish existing and future baseline data and current understanding with regards to climate and extreme weather impacts. This appendix provides information on this data.

A review of the recent and current climate of the region in which the A38 Derby junctions scheme (referred to as “the Scheme” herein) is sited indicated that there is already evidence of gradual warming and increases in average annual precipitation amounts between 1961 and 2006. The Local Climate Impacts Profile (LCLIP) for Derby (Derby City Council (DCiC), 2011) has assessed the vulnerability of Derby to weather events and provides evidence to suggest that flooding and heavy rains have been the most common form of severe weather related impact during the 2000 to 2010 Local Climate Impacts Profile study period, followed by high winds, storms, freezing temperatures and heavy snow. The UK Climate Change Risk Assessment (Climate Change Risk Assessment (CCRA), 2017) also presents the argument that the UK’s transport infrastructure is already being affected by severe weather events, specifically through flooding and changes to extreme weather event frequency and severity.

The Scheme and the nearest Met Office Weather Station (Watnall) sit within the UK Climate Projections’ East Midlands region. Climate observations for this region identify gradual warming, with an increase of 1.64°C in annual average temperatures between 1961 and 2006. Annual average daily maximum temperatures have increased by 1.79°C over the same period, and the annual average number of days with air frost has decreased by 25.3 days.

For the Met Office East Midlands region, climate observations indicate an 8.1% increase in average annual precipitation amounts between 1961 and 2006. This can be broken down to a 4.6% average decrease in precipitation levels in spring, a 2.6% average increase in summer, a 28.7% average increase in autumn, and an 11% average increase in winter (Met Office, 2006).

1. Climate resilience baseline

1.1 Current baseline

1.1.1 The Local Climate Impacts Profile (LCLIP) for Derby (Derby City Council (DCiC), 2011) assessed the vulnerability of council services to severe weather events, and was based on interviews with DCiC officers and a review of media stories over an 11 year period between 2000 and 2010. The LCLIP review found that Derby is already experiencing major weather events and that several highly significant events occurred over the 11 year LCLIP period.

1.1.2 Evidence suggests that the number of severe weather events is increasing, with intense rainfall events occurring more frequently over the LCLIP analysis period. Heavy snow and strong winds are also noted as severe weather events known to cause disruption.

1.1.3 Specifically relating to highways, flooding, snow and ice have been the biggest weather-related issues recorded over the ten year LCLIP analysis period. Flooding on major roads into the city on numerous occasions has resulted in accessibility problems and has created extra workload for Derbyshire Fire and Rescue by, for example, rescuing stranded motorists. Storms have resulted in a large numbers of fallen trees and freezing temperatures and heavy snow has caused disruption and road accidents.

1.1.4 Met Office historic climate data (Met Office, 2010) has been obtained from the Watnall Weather Station (the closest Weather Station to the Scheme area) showing that for the period 1981 - 2010:

a) Average annual maximum daily temperature were 13.4°C.

b) July was the warmest month on average (mean maximum daily temperature of 21.3°C).

c) February was the coldest month on average (mean daily minimum temperature of 1.1°C).

d) Mean annual rainfall levels were 709.4mm.

e) October was the wettest month on average (71.2mm of rainfall on average for the month).

f) February was the driest month on average (47.2mm of rainfall on average for the month).

g) January was, on average, the windiest month.

h) August was the least windy.

1.1.5 As noted by the UK Climate Change Risk Assessment (CCRA) (Committee for Climate Change, 2017), the UK's transport infrastructure is already being affected by severe weather events.

1.1.6 Specifically for transport infrastructure, the CCRA identifies two key risks:

a) Changes in extreme weather conditions, which will affect infrastructure, in particular through storm damage, flooding and high temperatures.

b) Flooding of transport, including roads and rail is likely to increase, affecting both urban and rural access routes.

1.2 Future baseline – Climate resilience assessment

1.2.1 The UK Climate Projections 2018 (UKCP18) (UK Met Office, 2018) provides the best scientific picture of how global climate change is likely to affect the Scheme location. UKCP18 provides climate change projections for pre-defined 30-year periods (such as 2020s (2010 - 2039), 2050s (2040 - 2069) and 2080s (2070 - 2099)), at annual and seasonal levels for changes to mean climatic conditions over land areas. For the purpose of the Scheme climate assessment, UKCP18 projections for temperature and precipitation variables have been obtained and analysed for the area surrounding the Watnall Weather Station, as used for the historic climate data above.

1.2.2 UKCP18 uses a range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform differing future emission trends. These RCPs (RCP2.6, RCP4.5, RCP6.0 and RCP8.5) "… *specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels*." In accordance with UKCP18 guidance, RCP8.5 has been used as it is the closest equivalent to the high emissions scenario within the UKCP09 data.

1.2.3 Tables 1 and 2 provide a summary of projections for changes to climate conditions, including projections for temperature and precipitation for the 2020s, the 2050s and the 2080s time periods. Annual, summer (June, July and August) and winter (December, January and February) temporal projections are included in this summary, with the results presented as anomalies relative to the 1981 - 2010 average.

Table 1: Projected changes to temperature variables (°C)[1]

Climate variable	Time period		
	2020s	2050s	2080s
Mean annual air temperature anomaly at 1.5m (°C)	+0.8 (+0.3 to +1.3)	+1.9 (+0.9 to +2.9)	+3.6 (+1.9 to +5.4)
Mean summer air temperature anomaly at 1.5m (°C)	+0.9 (+0.3 to +1.6)	+2.3 (+0.9 to +3.8)	+4.6 (+2.1 to +7.5)
Mean winter air temperature anomaly at 1.5m (°C)	+0.7 (-0.1 to +1.4)	+1.7 (+0.4 to +2.9)	+3.0 (+1.1 to +5.0)

[1]The main central number for each variable at each time period represents the 50 per cent probability level, indicating that the particular change is 'as likely as not' to occur. The figures in brackets show the wider range of probability and potential change (10 per and 90 per cent probability levels).

Climate variable	Time period		
	2020s	2050s	2080s
Maximum summer air temperature anomaly at 1.5m (°C)	+1.1 (+0.3 to +1.9)	+2.6 (+0.8 to +4.5)	+5.2 (+2.0 to +8.6)
Minimum winter air temperature anomaly at 1.5m (°C)	+0.6 (-0.1 to +1.4)	+1.6 (+0.4 to +3.0)	+3.0 (+1.0 to +5.3)

Table 2: Projected changes to precipitation variables (%)

Climate variable	Time period		
	2020s	2050s	2080s
Annual precipitation rate anomaly (%)	+1 (-2 to +4)	-1 (-6 to +4)	+0 (-4 to +5)
Summer precipitation rate anomaly (%)	-6 (-22 to +10)	-21 (-45 to +4)	-33 (-61 to -2)
Winter precipitation rate anomaly (%)	+4 (-4 to +12)	+8 (-4 to +22)	+18 (+1 to +38)

1.2.4 These projections represent average weather conditions and do not capture the full range of possible future severe weather events (i.e. droughts, heatwaves and prolonged heavy rainfall).

1.2.5 UKCP18 climate change projections have been used qualitatively to identify how events associated with climatic variables change over time. Baseline climatic conditions (as identified through the LCLIP and Met Office datasets) can subsequently be compared against climate change projections to indicate the direction and degree of change. This approach allows these events to be prioritised over the duration of a proposed scheme and the requirement for mitigation and adaptation responses to be identified and programmed accordingly.

2. References

Derby City Council (2011) The Local Climate Impacts Profile for Derby (LCLIP).

Met Office (2010) The Met Office historic climate data. Available from: www.metoffice.gov.uk/public/weather/climate/gcqfp5e8q

Met Office (2010) England SE & Central S climate variations average table. Available from: https://www.metoffice.gov.uk/public/weather/climate/gcng01df2

Committee for Climate Change (2017) UK Climate Change Risk Assessment.

UK Met Office (2018) UK Climate Projections 2018 (UKCP18). Available from: https://www.metoffice.gov.uk/research/collaboration/ukcp/download-data