

The Lake Lothing (Lowestoft) Third Crossing Order 201[*]



Lake Lothing
**THIRD
CROSSING**

Document 6.1: Environmental Statement

Planning Act 2008

Infrastructure Planning

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

Regulation Number: 5(2)(a)(l)(m)

PINS Reference Number: TR010023

Author: Suffolk County Council

Document Reference: 6.1

Date: June 2018

This page is intentionally left blank

Foreword

This Environmental Statement relates to an application ('the Application') submitted by Suffolk County Council ('the Applicant') to the Secretary of State (through the Planning Inspectorate) for a Development Consent Order ('DCO') under the Planning Act 2008.

If made by the Secretary of State, the DCO would grant development consent for the Applicant to construct, operate and maintain a new bascule bridge highway crossing, which would link the areas north and south of Lake Lothing in Lowestoft, and which is referred to in the Application as the Lake Lothing Third Crossing (or 'the Scheme').

This Environmental Statement has been prepared in accordance with the requirements of section 37(3)(d) of the Planning Act 2008 and regulation 5(2)(a)(l)(m) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 ('the APFP Regulations'), and in compliance with relevant guidance.

Contents

Foreword	i
Contents	ii
Abbreviations	viii
Tables	xii
Plates	xviii
1 Introduction	1
1.1 Background.....	1
1.2 Legislative & Policy Context of the Scheme	2
1.3 Implementing European Directive 2014/52/EU.....	13
1.4 Other regulatory regimes	17
2 The need for the Scheme	18
2.1 The Need for the Scheme	18
3 Alternatives Considered	22
3.1 Introduction	22
3.2 Study Options (OBC Stage)	23
3.3 Options generation.....	24
3.4 Discounting of Options	26
3.5 Final Alternative Locations Shortlisted	29
3.6 Comparison of final alternative locations to the Scheme	30
3.7 Central Option Design Alternatives	33
3.8 Bascule Bridge Design Alternatives	38
3.9 Conclusion.....	39
4 The Existing Environment	40
4.1 Introduction	40
4.2 Land uses adjacent and within the Scheme boundary	40
4.3 Wider land uses	41
4.4 Designated Sites.....	41
5 Description of the Scheme	44

5.1	Introduction	44
5.2	Scheme Description	45
5.3	Main Junction Arrangements	49
5.4	Drainage	50
5.5	Other Design Elements	51
5.6	Construction.....	52
5.7	Operation and Maintenance	59
5.8	Decommissioning.....	60
6	Scoping and Introduction to Environmental Assessments	61
6.1	Introduction	61
6.2	Main Potential Issues	62
6.3	Environmental Aspects	63
6.4	Format of the Assessments	68
7	Consultation.....	74
7.1	Introduction	74
7.2	Non-statutory Consultation.....	74
7.3	Statutory Consultation.....	75
7.4	Section 42 Consultation	76
7.5	Section 47 Consultation	79
7.6	Consultation Response	80
8	Air Quality.....	82
8.1	Scope of the Assessments.....	82
8.2	Directives, Statutes and Relevant Policy	83
8.3	Methods of Assessment.....	88
8.4	Baseline Environment	97
8.5	Predicted Impacts	103
8.6	Mitigation and Residual effects	112

8.7	Conclusion and Effects	114
9	Cultural Heritage.....	116
9.1	Scope of the Assessments.....	116
9.2	Directives, Statutes and Relevant Policy	118
9.3	Methods of Assessment.....	120
9.4	Stage 1 - Baseline Environment.....	128
9.5	Stage 2 – Heritage Assets and Settings Affected by the Scheme	152
9.6	Stage 3 – Value and Significance of Heritage Assets.....	152
9.7	Stage 4 – Magnitude of Impact	160
9.8	Stage 5 - Mitigation	164
9.9	Stage 6 - Significant effects	166
9.10	Predicted Impact and significance of effect tables.....	168
9.11	Conclusions and Effects.....	172
10	Townscape and Visual Impact	173
10.1	Scope of the Assessments.....	173
10.2	Directives, Statutes and Relevant Policy	174
10.3	Methods of Assessment.....	175
10.4	Baseline Environment	189
10.5	Embedded Mitigation	213
10.6	Predicted Impacts	214
10.7	Conclusions and Effects.....	225
11	Nature Conservation.....	227
11.1	Scope of the Assessments.....	227
11.2	Directives, Statutes and Relevant Policy	228
11.3	Methods of Assessment.....	230
11.4	Baseline Environment	234
11.5	Predicted Impacts before mitigation	240

11.6	Conclusions and Residual Effects.....	248
12	Geology, Soils and Contamination	250
12.1	Scope of the Assessments.....	250
12.2	Directives, Regulations, and Relevant Policy	251
12.3	Methods of Assessment.....	252
12.4	Baseline Environment	254
12.5	Predicted Impacts	259
12.6	Mitigation	262
12.7	Conclusions and Effects.....	264
13	Noise and Vibration	265
13.1	Scope of the Assessment	265
13.2	Directives, Regulations and Relevant Policy	266
13.3	Methods of Assessment.....	272
13.4	Baseline Environment	285
13.5	Predicted Impacts	286
13.6	Conclusions and Effects.....	302
14	Materials	303
14.1	Scope of the Assessments.....	303
14.2	Directives, Statutes and Relevant Policy	303
14.3	Methods of Assessment.....	306
14.4	Baseline Environment	310
14.5	Predicted Impacts	312
14.6	Embedded Mitigation	314
14.7	Conclusions and Effects.....	315
15	Private Assets	316
15.1	Scope of the Assessments.....	316
15.2	Directives, Regulations and Relevant Policy	316

15.3	Methods of Assessment.....	319
15.4	Baseline Environment.....	321
15.5	Predicted Impacts and mitigation.....	324
15.6	Conclusions and Effects.....	333
16	Socio-Economics including Recreation.....	334
16.1	Scope of the Assessments.....	334
16.2	Directives, Regulations and Relevant Policy.....	335
16.3	Methods of Assessment.....	336
16.4	Baseline Environment.....	339
16.5	Predicted Impacts.....	344
16.6	Mitigation and enhancement.....	354
16.7	Conclusions and effects.....	356
17	Road Drainage and the Water Environment.....	357
17.1	Scope of the Assessments.....	357
17.2	Directives, Statutes and Relevant Policy.....	357
17.3	Methods of Assessment.....	360
17.4	Baseline Environment.....	368
17.5	Predicted Impacts.....	374
17.6	Mitigation.....	381
17.7	Residual Effects and Conclusions.....	382
18	Flood Risk.....	385
18.1	Scope of the Assessments.....	385
18.2	Directives, Regulations and Relevant Policy.....	385
18.3	Methods of Assessment.....	387
18.4	Baseline Environment.....	390
18.5	Predicted Impacts.....	391
18.6	Conclusions and Effects.....	397

19	Traffic and Transport	399
19.1	Scope of the Assessments.....	399
19.2	Directives, Statutes and Relevant Policy.....	399
19.3	Methods of Assessment.....	401
19.4	Baseline Environment.....	410
19.5	Predicted Impacts.....	413
19.6	Mitigation Measures.....	435
19.7	Summary, Conclusions and Effects.....	436
20	Cumulative Effects	438
20.1	Scope of the Assessments.....	438
20.2	Directives, Regulations and Relevant Policy.....	438
20.3	Methods of Assessment.....	440
20.4	Baseline Environment.....	444
20.5	Predicted Impacts.....	450
20.6	Conclusions and Effects.....	466
	Glossary of Terms	468

Abbreviations

AADT	Annual Average Daily Traffic
AAP	Area Action Plan
ABP	Associated British Ports
ACM	Asbestos Containing Material
AEP	Annual Exceedance Probability
ALC	Agricultural Land Classification
APIS	Air Pollution Information System
AQMAs	Air Quality Management Areas
BAP	Biodiversity Action Plan
BMV	Best and Most Versatile
BNL	Basic Noise Level
BS	British Standard
CD	Chart Datum
CEA	Cumulative Effects Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CMS	Construction Method Statements
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act 1974
CROW	Countryside Rights of Way
CTMP	Construction Traffic Management Plan
CWS	County Wildlife Sites
Db	Decibel
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DEFRA	Department for Environment Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DPD	Development Plan Document
DSM	Digital Surface Modelling
EA	Environmental Agency
EAR	Environmental Appraisal Report
ECI	Early Contractor Involvement

EEA	European Economic Area
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act 1990
EQS	Environmental Quality Standards
ES	Environmental Statement
FDGiA	Flood Defence Grant in Aid
FRA	Flood Risk Assessment
GDD	Groundwater Daughter Directive
GI	Geotechnical Site Investigations
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HAT	Highest Astronomical Tide
HAWRAT	Highways Agency Water Risk Assessment Tool
HC	Hydrocarbons
HDV	Heavy Duty Vehicle
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HLC	Historic Landscape Characterisation
HRA	Habitats Regulations Assessment
IANs	Interim Advice Notes
IAQM	Institute of Air Quality Management
ICD	Inscribed Circle Diameter
IEMA	Institute of Environmental Management
IMD	Index of Multiple Deprivation
LAQM	Local Air Quality Management
LAT	Lowest Astronomical Tide
LCA	Local Character Areas
LDO	Local Development Order
LNR	Local Nature Reserve
LNSR	Lowestoft Northern Spine Road
LOAEL	Lowest Observed Adverse Effect Level
MCHW	Manual of Contract Documents for Highway Works
MHST	Mean High Spring Tide
MMO	Marine Management Organisation
MPS	Marine Policy Statement

MW	Megawatts
NAEI	National Atmospheric Emissions Inventory
NERC	Natural Environment and Rural Communities
NHLE	National Heritage List for England
NNNPS	National Networks National Policy Statement
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
OBC	Outline Business Case
ONS	Office for National Statistics
OS	Ordnance Survey
PCM	Pollution Climate Mapping
PEI	Preliminary Environmental Information
PEIR	Preliminary Environmental Information Report
PIC	Personal Injury Collision
PINS	The Planning Inspectorate
PNPS	Ports National Policy Statement
PPG	Planning Policy Guidance
PPS	Planning Policy Statements
PPV	Peak Particle Velocity
PRoW	Public Right of Way
PVB	Present Value of Benefit
RFC	Ratio of Flow to Capacity
SAC	Special Area of Conservation
SCC	Suffolk County Council
SCCAS	Suffolk County Council Archaeological Services
SHA	Statutory Harbour Authority
SLRR	South Lowestoft Relief Road
SM	Scheduled Monuments
SOAEL	Significant Observed Adverse Effect Level
SoS	Secretary of State
SPA	Special Protection Area
SRN	Strategic Road Network

SSSI	Sites of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SWMP	Site Waste Management Plan
TA	Transport Assessment
TEN-T	Trans European Network–Transport
TPH	Total Petroleum Hydrocarbons
TPO	Tree Preservation Order
TRA	Traffic Reliability Area
TUBA	Transport User Benefit Appraisal
UKBAP	UK Biodiversity Action Plan
UKPN	UK Power Networks
UNECE	United Nations Economic Commission for Europe
VDV	Vibration Dose Value
WCA	Wildlife and Countryside Act
WDC	Waveney District Council
WFD	Water Framework Directive
WIMBY	What's in My Backyard
ZTV	Zone of Theoretical Visibility

Tables

<i>Table 1-1 – Volume I – Written Statement</i>	7
<i>Table 1-2 – Volume II - Figures</i>	7
<i>Table 1-3 – Volume III - Appendices</i>	10
<i>Table 1-4 – Requirements of the 2009 Regulations and where in the ES they are fulfilled ..</i>	12
<i>Table 1-5 – Inclusion of the Do Nothing scenario with the assessments</i>	15
<i>Table 1-6 – Environmental Factors included within the ES</i>	15
<i>Table 1-7 – New Sources of Environmental Effects</i>	16
<i>Table 3-1 – OBC Scheme Options</i>	25
<i>Table 3-2 – Western Options</i>	27
<i>Table 3-3 – Central Options</i>	27
<i>Table 3-4 – Eastern Options</i>	28
<i>Table 3-5 – Tunnel Option</i>	28
<i>Table 3-6 – User benefits</i>	30
<i>Table 3-7 - Traffic impacts in peak hours</i>	31
<i>Table 3-8 – Public consultation (2014)</i>	32
<i>Table 3-9 – Stakeholder survey</i>	33
<i>Table 3-10 – Design Constraints</i>	34
<i>Table 4-1 – Environmental Statutory Designations</i>	42
<i>Table 4-2 – Environmental Non-Statutory Designated Sites</i>	43
<i>Table 5-1 – Scheme aspects</i>	44
<i>Table 5-2 – Limits of Deviation</i>	46
<i>Table 5-3 – Construction phases of the Scheme</i>	57
<i>Table 5-4 – Construction phases of the Scheme bascule bridge</i>	57
<i>Table 6-1 – Study areas within the assessment</i>	69
<i>Table 7-1 – Number of consultation responses received by format</i>	80
<i>Table 8-1 – National (England) air quality objectives and European Directive limit values ..</i>	86
<i>Table 8-2 Sensitivity of the Area to Dust Soiling Effects on People and Property</i>	90
<i>Table 8-3 Magnitude of Change Criteria</i>	93

<i>Table 8-4 Impact Descriptors for Modelled Sensitive Receptors (annual mean NO₂ and PM₁₀)</i>	95
<i>Table 8-5 - Defra Mapped Background Annual Mean Concentrations for each Pollutant in Base (2016), Current (2018) and Opening (2022) Years</i>	97
<i>Table 8-6 – Local Authority NO₂ Monitoring Results</i>	98
<i>Table 8-7 – Summary of Scheme Specific Monitored NO₂ Annual Mean Concentrations (December 2016 to December 2017)</i>	99
<i>Table 8-8 – Identified Potentially Sensitive Receptor Locations</i>	101
<i>Table 8-9 - Base Year 2016 NO_x Concentrations and Nitrogen Deposition Rates for Ecological Sites</i>	103
<i>Table 8-10 – Receptor Count within 350m of Earthworks and Construction Activities</i>	104
<i>Table 8-11 – Summary of Predicted Annual Mean NO₂, PM₁₀ and PM_{2.5} Concentrations at Sensitive Receptor Locations in Base (2016) and Opening Year (2022)</i>	106
<i>Table 8-12 – Predicted Magnitude of Change in Annual Mean Concentrations in the Opening Year</i>	108
<i>Table 8-13 – Regional Emissions Assessment Outputs</i>	110
<i>Table 8-14 – Predicted sensitive receptor impact (IAQM)</i>	111
<i>Table 9-1 – The significance of archaeological remains</i>	124
<i>Table 9-2- The significance of built heritage assets</i>	124
<i>Table 9-3 – The significance of historic landscapes</i>	125
<i>Table 9-4 – The magnitude of impacts upon heritage assets</i>	126
<i>Table 9-5 – The significance of effects upon heritage assets</i>	128
<i>Table 9-6 – Designated Heritage Assets</i>	130
<i>Table 9-7 – Designated Built Heritage Value, Setting and Significance Appraisal (1 of 2)</i> . 155	
<i>Table 9-8 – Designated Built Heritage Value, Setting and Significance Appraisal (2 of 2)</i> . 156	
<i>Table 9-9 – Non-designated Built Heritage Value, Setting and Significance Appraisal</i>	157
<i>Table 9-10 – Impacts to conservation areas and significant effects following further mitigation</i>	169
<i>Table 9-11 – Impacts to built heritage assets and significant effects following further mitigation</i>	169
<i>Table 9-12 – Impacts to archaeological heritage assets and significant effects following further mitigation</i>	170
<i>Table 9-13 – Impacts to the historic landscape and significant effects following further mitigation</i>	171

<i>Table 10-1 – Townscape/Landscape Regulatory and Policy Framework.....</i>	<i>174</i>
<i>Table 10-2 – Townscape Quality.....</i>	<i>177</i>
<i>Table 10-3 – Value criteria for townscape character</i>	<i>178</i>
<i>Table 10-4 – Sensitivity to change criteria for townscape character</i>	<i>179</i>
<i>Table 10-5 Magnitude of impact criteria for townscape character.....</i>	<i>179</i>
<i>Table 10-6 –Significance of effect categories for townscape character</i>	<i>180</i>
<i>Table 10-7 – Coordinates used in the ZTV assessment.....</i>	<i>183</i>
<i>Table 10-8 Sensitivity of viewpoints</i>	<i>186</i>
<i>Table 10-9 Magnitude of visual effect criteria</i>	<i>187</i>
<i>Table 10-10 – Significance of Visual Effect Categories</i>	<i>188</i>
<i>Table 10-11 – Significance of effect ratings.....</i>	<i>188</i>
<i>Table 10-12 – Summary of LCA sensitivity to change to the type of development proposed</i>	<i>205</i>
<i>Table 10-13 – Summary of viewpoint sensitivity to change</i>	<i>213</i>
<i>Table 10-14 – Summary of LCA and predicted significance of effect.....</i>	<i>220</i>
<i>Table 10-15 – Summary of viewpoint and predicted significance of effect.....</i>	<i>224</i>
<i>Table 11-1 - Value of ecological resources</i>	<i>232</i>
<i>Table 11-2 –Magnitude of ecological impacts</i>	<i>234</i>
<i>Table 11-3 – Habitats present in the Main Study Area</i>	<i>237</i>
<i>Table 11-4 – Survey Findings for Species.....</i>	<i>238</i>
<i>Table 11-5 - Effects of the Scheme.....</i>	<i>242</i>
<i>Table 11-6 – Mitigation measures and pre-construction surveys.....</i>	<i>245</i>
<i>Table 12-1 – Geology and Soils Construction Mitigation Measures.....</i>	<i>263</i>
<i>Table 12-2 – Geology and Soils Operational Mitigation Measures</i>	<i>264</i>
<i>Table 13-1 – PPG Noise Exposure Hierarchy</i>	<i>270</i>
<i>Table 13-2 – BS 5228-1 Example Method 1 – The ABC Method.....</i>	<i>276</i>
<i>Table 13-3 – Construction Noise – Effect Level Criteria</i>	<i>276</i>
<i>Table 13-4 – Significance of Effect Criteria for Construction Noise Combining Duration of Exposure and Effect Levels</i>	<i>277</i>
<i>Table 13-5 - BS 5228-2 Guidance on Effects of Vibration Levels</i>	<i>278</i>
<i>Table 13-6 - Transient Vibration Guide Values for Cosmetic Damage.....</i>	<i>278</i>
<i>Table 13-7 - Construction Vibration – Effect Level Criteria</i>	<i>279</i>

Table 13-8 – Significance of Effect Criteria for Construction Vibration Combining Duration of Exposure and Effect Levels	279
Table 13-9 – Traffic Noise Effect Levels.....	283
Table 13-10 - Classification of Magnitude of Noise Impacts (based on DMRB HD 213/11)	284
Table 13-11 - Significance Effect Level Criteria for Operational Traffic Noise.....	284
Table 13-12 – Noise Monitoring Locations	285
Table 13-13 – Construction Noise Thresholds	287
Table 13-14 - Combined Activity Sound Power Levels during Each Stage of Construction	288
Table 13-15 - Single Point Operating Distances assumed for Prediction of Construction Noise	289
Table 13-16 - Predicted Unmitigated Construction Noise Levels, $L_{Aeq,T}$ dB.....	290
Table 13-17 – Significance of Impact for Construction Noise	291
Table 13-18 – Residual Construction Noise Significance of Effects – Including Mitigation	293
Table 13-19 - Predicted Groundborne Vibration Levels Applicable to Typical Vibration Generating Construction Activities	294
Table 13-20 - Significance of Construction Vibration Impacts.....	295
Table 13-21- Construction Traffic Data	296
Table 13-22- Short-term Construction Traffic Noise Impacts, dB $L_{A10,18h}$	296
Table 13-23- Overall Short-term Operational Noise Impacts	297
Table 13-24 - Overall Long-term Operational Noise Impacts.....	298
Table 13-25 – Predicted Noise Levels at Designated Sites	299
Table 13-26 - Operational Noise Impacts within NIAs – Number of NSRs.....	300
Table 14-1 – Sensitivity of Regional Natural Resources.....	308
Table 14-2 – Sensitivity of Receptor(s) – Waste Assessment	308
Table 14-3 – Scale of Impact Magnitude – Depletion of Natural Resources	308
Table 14-4 – Scale of Impact Magnitude – Material Resources.....	309
Table 14-5 – Scale of Impact Magnitude - Waste.....	309
Table 14-6 – Significance of Depletion of Natural Resources and Waste Effects Matrix....	310
Table 14-7 – List of Landfill Sites in Proximity to the Scheme	312
Table 14-8 – Material Quantities to be Imported for Construction.....	313
Table 15-1: Private Assets Policy Framework	317
Table 15-2 – Significance Criteria for the Private Assets Assessment.....	319

<i>Table 15-3 – Description of Land Use</i>	322
<i>Table 15-4 – Predicted Impacts upon Private Assets</i>	325
<i>Table 16-1 - Socio-Economic Regulatory and Policy Framework</i>	335
<i>Table 16-2 – Socio-economic sensitivity</i>	338
<i>Table 16-3 – Socio-economic magnitude of impact</i>	339
<i>Table 16-4 – Socio-economics significance of effect</i>	339
<i>Table 16-5 - Employment by occupation category</i>	341
<i>Table 16-6 – Qualification levels</i>	342
<i>Table 16-7 – Retail establishments within Lowestoft Town Centre</i>	343
<i>Table 16-8 – Socio-economic sensitivity of environmental aspects</i>	345
<i>Table 16-9 – Assessment of effects</i>	348
<i>Table 16-10 – Assessment of effects upon employment</i>	353
<i>Table 17-1: Estimating the Importance of Water Environment Attributes (taken from HD 45/09, Table A4.3)</i>	364
<i>Table 17-2: Estimating the Magnitude of an Impact on an Attribute (taken from HD 45/09, Table A4.4)</i>	365
<i>Table 17-3: Estimating the Significance of Potential Effects (taken from HD 45/09, Table A4.5)</i>	368
<i>Table 17-4: Water Quality Sample Locations</i>	372
<i>Table 17-5: Importance of water features within the study area</i>	373
<i>Table 17-6: Summary of HAWRAT assessment of pollution risks to Lake Lothing</i>	378
<i>Table 17-7: Summary of Residual Effects</i>	383
<i>Table 18-1 – Classification of magnitude of Flooding Impact</i>	390
<i>Table 18-2 – Significance of flood impact</i>	390
<i>Table 18-3 – Model results for the present day (2017) scenario</i>	392
<i>Table 18-4 – Model results for the climate change (2117) scenario</i>	394
<i>Table 18-5 – Model results for the H++ scenario</i>	395
<i>Table 19-1 – DMRB Magnitude Criteria, New Severance</i>	405
<i>Table 19-2 – Fear and Intimidation Thresholds for traffic</i>	408
<i>Table 19-3 – DMRB Magnitude Criteria, Views from the Road</i>	408
<i>Table 19-4: Magnitude of Traffic Impact Criteria (Beneficial and Adverse)</i>	409
<i>Table 19-5: Receptor Sensitivity Criteria</i>	410

<i>Table 19-6 – DMRB Magnitude Criteria (incorporating IEMA impact ratings), Significance</i>	<i>410</i>
<i>Table 19-7 – Existing and Historic Two-way Traffic Flows in the Study Area.....</i>	<i>411</i>
<i>Table 19-8 – 2022 and 2037 DM and DS Peak Hours Traffic Flows (AM and PM).....</i>	<i>415</i>
<i>Table 19-9 – 2022 and 2037 Percentage Change in Traffic Flow.....</i>	<i>417</i>
<i>Table 19-10: Summary of Junction Operation Assessments in 2022.....</i>	<i>419</i>
<i>Table 19-11: Summary of Junction Operation Assessments in 2037.....</i>	<i>420</i>
<i>Table 19-12: Junctions which Operate within an RFC of 0.85/PRC of 0.90 with the Scheme in Place.....</i>	<i>421</i>
<i>Table 19-13: Junctions which are Beneficially Impacted by the Scheme.....</i>	<i>422</i>
<i>Table 19-14 – Relief from Existing Severance (AADT).....</i>	<i>427</i>
<i>Table 19-15 – Future pedestrian trips on the Scheme.....</i>	<i>429</i>
<i>Table 19-16 – Future cyclist trips on the Scheme.....</i>	<i>429</i>
<i>Table 19-17 – Pedestrian Distances to Key Destinations.....</i>	<i>430</i>
<i>Table 19-18 – 2022 and 2037 DM and DS Peak Hours Traffic Flows (AM and PM) – Fear and Intimidation.....</i>	<i>432</i>
<i>Table 19-19 – 2022 and 2037 Fear and Intimidation Changes in Impact.....</i>	<i>434</i>
<i>Table 19-20 – Improvement measures.....</i>	<i>435</i>
<i>Table 19-21: Summary of Impacts.....</i>	<i>436</i>
<i>Table 20-1 – ‘Other Development’ for Inclusion in CEA.....</i>	<i>440</i>
<i>Table 20-2 – The CEA Stages.....</i>	<i>441</i>
<i>Table 20-3 – Interaction between topics on receptor groups.....</i>	<i>443</i>
<i>Table 20-4 – Significance criteria thresholds for synergistic effects assessment.....</i>	<i>444</i>
<i>Table 20-5 – Information sourced to date on the projects.....</i>	<i>447</i>
<i>Table 20-6 – Assessment of Cumulative Effects.....</i>	<i>451</i>

Plates

<i>Plate 1-1: Location of the Scheme in Lowestoft.....</i>	<i>2</i>
<i>Plate 5-1 – Rolling bascule mechanism</i>	<i>48</i>
<i>Plate 5-2 – Preliminary construction programme showing likely timings and durations to inform the assessments</i>	<i>53</i>
<i>Plate 5-3 – Indicative daily employment numbers</i>	<i>55</i>
<i>Plate 5-4 – Weekly HGV movements</i>	<i>56</i>
<i>Plate 9-1 – Wellington Esplanade</i>	<i>132</i>
<i>Plate 9-2 – Ashurst</i>	<i>132</i>
<i>Plate 9-3 – 9, 10 and 11 Waterloo and 16-28 Victoria Terrace</i>	<i>133</i>
<i>Plate 9-4 – The Port House.....</i>	<i>134</i>
<i>Plate 9-5 – The Royal Norfolk and Suffolk Yacht Club</i>	<i>134</i>
<i>Plate 9-6 – Central Railway Station.....</i>	<i>136</i>
<i>Plate 9-7 – 7-11 Station Square</i>	<i>136</i>
<i>Plate 9-8 – 18-32 Station Square</i>	<i>137</i>
<i>Plate 9-9 – 1-8 Pier Terrace.....</i>	<i>137</i>
<i>Plate 9-10 – RNLI Statue</i>	<i>138</i>
<i>Plate 9-11 – Three Storey Terraced Houses, Commercial Road.....</i>	<i>139</i>
<i>Plate 9-12 – Warehouse at 41 Commercial Road</i>	<i>140</i>
<i>Plate 9-13 - Goods Office for Freight Yard, Commercial Road</i>	<i>140</i>
<i>Plate 9-14 – Freight Yard Building, Commercial Road</i>	<i>141</i>
<i>Plate 9-15 – 42 Waveney Drive.....</i>	<i>141</i>
<i>Plate 9-16 – 50-56 Waveney Drive.....</i>	<i>142</i>
<i>Plate 10-1 – Commercial areas on London Road North</i>	<i>191</i>
<i>Plate 10-2 – View across the marina towards the A47 Bascule Bridge and the entrance to Lake Lothing</i>	<i>192</i>
<i>Plate 10-3 – View along the High Street in the North Lowestoft Conservation Area</i>	<i>192</i>
<i>Plate 10-4 – The Victorian seaside terraces along Marine Parade</i>	<i>194</i>
<i>Plate 10-5 – View south along The Esplanade from South Pier towards Claremont Pier... ..</i>	<i>194</i>
<i>Plate 10-6 – Compact terraced housing along Maidstone Road with Lake Lothing in the background.....</i>	<i>195</i>

<i>Plate 10-7 – One of the early areas of residential expansion in this LCA along Clemence Street.....</i>	<i>196</i>
<i>Plate 10-8 – View along one of the traditional routes on Carlton Road.....</i>	<i>197</i>
<i>Plate 10-9 – View of the housing and diverse road layouts along Lorne Road and St Leonard’s Road</i>	<i>197</i>
<i>Plate 10-10 – View towards the Outer Harbour from the waterfront on the south side of Lake Lothing.....</i>	<i>199</i>
<i>Plate 10-11 – Industrial areas fringing Lake Lothing.....</i>	<i>199</i>
<i>Plate 10-12 – View along Higher Drive in Normanston in a more established part of the townscape.....</i>	<i>201</i>
<i>Plate 10-13 – Normanston Park to the north of Lake Lothing</i>	<i>201</i>
<i>Plate 10-14 – View along Edgerton Road, an early area of 20th century residential expansion</i>	<i>202</i>
<i>Plate 10-15 – Mixed housing along Planters Grove in Coleville in the south of the LCA....</i>	<i>203</i>
<i>Plate 10-16 – View across Oulton Broad towards the housing on the north side and The Broads beyond.....</i>	<i>204</i>
<i>Plate 10-17 – View from Nicolas Everitt Park towards the moored leisure craft.....</i>	<i>205</i>
<i>Plate 10-18 – Area Action Plan Site Allocations</i>	<i>208</i>
<i>Plate 15-1 – Potential Demand for Bridge openings Hourly Bridge Openings identified from the Vessel Survey (dates 13 June to 30 September 2017).....</i>	<i>331</i>
<i>Plate 16-1 – Openings per day for recreational vessels only.....</i>	<i>346</i>

1 Introduction

1.1 Background

- 1.1.1 Suffolk County Council ("the Applicant") is proposing a new crossing of Lake Lothing in Lowestoft, Suffolk known as the Lake Lothing Third Crossing.
- 1.1.2 The Scheme involves the construction, operation and maintenance of a new bascule bridge highway crossing linking the areas north and south of Lake Lothing in Lowestoft, hereafter referred to as the Lake Lothing Third Crossing ("the Scheme").
- 1.1.3 The Scheme would provide a new single-carriageway road crossing of Lake Lothing, consisting of a multi-span bridge with associated approach roads, and would comprise:
- an opening bascule bridge over the Port of Lowestoft, in Lake Lothing;
 - on the north side of Lake Lothing, a bridge over Network Rail's East Suffolk Line, and a reinforced earth embankment joining that bridge, via a new roundabout junction, to the C970 Peto Way, between Rotterdam Road and Barnards Way; and
 - on the south side of Lake Lothing, a bridge over the northern end of Riverside Road including the existing access to commercial property (Nexen Lift Trucks) and a reinforced earth embankment (following the alignment of Riverside Road) joining this bridge to a new roundabout junction with the B1531 Waveney Drive.
- 1.1.4 The Scheme would be approximately 1 kilometre long and would be able to accommodate all types of vehicular traffic as well as non-motorised users, such as cyclists and pedestrians.
- 1.1.5 The opening bascule bridge design would allow large vessels to continue to use the Port of Lowestoft.
- 1.1.6 A new control tower building would be located immediately to the south of Lake Lothing, on the west side of the new highway crossing, to facilitate the operation of the opening section of the new bascule bridge.
- 1.1.7 The Scheme would also entail:
- the following changes to the existing highway network:
 - the closure of Durban Road to vehicular traffic at its junction with Waveney Drive;
 - the closure of Canning Road at its junction with Riverside Road, and the construction of a replacement road between Riverside Road and Canning Road to the west of the Registry Office; and
 - a new access road from Waveney Drive west of Riverside Road (New Access Road), to provide access to property at Riverside Business Park;
 - improvements to Kimberley Road at its junction with Kirkley Run; and
 - part-signalisation of the junction of the B1531 Victoria Road / B1531 Waveney Drive with Kirkley Run;

- the provision of a pontoon for use by recreational vessels, located to the east of the new highway crossing, within the Inner Harbour of Lake Lothing; and
- works to facilitate the construction, operation and maintenance of the Scheme, including the installation of road drainage systems; landscaping and lighting; accommodation works for accesses to premises; the diversion and installation of utility services; and temporary construction sites and access routes.

1.1.8 The works required for the delivery of the Scheme are set out in Schedule 1 to the draft Development Consent Order (DCO) (document reference 3.1), where they are referred to as "the authorised development", with their key component parts being allocated reference numbers, which correspond to the layout of the numbered works as shown on the Works Plans (document reference 2.4). The General Arrangement Plans (document reference 2.2) illustrate the key features of the Scheme.

1.1.9 Plate 1-1 provides a diagrammatic representation of the Scheme.



Plate 1-1: Location of the Scheme in Lowestoft

1.2 Legislative & Policy Context of the Scheme

- 1.2.1 In a direction made under section 35 of the Planning Act 2008 (as amended) on 22 March 2016 the Secretary of State (SoS) for Transport formally directed that the Scheme should be considered to be a nationally significant infrastructure project (NSIP).
- 1.2.2 Promoters of projects that are the subject of a section 35 direction are required to apply to the SoS for a Development Consent Order (DCO) to construct, maintain and operate the project. In the case of the Scheme, the Applicant is Suffolk County Council (SCC).

Environmental Impact Assessment

- 1.2.3 Under Schedule 2 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009, (hereinafter referred to as “the 2009 Regulations”), Environmental Impact Assessment (EIA) is mandatory for all developments listed in Schedule 1. EIA is also mandatory for developments listed in Schedule 2 of the 2009 Regulations that are likely to have a significant effect on the environment due to such factors as its size and location. The Scheme doesn't meet the qualifying criteria for a Schedule 1 development but it does for Schedule 2 as it constitutes the “construction of roads.”
- 1.2.4 Therefore, the need for an EIA is informed by the parameters defined in Schedule 3 of the 2009 Regulations (noting Section 1.3 for further information on the update to the EIA regulations in 2017). Having considered the nature of the Scheme, the receiving environment, and the characteristics of the potential impact of the Scheme, the Applicant is of the opinion that the Scheme has the potential for likely significant effects upon the environment and, therefore, an EIA is required.
- 1.2.5 Consequently, on 28 February 2017, the Applicant notified the SoS under Regulation 6(1)(b) of the 2009 Regulations that it proposed to provide an ES in respect of the proposed Scheme. Therefore, in accordance with Regulation 4(2)(a) of the 2009 Regulations, the Scheme is determined to be 'EIA development'.
- 1.2.6 Alongside the Regulation 6(1)(b) notification, the Applicant submitted a Scoping Report, requesting a Scoping Opinion from the SoS as to what should be included in an ES (and what could be 'scoped out' of it). This was duly issued on 7 April 2017. Both the Scoping Report and Scoping Opinion are included in Appendix 6A and 6B respectively.

National Policy Statements

- 1.2.7 National Policy Statements are required to be produced by Government under the Planning Act 2008 and they present the planning policy framework for all decision making for NSIPs. Under section 104 of the Planning Act 2008, the SoS must have regard to these statements when considering an application for an order granting development consent under this Act.
- 1.2.8 As stated in 1.2.1 the Scheme is a NSIP under section 35 of the Planning Act 2008 (as amended). Paragraphs 1.3 and 1.5 of the National Policy Statement for National Networks (NNNPS) state that applications for a DCO for NSIP proposals under section 35 of the Planning Act 2008 need to be considered in accordance with the NNNPS.
- 1.2.9 National Policy Statements also include the Government's objectives for the development of NSIPs.
- 1.2.10 National Policy Statements have been produced for many different types of infrastructure development. In relation to the Scheme, the NNNPS and the National Policy Statement for Ports (PNPS) are the statements that need to be taken into account, as is explained in the Case for the Scheme (document reference 7.1)

National Policy Statement for National Networks

- 1.2.11 The NNNPS was designated by the Secretary of State (SoS) in December 2014 and sets out the Government's policies for nationally significant road and rail projects. It

sets out the principles by which the Secretary of State will assess NSIPs and the information that should be provided as part of a DCO application.

- 1.2.12 The NNNPS has therefore informed the development of the baseline information, assessments, and mitigation measures provided within this ES. Appendix A to the Case for the Scheme (document reference 7.1) provides a full assessment of generic impacts as set out in Section 5 of the NNNPS. Where relevant, the applicable paragraphs of the NNNPS are referenced within the relevant ES chapter so that the Scheme's compliance with the NNNPS can be appraised.

National Policy Statement for Ports

- 1.2.13 The PNPS was designated by the SoS in January 2012 and sets out the Government's policies for new nationally significant port development projects.

- 1.2.14 The Scheme does not provide for port development. However, where aspects of the PNPS are pertinent to aspects of the Scheme that may affect existing port facilities, assessments within this ES have appropriately referenced the statement. This is further explained in the Case for the Scheme (document reference 7.1).

Communities and Local Government; Pre-Application Guidance

- 1.2.15 In March 2015 the Department for Communities and Local Government (DCLG) published a statutory guidance document on the pre-application process for NSIPs, compliance with which is required by promoters of NSIPs under section 50 of the Planning Act 2008. Whilst statutory requirements for consultation are provided in the Planning Act the purpose of the guidance is to:

- advise users of the (Planning Act) regime on the processes involved in the pre-application stage;
- guide applicants as to how the pre-application requirements of the Planning Act should be fulfilled and provide some advice on best practice;
- inform other users of the regime, including consultees, of their roles in the pre-application process and to let them know what is expected of applicants at this stage; and
- help ensure that the regime is transparent and accessible to all.

- 1.2.16 The Applicant has taken account of this guidance in undertaking its pre-application consultation and in the development of the Scheme and this ES.

Planning Inspectorate Advice Notes

- 1.2.17 PINS has published a series of non-statutory Advice Notes to inform developers, consultees, the public and other interested parties about a range of procedural matters in relation to the Planning Act 2008 process. Not all of these Advice Notes are applicable to the ES, however those that are integral, and have informed the environmental assessment process for the Scheme, are discussed further below.

Advice Note 3: EIA Notification and Consultation v7

- 1.2.18 The Advice Note 3 outlines the approach taken by the Planning Inspectorate, when identifying consultation bodies to be notified, and where relevant, consulted on the scope of the Environmental Statement (ES), in accordance with the Infrastructure

Planning (Environmental Impact Assessment) Regulations 2017 (see Paragraph 1.3.1). Version 7 is the current version of this advice note and it has been prepared to support the 2017 Regulations and whilst the application for the Scheme is being considered under the 2009 Regulations, this advice note is still considered suitable advice to consider.

1.2.19 This Advice Note also identifies non-prescribed consultation bodies that the Planning Inspectorate may consult on a discretionary basis.

Advice Note 7: Environmental Impact Assessment Preliminary Environmental Information, Screening and Scoping v5

1.2.20 This Advice Note 7 details the procedural requirements that apply to NSIPs which are EIA development particularly with regard to scoping and the information presented within a Preliminary Environmental Information Report (PEIR).

1.2.21 Greater information on how the scoping and PEIR process has informed the assessments within this ES is included in Chapters 6 and 7 respectively.

Advice Note 9: Rochdale Envelope v2

1.2.22 This Advice Note provides guidance on the use of the 'Rochdale Envelope'; a term used to describe those elements of a Scheme that have not yet been finalised but yet can be constrained within certain limits and parameters hence allowing a determination of likely significant effects to be presented in the ES.

1.2.23 This Advice Note sets out that, when using the Rochdale Envelope to allow for flexibility within a DCO application, a NSIP promoter should use a worst case approach to identifying likely significant effects and should incorporate mitigation accordingly within the parameters of their Scheme. Chapter 5, and Table 5-2 of this ES sets out how the Rochdale Envelope approach has been utilised in respect of this ES and the Scheme.

Advice Note 10: Habitat Regulations Assessment relevant to nationally significant infrastructure projects v8

1.2.24 This Advice Note sets out the approach to follow when undertaking Habitats Regulations Assessment (HRA) in relation to NSIPs. The HRA Report is included in Application, document reference 6.5.

Advice Note 17: Cumulative effects assessment v4

1.2.25 This Advice Note sets out the recommended approach to Cumulative Effects Assessment (CEA) for NSIP projects including guidance on the relative weight to be applied to other developments depending upon how progressed they are through the consenting process.

1.2.26 Greater information on how CEA has been undertaken for the Scheme is included within Chapter 20.

Advice Note 18: The Water Framework Directive v1

1.2.27 Advice Note 18 provides guidance on the approach to coordinating the requirements of the Water Framework Directive (WFD) with the EIA process. Consideration of the WFD in respect of the Scheme is included in Chapter 17 and Appendix 17A.

Preliminary Environmental Information Report

1.2.28 A PEIR was published as part of the consultation (see Chapter 7 for greater information).

1.2.29 The role of the PEIR was to provide consultees with preliminary information on the likely significant environmental effects of the construction, operation and maintenance of the Scheme, as it was then referred to, based on the emerging design. As discussed in Chapter 7, the feedback from the consultation was used to inform and further refine this ES.

Structure of this ES

1.2.30 The ES is formed of four volumes. Volume I is the written statement, Volume II contains the Figures, Volume III comprises the Appendices and Volume IV is the Non-Technical Summary (NTS) of the ES. The format and information that is included in Volumes I to III of the ES is presented in Table 1-1 to Table 1-3.

Table 1-1 – Volume I – Written Statement

Chapter Number	Title
Chapter 1	Introduction
Chapter 2	Need for the Scheme
Chapter 3	Alternatives Considered
Chapter 4	The Existing Environment
Chapter 5	Description of the Scheme
Chapter 6	Scoping and Introduction to the Assessment
Chapter 7	Consultation
Chapter 8	Air Quality
Chapter 9	Cultural Heritage
Chapter 10	Townscape and Visual Impact Assessment
Chapter 11	Nature Conservation
Chapter 12	Geology, Soils and Contamination
Chapter 13	Noise and Vibration
Chapter 14	Materials
Chapter 15	Private Assets
Chapter 16	Socio Economics including Recreation
Chapter 17	Road Drainage and the Water Environment
Chapter 18	Flood Risk
Chapter 19	Traffic and Transport
Chapter 20	Cumulative Impacts

Table 1-2 – Volume II - Figures

Chapter Number	Figure Number	Figure Title
Chapter 1	Figure 1.1	Site Location Plan
	Figure 1.2	Order Limits
Chapter 2	Not applicable	
Chapter 3	Figure 3.1	Alternatives considered
	Figure 3.2	Alternative Waveney Drive Access Arrangements
Chapter 4	Figure 4.1	Adjacent Land Uses
	Figure 4.2	Designated Sites
	Figure 4.3	Tree Preservation Orders
Chapter 5	Figure 5.1	The Order Limits and the Scheme
	Figure 5.2	Design considerations

Chapter Number	Figure Number	Figure Title
	Figure 5.3	Drainage Arrangement
	Figure 5.4	Construction Compound Locations
	Figure 5.5	Highway Lighting
	Figure 5.6	Construction Phase Cofferdam Arrangement
Chapter 6	Not applicable	
Chapter 7	Figure 7.1	Consultation area
Chapter 8	Figure 8.1	Operational Air Quality Study Area
	Figure 8.2	Air Quality Construction Phase Assessment Study Area
	Figure 8.3	Local Air Quality Assessment Study Area
	Figure 8.4	Air Quality Monitoring Locations
	Figure 8.5	Regional Affected Roads
	Figure 8.6	Ecological Assessment Study Area
	Figure 8.7	Local Air Quality Assessment NO ₂ Results 2016 Base Year Scenario
	Figure 8.8	Local Air Quality Assessment NO ₂ Results 2022 Do Minimum Scenario
	Figure 8.9	Local Air Quality Assessment NO ₂ Results 2022 Do Something Scenario
	Figure 8.10	Local Air Quality Assessment NO ₂ Change Between Do Minimum and Do Something Scenario
	Figure 8.11	Local Air Quality Assessment PM ₁₀ Results 2016 Base Year Scenario
	Figure 8.12	Local Air Quality Assessment PM ₁₀ Results 2022 Do Minimum Scenario
	Figure 8.13	Local Air Quality Assessment PM ₁₀ Results 2022 Opening Year Do Something Scenario
	Figure 8.14	Local Air Quality Assessment PM ₁₀ Change Between Do Minimum and Do Something Scenario
	Figure 8.15	Local Air Quality Assessment PM _{2.5} Results 2016 Base Year Scenario
	Figure 8.16	Local Air Quality Assessment PM _{2.5} Results 2022 Opening Year Do Minimum Scenario
	Figure 8.17	Local Air Quality Assessment PM _{2.5} Results 2022 Opening Year Do Something Scenario
	Figure 8.18	Local Air Quality Assessment PM _{2.5} Change Between Do Minimum and Do Something Scenario
	Figure 8.19	Ecological Assessment NO _x Results
	Figure 8.20	Ecological Assessment N-Deposition Results
	Figure 8.21	Compliance Risk Assessment Study Area
Chapter 9	Figure 9.1	Built Heritage Assets
	Figure 9.2	Designated Heritage Areas
	Figure 9.3	Non-Designated Heritage Assets
	Figure 9.4	GI Sampling Locations Subject to Archaeological Watching Brief

Chapter Number	Figure Number	Figure Title
Chapter 10	Figure 10.1	Townscape Constraints
	Figure 10.2	Zone of Theoretical Visibility (HGV Traffic)
	Figure 10.3	Zone of Theoretical Visibility (Bridge Lowered)
	Figure 10.4	Zone of Theoretical Visibility (Bridge Raised)
	Figure 10.5	Key Viewpoint Locations
	Figure 10.6	Key Viewpoint 1 – Waveney Drive
	Figure 10.7	Key Viewpoint 2 – Tom Crisp Way
	Figure 10.8	Key Viewpoint 3 – Inner Harbour South
	Figure 10.9	Key Viewpoint 4 – A47 Bascule Bridge
	Figure 10.10	Key Viewpoint 5 – Clemence Street
	Figure 10.11	Key Viewpoint 6 – Denmark Road
	Figure 10.12	Key Viewpoint 7 – Normanston Park
	Figure 10.13	Key Viewpoint 8 – Brooke Peninsula
	Figure 10.14	Key Viewpoint 9 – Kirkley Waterfront
	Figure 10.15	Key Viewpoint 10 – Mutford Bridge
	Figure 10.16	Key Viewpoint 11 – Lake Lothing
	Figure 10.17	Key Viewpoint 12 – Oulton Broad
	Figure 10.18	Key Viewpoint 13 – Camps Heath
	Figure 10.19	Key Viewpoint 14 – Britten Road
	Figure 10.20	Key Viewpoint 15 – Lowestoft Cemetery
Chapter 11	Figure 11.1	Main and Broad Study Area
	Figure 11.2	Extended Study Area
	Figure 11.3	Bat Survey Locations
	Figure 11.4	Reptile Survey Locations
	Figure 11.5	Bird Survey Locations
	Figure 11.6	Invertebrate Survey Location
Chapter 12	Figure 12.1	Historic Landfill Areas
	Figure 12.2	Sampling locations
Chapter 13	Figure 13.1	Noise monitoring locations
	Figure 13.2	Noise Study Area
	Figure 13.3	Short Term Noise Change Contours
	Figure 13.4	Long Term Noise Change Contours
	Figure 13.5	Night time Noise Change Contours
Chapter 14	Figure 14.1	Landfill and Concrete Batching Plant Locations
Chapter 15	Figure 15.1	Port of Lowestoft

Chapter Number	Figure Number	Figure Title
	Figure 15.2	Berth Arrangements
Chapter 16	Figure 16.1	Socio-Economics and Recreation
Chapter 17	Figure 17.1	Water Environment Study Area and Baseline Features
	Figure 17.2	Water Quality Sampling Locations
	Figure 17.3	Waterbody Protection Areas
Chapter 18	Figure 18.1	Flood Zones 2 and 3
	Figure 18.2	Model Location Points
Chapter 19	Figure 19.1	Transport Assessment Junction Assessments
	Figure 19.2	PRoW and Cycle Routes
	Figure 19.3	Community and Private Assets Plan
	Figure 19.4	AADT flows
	Figure 19.5	Lowestoft Walk Isochrones North Bank Without Scheme
	Figure 19.6	Lowestoft Walk Isochrones North Bank With Scheme
	Figure 19.7	Lowestoft Cycle Isochrones North Bank Without Scheme
	Figure 19.8	Lowestoft Cycle Isochrones North Bank With Scheme
	Figure 19.9	Lowestoft Walk Isochrones South Bank Without Scheme
	Figure 19.10	Lowestoft Walk Isochrones South Bank With Scheme
	Figure 19.11	Lowestoft Cycle Isochrones South Bank Without Scheme
	Figure 19.12	Lowestoft Cycle Isochrones South Bank With Scheme
	Figure 19.13	Lowestoft Walk Isochrones Town Centre Without Scheme
	Figure 19.14	Lowestoft Walk Isochrones Town Centre With Scheme
	Figure 19.15	Lowestoft Cycle Isochrones Town Centre Without Scheme
	Figure 19.16	Lowestoft Cycle Isochrones Town Centre With Scheme
Chapter 20	Figure 20.1	Cumulative Impacts Regulation
Chapter 21	Not Applicable	

Table 1-3 – Volume III - Appendices

Chapter Number	Appendix Number	Appendix Title
Chapter 1	Appendix 1A	Potential Health Assessment Topics
	Appendix 1B	Statement of Authority
Chapter 2	Not Applicable	
Chapter 3	Not Applicable	
Chapter 4	Appendix 4a	Tree Preservation Orders
Chapter 5	Appendix 5a	Interim Code of Construction Practice
Chapter 6	Appendix 6A	Scoping Report

Chapter Number	Appendix Number	Appendix Title
	Appendix 6B	Scoping Opinion
	Appendix 6C	Scoping Tracker
Chapter 7	Not Applicable	
Chapter 8	Appendix 8A	Construction Phase Assessment Methodology
	Appendix 8B	Operational Phase Assessment Methodology
	Appendix 8C	Compliance Risk Assessment
	Appendix 8D	Scheme Specific Air Quality Monitoring
	Appendix 8E	Wind rose
	Appendix 8F	Local Air Quality Results for Consultee Receptors
	Appendix 8G	Ecological Assessment Detailed Results and Impacts
Chapter 9	Appendix 9A	Cultural Heritage Desk Based Assessment
	Appendix 9B	Deposit Model
	Appendix 9C	Written Scheme of Investigation (Trial Pits)
	Appendix 9D	Watching Brief Report (Quay Wall ties)
	Appendix 9E	Watching Brief Report (Trial pits)
	Appendix 9F	Written Scheme of Investigation for Future Evaluation and Mitigation
	Appendix 9G	Gazetteer of Cultural Heritage Assets
Chapter 10	Appendix 10A	Verified Photomontage Methodology
	Appendix 10B	Visual Effects Schedule
Chapter 11	Appendix 11A	Preliminary Ecological Appraisal
	Appendix 11B	Bat Survey
	Appendix 11C	BAP List
	Appendix 11D	Wintering Bird Survey
	Appendix 11E	Reptile Survey
	Appendix 11F	Invertebrate Survey
	Appendix 11G	Benthic Survey
Chapter 12	Appendix 12A	Environmental Desk Study Report
	Appendix 12B	Interpretative Environmental Ground Investigation Report
	Appendix 12C	Piling Works Risk Assessment
Chapter 13	Appendix 13A	Baseline noise monitoring results
	Appendix 13B	Sound Power for Construction
	Appendix 13C	Noise meter calibration certificates
	Appendix 13D	Operational Noise and Vibration Nuisance Assessment
Chapter 14	Not Applicable	
Chapter 15	Appendix 15A	Vessel Simulation Report

Chapter Number	Appendix Number	Appendix Title
Chapter 16	Not Applicable	
Chapter 17	Appendix 17A	WFD Assessment
	Appendix 17B	HAWRAT
	Appendix 17C	Sediment Transport Assessment
Chapter 18	Appendix 18A	Flood Risk Assessment
	Appendix 18B	Drainage Strategy
Chapter 19	Not Applicable	
Chapter 20	Not Applicable	

1.2.31 The requirements of Part 1 of Schedule 4 of the 2009 Regulations describes the information that needs to be included in an ES that accompanies a DCO application. The location of this information within this ES is presented in Table 1-4.

Table 1-4 – Requirements of the 2009 Regulations and where in the ES they are fulfilled

Requirement of Part 1 of Schedule 4 of the Regulations	Location within the ES
Description of the development, including in particular: (a) a description of the physical characteristics of the whole development and the land-use requirements during the construction and operational phases; (b) a description of the main characteristics of the production processes, for instance, nature and quantity of the materials used; and (c) an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed development.	Chapter 5 and Chapters 8 to 20 for (c)
An outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects.	Chapters 3
A description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors.	Chapter 4 and Chapters 8 to 20
A description of the likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects of the development, resulting from: (a) the existence of the development; (b) the use of natural resources; and (c) the emission of pollutants, the creation of nuisances and the elimination of waste, and the description by the applicant of the forecasting methods used to assess the effects on the environment.	Chapters 8 to 20
A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.	Chapters 8 to 20 and
A non-technical summary	Volume IV

Requirement of Part 1 of Schedule 4 of the Regulations	Location within the ES
An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the applicant in compiling the required information.	Chapters 8 to 20 detail where in the assessment there have been limitations and assumptions.

1.3 Implementing European Directive 2014/52/EU

1.3.1 European Directive 2014/52/EU (“the 2014 Directive”) was required to be implemented into English law by 16 May 2017. Article 3 of the 2014 Directive contained transitional provisions to allow certain projects to continue to be assessed under Directive 2011/92/EU (“the 2011 Directive”). On 18 April 2017 the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (“the 2017 Regulations”) were made, taking effect on 16 May 2017. The 2017 Regulations implemented the 2014 Directive and in Regulation 37 set out the transitional arrangements in accordance with Article 3. These continued to apply the earlier 2009 Regulations to DCO projects where before 16 May 2017 a request had already been made for a scoping opinion in relation to that project.

1.3.2 As a scoping opinion was requested from the SoS in February 2017 (and, indeed, the scoping opinion was issued by PINS on 7 April 2017), this ES has therefore been prepared on the basis that the DCO will be considered against the 2009 Regulations rather than against the 2017 Regulations.

1.3.3 As anticipated in the Scoping Report (for example in paragraphs 2.2.2, 2.2.5 and 2.2.6 of Appendix 6A) and recognised in the Scoping Opinion (paragraph 2.27 of Appendix 6B), the Scheme has undergone further refinement since the Scoping stage. Nonetheless the Scheme described in this ES (see Chapter 5) remains the same in all fundamental respects as that described in the Scoping Report. The Scoping Report in particular recognised that:

- the land requirements of the Scheme were to be confirmed;
- that work was ongoing in respect of the southern junction arrangements; and
- that the Scheme would involve alterations to local roads, including severing of access.

1.3.4 The refinements to the Scheme in the light of that further work have not resulted in a different Scheme and the Scoping Opinion remains applicable to inform the ES for the Scheme.

1.3.5 Section 5.9 of the Scoping Report identified the potential scope of the impacts of the project on private assets and confirmed that dwellings may be affected by the proposals. Further traffic modelling and junction design work undertaken since the Scoping stage, has confirmed a larger land take than was proposed at the Scoping stage is required for the southern junction, affecting three neighbouring residential properties including the demolition of one property. Furthermore, the bridge design has been refined to a single leaf with slimmer piers and an overhead counterweight and the Scheme will require the closure of Durban Road. These matters are discussed further in Chapter 3, Alternatives and an assessment of these aspects of the design is

considered in the relevant chapter of the ES.

- 1.3.6 In respect of the 2017 Regulations, the Applicant notes that the SoS in issuing a Scoping Opinion (Appendix 6B) for the Scheme in April 2017 set out that “*the Applicant is advised to consider the effect of the implementation of the revised Directive in terms of the production and content of the ES.*”
- 1.3.7 The Applicant considers that, as set out above, by reason of the transitional provisions expressly set out in both the 2014 Directive and the 2017 Regulations, the latter’s implementation strictly has no effect on the production or content of this ES. Thus, in regulatory and procedural terms, the ES has been prepared in accordance with the 2009 Regulations. However, the Applicant recognises that the purpose of the 2014 Directive and the 2017 Regulations is to improve the quality of environmental information that is included in an ES. The Applicant has therefore reviewed the substantive requirements of the 2017 Regulations in relation to the subject matter of each environmental topic and Paragraphs 1.3.9 to 1.3.18 expand upon how this ES has considered the expectations of the 2017 Regulations. That said, in formal terms, the ES remains an ES which had been prepared in accordance with the 2009 Regulations.
- 1.3.8 The 2017 Regulations places a number of new or expanded obligations upon an applicant for a DCO when compared to the 2009 Regulations, although not all of these are applicable to the Scheme. In any event the Applicant has considered in greater detail below the new elements within the 2017 Regulations that would be pertinent had the Scheme come under their remit and has identified where appropriate how this approach already addresses the requirement or why it is not appropriate to do so.

Consideration of Alternatives

- 1.3.9 The 2017 Regulations require a “comparison” of environmental effects of the reasonable alternatives that have been studied when providing an indication of the main reasons for selecting the chosen option. Chapter 3 includes a comparison of the high level environmental effects associated with alternative design options as well as options associated with alternative arrangements within the Scheme alignment.

Monitoring of significant effects

- 1.3.10 The 2017 Regulations require monitoring of the significant effects identified in an ES. As identified in Chapter 8: Air Quality, Chapter 13: Noise and Vibration, Chapter 17: Road Drainage and the Water Environment, and Chapter 19: Traffic and Transport, the Applicant will be undertaking monitoring where this has shown to be necessary following an assessment of the impacts of the Scheme.

Coordination with the Habitats Regulations Assessment process

- 1.3.11 Included in (document reference 6.5) is an HRA Report of the Scheme as required by the Habitats Regulations to assess whether there are likely significant effects upon European Sites; a term given to sites of ecological importance which are designated at the European level.
- 1.3.12 This screening assessment has concluded that the Scheme is not likely to have a significant effect upon the European Sites. A full Habitats Regulation Assessment has therefore not been included in the DCO application for the Scheme.

The 'Do Nothing' Scenario

1.3.13 The 'Do Nothing' scenario, in effect the evolution of the baseline environment were the Scheme not to be constructed, is included where appropriate within the assessments within Chapters 8 to 20 and as identified further in Table 1-5 below.

Table 1-5 – Inclusion of the Do Nothing scenario with the assessments

Chapter	How it has been addressed
Chapter 8 – Air Quality	The do nothing scenario is an intrinsic requirement of the assessment of road traffic during the operational phase in so far that the change in the future with and without the Scheme in place is the measure of the environmental effect caused by the Scheme. Please see Paragraph 8.3.24.
Chapter 10 – Townscape	An assessment of the Lowestoft Future Townscape is included within the ES, which, whilst not strictly the do nothing scenario, does present how the local townscape is expected to develop and change the townscape character in the absence of the Scheme (see Paragraph 10.4.45).
Chapter 13 – Noise	Similarly to air quality the assessment of change in road traffic noise with and without the Scheme in place is a fundamental part of the assessment (see Paragraph 13.3.50).
Chapter 18 – Flooding	The flood risk assessment identifies the change in flood level that would be experienced should the Scheme be constructed, above the do nothing scenario (see Paragraph 18.3.7).
Chapter 19 – Traffic and Transport	The traffic and transport chapter identifies the changes to traffic on the highway network, including junctions, which can be expected should the Scheme be built.

New Environmental Aspects

1.3.14 The 2017 Regulations refer, in Part 4 of Schedule 4, to environmental “factors” that are to be considered for inclusion within an ES; the 2009 Regulations refer to these as the environmental “aspects”. A number of new “factors” have been introduced by the 2017 Regulations.

1.3.15 The new environmental factors that have been introduced through the 2017 Regulations are set out in Table 1-6 below.

Table 1-6 – Environmental Factors included within the ES

Environmental Factors	How it has been addressed
The impact of the project upon climate and the vulnerability of the project to climate change	Including within Chapter 18 is an assessment of the effects of the Scheme upon flood risk as well as the risk of flooding to the Scheme itself. The assessment has been undertaken in agreement with the Environment Agency and forecasts for climate change have been included within this assessment.
Climate (impacts upon the Scheme)	Included within Chapter 18 is an assessment of how the Scheme will be impacted upon in the event of an extreme flood event that has been exacerbated in its magnitude as a result of climate change.
Land (for example land take)	Chapter 15 quantifies the extent to which businesses within the footprint of the Scheme will be affected. The

Environmental Factors	How it has been addressed
	amount of land taken from land owners is quantified in the Book of Reference (document reference 4.3)
Climate (impacts of the Scheme)	The change in greenhouse gas emissions from road transport associated with the operation of the Scheme is included within Chapter 8 of the ES although it is concluded that the traffic effects of the operation of the Scheme will not give rise to any significant climate change consequences. Refer to Paragraphs 8.5.53 to 8.5.54 where the conclusions of a regional emissions assessment are presented.
Human health	Appendix 1A identifies where health effects have been taken into account within the topic chapters of this ES.

1.3.16 In addition, the 2017 Regulations introduce in Part 5 of Schedule 4 a greater number of sources to be considered in an ES than was included within the Regulations, from which likely significant effects could result. The new sources specifically identified in the 2017 Regulations are set out in Table 1-7.

Table 1-7 – New Sources of Environmental Effects

Environmental Factors	How it has been addressed
Risks to human health, cultural heritage or the environment (for example due to accidents or disasters)	<p>Natural disasters in Lowestoft are likely to be limited to those associated with flooding which are addressed in Chapter 18.</p> <p>With regard to accidents, the assessments have included pollution control measures during the construction phase and within the mitigation in the noise, air quality and water environment chapters. Measures to deal with operational accidents, such as spillages from an HGV is included in the water environment chapter. Included in document reference 6.7 is a Preliminary Navigation Risk Assessment that assesses the risk of vessel collision in Lake Lothing during the construction and operational phases of the Scheme.</p> <p>Consideration has been given to the scope of any assessment of the likely significant effects of deliberate acts and suitable vehicle restraint has been provided on the Scheme Bascule Bridge (see 5.5.4).</p>
Demolition works	Demolition of existing structures as part of the construction of the Scheme, and the associated environmental effects of this, are considered in chapter 8, Air Quality and Chapter 13, Noise and Vibration.
Disposal and recovery of waste	The nature of waste that arises during both the construction and operation of the Scheme, and how it will be managed, has been addressed in both Chapter 5 and within Chapter 14: Materials.
The impact of the project on climate	As stated in Table 1-6, a regional emissions assessment has been included within Chapter 8, Air Quality.

Environmental Factors	How it has been addressed
Technologies and substances used	Whilst this requirement is more appropriate for developments that require the use of raw materials as an integral part of their process, such as chemical refineries for example, information has been included within Chapter 5 on the maintenance requirements of the Scheme and this is also addressed in Chapter 14: Materials.

1.3.17 A reference list of the sources used within the ES is also now a requirement of the 2017 Regulations although including footnotes of references is common practice and has been included within this ES.

1.3.18 The 2017 Regulations also require the Applicant to ensure that the ES is prepared by competent experts and a statement must be included in the ES that confirms the relevant expertise and qualifications of the experts. WSP, members of the Institute of Environmental Management's (IEMA) Quality Mark standard for the preparation of ESs have been responsible for the coordination and preparation of all chapters of this ES and included in Appendix 1B is a Statement of Authority that identifies the qualifications of the lead authors of the ES.

1.4 Other regulatory regimes

1.4.1 The DCO includes a number of consents that deal with other regulatory regimes such as a Flood Risk Activity Permit and a Deemed Marine Licence. These consents, and the status of discussions as to those consents that are not included in the DCO are set out in the Consent and Agreements Position Statement (document reference 7.7) and are also discussed in greater detail in the specific environmental aspects covered in this ES where appropriate.

2 The need for the Scheme

2.1 The Need for the Scheme

National policy and guidance

2.1.1 The national significance and need for the Scheme primarily derives from its benefit to the Strategic Road Network (SRN). For this reason, it has been identified as a project of national significance, (as described at paragraph 1.2.1), and is included in the National Infrastructure Delivery Plan 2016-2021 and its associated National Infrastructure Pipeline. In making the S35 direction determining the project's national significance, it was the view of the SoS that the Scheme was a NSIP because:

- It provides a connection to/from the Trans European Network–Transport (TEN-T) and the Strategic Road Network. The TEN-T link is to the A12/A47, one of only a limited number of routes in the East of England which is recognised as such; and
- It would act as a tactical diversion route for the strategic road network (SRN), the A12/A47 when the Bascule Bridge, a nationally recognised pinch point, is closed thereby reducing delays and congestion on the SRN.

2.1.2 In addition, it was stated by the SoS in making this direction that the Scheme:

- Supports national growth potential by directly delivering over 9,000 jobs with a further 3,500 indirect jobs, thus supporting the proposed employment growth;
- Improves connection to/from the Great Yarmouth and Lowestoft Enterprise Zone; and
- Delivers the Port of Lowestoft's role in being the hub for the off-shore wind farms that are part of the East Anglia Array, a major energy supplier for the UK.

2.1.3 Lowestoft is the eastern-most terminus of the SRN in the UK with its end point being the A47 Bascule Bridge. Following the detrunking of the A12 between Seven Hills near Ipswich and the A47 Bascule Bridge in 2001, access to Lowestoft via the SRN is by the A47¹ from Great Yarmouth. Conversely, traffic wishing to access the SRN from the south is directed over the A47 Bascule Bridge.

2.1.4 The 2013 Department for Transport publication, Action for Roads, identified capacity issues of increasing severity on the A47 south of Great Yarmouth into Lowestoft (including the A47 Bascule Bridge), with congestion predicted to be 'severe' on most of that section by 2040. A similar story is told in Annex A of the National Networks National Policy Statement (NNNPS).

2.1.5 Consequently, Highways England's 2015 Route Strategy for the East of England identifies river crossing capacity on the A47 at Lowestoft to be a key challenge in the region. Evidence prepared to support the Route Strategy (collected in 2014), records that the existing "*bascule bridge significantly influences capacity, speed and reliability of the route in Lowestoft*" and is the least reliable section of the SRN in the East of England, recording average peak (defined as Monday to Friday 7-10am and 4-7pm)

¹ The A12(N) from Lowestoft to Great Yarmouth was renumbered as the A47 in March 2017

speeds of less than 20mph. However, no solutions were put forward to resolve this.

- 2.1.6 An Outline Business Case (OBC) for the Scheme was submitted to the Department for Transport (DfT) in December 2015. An OBC application consists of an appraisal, largely in terms of traffic benefits, of how a project will deliver value for money based upon set criteria prescribed by the DfT.
- 2.1.7 In the submission of the OBC, the benefit of the improvements was demonstrated to provide a benefit-cost ratio of 8.50, which comes under the definition of very high value for money.
- 2.1.8 The historic need for the Scheme can further be traced back to the 1989 Roads for Prosperity White Paper as part of a Scheme that included the South Lowestoft Relief Road (SLRR) and the Lowestoft Northern Spine Road (LNSR). The SLRR was promoted and constructed by SCC, and opened to traffic in 2007. A similar arrangement has followed for the LNSR which opened in 2015. There now therefore remains a central gap of less than 650m between these two roads, as the crow flies, but the actual driving distance (via the A47 Bascule Bridge) is nearly 2km. A new crossing of Lake Lothing will help link the SLRR and LNSR.
- 2.1.9 Bridging this gap is not only important for the efficient functioning of the SRN and the TEN-T, but to more widely address the congestion and severance within Lowestoft, caused by the current arrangement of crossing points of Lake Lothing. In turn, improved accessibility throughout the town, to the Port of Lowestoft and to key redevelopment sites identified with the Lake Lothing and Outer Harbour Area Action Plan, enhances the opportunities for regeneration, investment in the Port of Lowestoft and fully realising the growth potential of the Great Yarmouth and Lowestoft Enterprise Zone. Furthermore, eleven wards within Lowestoft have been granted Assisted Area status which are areas recognised as being less economically advantaged and therefore benefit from additional support for development. Five of the wards lie directly to the north and south of Lake Lothing.
- 2.1.10 The Direction from the SoS is set out in Appendix B of the Case for the Scheme (document reference 7.1), and the associated qualifying request made by the Applicant is available on the project website.

National Policy Statement for National Networks

- 2.1.11 As stated in paragraph 1.2.7 the Scheme is a NSIP and therefore the NNNPS is the applicable guidance policy against which the Scheme will be considered. The NNNPS describes the Government's objectives for the delivery of national networks that support a prosperous and competitive economy and improve quality of life. This means:
- Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs;
 - Networks which support and improve journey quality, reliability and safety;
 - Networks which support the delivery of environmental goals and the move to a low carbon economy; and
 - Networks which join up our communities and link effectively to each other.

-
- 2.1.12 Paragraph 2.6 of the NNNPS supports the need for further development of national networks to support national and local economic growth and regeneration, particularly in the most disadvantaged areas.
- 2.1.13 Paragraph 2.8 of the NNNPS identifies the importance of integration between transport modes, particularly the need to improve linkages to ports and airports. Paragraph 2.13 similarly also identifies the importance of the SRN in providing critical links between cities and the UK's major ports,
- 2.1.14 Greater information in the Case for the Scheme (document reference 7.1) identifies how the Scheme aligns with the objectives and requirements of the NNNPS.

National Strategies and Studies

- 2.1.15 The Government's Industrial Strategy (November 2017) seeks to develop a modern industrial strategy to shape a stronger, fairer economy. The strategy outlines five foundations which align to this vision, one of which is to provide a major upgrade to the UK's infrastructure. The importance of infrastructure to the creation of jobs is recognised in the Strategy which seeks to help businesses create high quality, well paid jobs across the country. It states (on page 128) that *"infrastructure is the essential underpinning of our lives and work, and having modern and accessible infrastructure throughout the country is essential to our growth and prosperity"*.
- 2.1.16 The DfT has also recently published a study into England's port connectivity² stating in paragraph 1 of its executive summary that *"at present around 95% of all goods entering and leaving the UK are moved by sea and the UK port sector directly contributes £1.7billion to the UK economy"*. The study also notes in paragraph 3 of the executive summary that *"if our ports are to continue to thriving then the national, regional and local infrastructure supporting them has to be effective and efficient"*. The study recognises that renewable energy sectors are closely linked to the port industry and states at paragraph 2.56 that *"port access will be an issue for their supply chains and their employees"*. In Lowestoft the SRN plays an important role in relation to the Port and the Scheme is identified in the study as a port connectivity project, being funded by the Large Local Majors Fund.

Regional and local policy and plans

- 2.1.17 There are local plans and policies that are relevant to the development for the Scheme and which demonstrate support for its development.
- 2.1.18 The New Anglia LEP's Strategic Economic Plan (SEP) outlines the need for the Scheme. Section 6.39 states
- "The two towns (Great Yarmouth and Lowestoft) suffer from congestion arising from bottlenecks at key locations, including North Quay and Haven Bridge in Great Yarmouth and Lowestoft Bascule Bridge, Both towns have limited river crossings forcing traffic onto a few congested routes"*.
- 2.1.19 The Suffolk Local Transport Plan 2011-2031 outlines that the Scheme is a key improvement project that SCC will work with Highways England to deliver.

² Department for Transport (April 2018), Transport Infrastructure for our global future, A Study of England's Port Connectivity

-
- 2.1.20 The Lowestoft Lake Lothing and Outer Harbour Area Action Plan (AAP) (January 2012) is a Development Plan Document (DPD) that sets the policy framework for the revitalisation of Lake Lothing and the Outer Harbour. The AAP identifies that a third crossing of Lake Lothing is an ambition of WDC.
- 2.1.21 The Waveney Final Draft Local Plan (March 2018), which underwent consultation from the 29 of March 2018 to the 24 of May 2018, makes reference to the importance of the Scheme for economic growth. In particular, it recognises the traffic congestion issues at the two current crossings of Lake Lothing and it acknowledges that the Scheme will help to alleviate traffic congestion in the town, improve connectivity and help deliver regeneration sites.
- 2.1.22 Additionally, the Waveney Final Draft Local Plan (March 2018) outlines that the Scheme will help reduce the effect of traffic in the centre of Lowestoft, and alongside the proposed Tidal Barrier (see Chapter 20) will encourage the inward investment nearer the A47 Bascule Bridge. Policy WLP1.4 sets out that Waveney District Council will work with partners to ensure the timely delivery and success of the Lake Lothing Third Crossing.
- 2.1.23 Additionally, the Suffolk Local Transport Plan 2011-2031³ outlines that the Third River Crossing of lake Lothing in Lowestoft would be a much needed improvement for which there is a very strong desire in the local community.
- 2.1.24 Policy WLP2.3 Peto Square also incorporates the Third River Crossing. Land compromising Peto Square as defined on the policy map is allocated for mixed use development.

³ <https://www.suffolk.gov.uk/assets/Roads-and-transport/public-transport-and-transport-planning/2011-07-06-Suffolk-Local-Plan-Part-2-lr.pdf>

3 Alternatives Considered

3.1 Introduction

3.1.1 This Chapter outlines the alternative Scheme options that have been considered during the design and pre-application process. The 2009 Regulations, in Schedule 4, Part 1, Paragraph 18 state that an ES must include:

“An outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant’s choice, taking in to account the environmental effects.”

3.1.2 This chapter therefore provides an outline of the options and alternatives to the Scheme that have been considered; and through this, what has led to the choice of the Scheme. As stated in Section 1.3, the requirements of the 2017 Regulations relating to the consideration of alternatives (whilst not applicable to the Scheme) have also been addressed within the information presented in this Chapter.

3.1.3 The consideration of alternatives in the development of the Scheme has covered four broad issues:

- The broad location of the Scheme i.e. an eastern, western or central crossing of Lake Lothing, as well as non-road options;
- The constraints associated with the chosen central option corridor and the northern and southern junction arrangements;
- Waveney Drive access arrangements; and
- Bascule Bridge design alternatives.

3.1.4 In respect of the first and second issues, at the outset of the Outline Business Case (OBC) (see Paragraph 2.1.7) stage of the development of the Scheme in 2015, a number of Scheme objectives were identified and a series of alternative options designed to try and meet these objectives were developed and are discussed in detail below. The Section 35 direction application referred to in paragraph 1.2.1 contained a number of Scheme objectives and the Section 35 direction provides confirmation that the Scheme is nationally significant.

3.1.5 As this chapter shows, the decision to progress the central option is the result of assessments designed to ensure that the chosen Scheme performed well in economic, social and environmental terms, resulting in the selection of the optimised solution. This chapter identifies alternatives that are pertinent to both those that were considered early in the development of the Scheme at the OBC stage and those that have been developed since the OBC was submitted.

3.1.6 Once the optimised solution had been identified, it underwent further design refinement to identify and develop the preferred junction arrangements at the north and the south of the Scheme. This chapter provides an outline of the types of junctions that were considered and the reasons for the arrangements chosen that are presented within the Figures that accompany Chapter 5; Description of the Scheme.

3.1.7 This chapter, and the additional information provided in the OBC (document reference

7.4) demonstrate how alternative Scheme options have been considered, and the options appraisal process has been undertaken, as is required by paragraphs 4.26 and 4.27 of the National Policy Statement for National Networks (NNNPS). The Scheme has also undergone screening under the Habitats Regulations (see document reference 6.5) and this concludes that full Habitats Regulations Assessment (HRA) is not necessary. Further discussion of alternatives in the HRA context is therefore not required.

3.2 Study Options (OBC Stage)

3.2.1 The overall aim of the Scheme at the outset of the development of the OBC application and the S35 application, was:

“to stimulate regeneration, sustain economic growth, and enhance Lowestoft as a place to live and work in, and to visit”.

3.2.2 The specific Scheme objectives set in 2015 for the OBC application were:

- To open up opportunities for regeneration and development in Lowestoft;
- To provide the capacity needed to accommodate planned growth;
- To reduce community severance between north and south Lowestoft;
- To reduce congestion and delay on the existing bridges over Lake Lothing;
- To reduce congestion in the town centre and improve accessibility;
- To encourage more people to walk and cycle, and reduce conflict between cycles, pedestrians and other traffic;
- To improve bus journey times and reliability; and
- To reduce accidents.

3.2.3 In order to produce options to align with these project aims, a combination of desktop studies, historical studies and site observations were used to produce a list of spanning bridge, tunnel, non-road and low-cost alternative options. These are identified in greater detail in the OBC (document reference 7.4).

3.2.4 Having taken into account the principal physical and environmental constraints of the project, suitable ‘corridors’ were considered which broadly categorised the Scheme into three distinct locations:

- A western crossing, linking Peto Way with Waveney Drive;
- A central crossing, linking Denmark Road with Waveney Drive; and
- An eastern crossing, close to the existing A47 Bascule Bridge.

3.2.5 In addition, non-crossing options were considered.

3.2.6 The following sections use these general corridor categorisations to more effectively describe how final option selection was achieved and to demonstrate why options at specific locations were eventually rejected.

3.3 Options generation

3.3.1 Using the locational distinctions outlined above, a 'long-list' of 15 options was compiled within the three corridors identified above. For the purpose of option comparison, a series of parameters was developed, enabling all locations and design possibilities to be thoroughly examined against each other. The requirements of the Scheme were developed as listed below:

- Provide a standard width 7.3m single carriageway road with footways and a cycle lane;
- Connect to the existing highway network with at-grade junctions, wherever possible;
- Provide clearance above the railway line;
- Allow large vessels to turn within the confines of the channel;
- Relate logically to the existing highway network;
- Have minimal impact on existing development; and
- Avoid conflicting with planned new development, as envisaged in the Lake Lothing and Outer Harbour Area Action Plan.

3.3.2 Options that were considered but not included in the long list at this point included:

- Fixed Bridge Options – A non-lifting bridge would need to have a 35m clearance, would be more expensive than other options, more visually intrusive and more difficult to tie back in to the existing road network due to the level changes involved;
- Floating bridge options⁴ – this option was not feasible due to the impracticality of a water level structure within Lake Lothing tying in to the minimum height restrictions associated with the East Suffolk line on the northern shore of the Lake. A floating bridge would have to open for any size vessel whereas a conventional bridge would allow for smaller vessels to pass through without the need to open; and
- Dual carriageway options – as well as costing more, Lowestoft's road network has been developed exclusively with single carriageway roads, including the A12 and A47, and therefore there would be limited benefit in single lane roads feeding a dual carriageway only to revert back to single carriageway once the bridge was crossed.

3.3.3 The options appraisal identified a long list of options comprised of bridges, tunnels, junction improvements and road pricing, which are listed in Table 3-1 and also shown in Figure 3.1. It is noteworthy that the number reference of the options has continued to evolve in conjunction with the design generation.

⁴ A floating bridge in this context means a floating superstructure at water level in Lake Lothing, constrained by fixed piers, with a lifting section for the passage of vessels.

Table 3-1 – OBC Scheme Options

Name	Type	From (N)	To (S)
W1	Bascule Bridge	Peto Way	Waveney Drive
W2	Bascule Bridge	Peto Way/ Denmark Road	Waveney Drive
W3	Bascule Bridge	Peto Way/ Denmark Road	Waveney Drive/ Riverside Road
C1	Bascule Bridge	Peto Way/ Denmark Road	Waveney Drive/ A12 Horn Hill
C3 ⁵	Bascule Bridge	Denmark Road	Waveney Drive/ A12 Horn Hill
C4	Bascule Bridge	Denmark Road	Waveney Drive/ A12 Horn Hill
E1	Bascule Bridge	Commercial Road	Belvedere Road
E2	Bascule Bridge	Katwijk Way/ Denmark Rd	Belvedere Road
E3	Bascule Bridge	Katwijk Way	Belvedere Road
E4	Bascule Bridge	Commercial Road	Belvedere Road
L1	Lock/flood barrier with lifting bridges	Denmark Road	Waveney Drive
T1	Road tunnel ⁶	Peto Way/ Denmark Way	Waveney Drive
J1	Junction improvement	Various measures (see 3.3.5) ⁷	Considered as an alternative to a crossing
S1	Smarter Choices	Various measures such as introducing area wide travel planning	Considered as an alternative to a crossing
P1	Road Pricing	Introduce road pricing to discourage traffic	Considered as an alternative to a crossing

3.3.4 Of the 15 options identified in Table 3-1 and taken forward for further assessment, options J1, S1, P1 and L1 were not considered viable alternatives for the following reasons.

3.3.5 Option J1 (Junction Improvement) comprised a package of measures to increase capacity and improve traffic flow at problem junctions throughout Lowestoft without providing a third crossing, but rather ‘fine tuning’ the existing network. This could have included improvements to existing junctions⁷ such as:

- The A12 Tom Crisp Way/Blackheath Road junction;
- The A12 Belvedere Road/Mill road/Kirkley Rise junction; and
- The A1117 Normanston Drive/Gorleston Road junction.

3.3.6 Option J1 was rejected as a viable alternative because it would fail to address the

⁵ Option C2 was subsequently renumbered as L1.

⁶ Only one tunnel option (in the western corridor) was developed as insufficient land is available for the entry and exit in the other corridors. See Paragraph 3.4.3 of Appendix A to the OBC (document reference 7.4).

⁷ Lowestoft Harbour Crossings & Associated Problem Junctions, AECOM, November, 2015

fundamental problem of physical severance caused by Lake Lothing and would therefore not fully meet the objectives of the Scheme.

- 3.3.7** Option S1 (Smarter Choices) was a package of alternative options to encourage people to make fewer journeys by private car. Earlier work by SCC in preparing the OBC suggested that, considering the achievements in modal shift to date and the congestion at the existing crossings that would still be expected even with this option implemented, these would be insufficient to meet the Scheme objectives. This option was therefore rejected because it would be unlikely to fully address the Scheme objectives, including the reduction of severance and unlocking of opportunities for regeneration that are provided through increased vehicular access.
- 3.3.8** Option P1 (Road Pricing) comprised the introduction of road pricing to discourage traffic from congested routes and to encourage people to make fewer journeys by private car. It was considered unlikely that this would be appropriate in the present economic climate, particularly in Lowestoft where parts of some wards are among the 5% most deprived in England. It could also dissuade investment in the town contrary to the Scheme objectives to encourage regeneration and redevelopment.
- 3.3.9** Option L1 (Lock/flood barrier with lifting bridges) was also discounted due to the impact on the operation of the Port, concerns over the intrusive nature of such a structure and the fact that proposals for a Tidal Barrier for Lowestoft (see Chapter 20) are being progressed which would make the flood defence capabilities of option L1 likely redundant. It is noteworthy that the Tidal Barrier proposals are for a barrier to the east of the A47 Bascule Bridge (see Figure 20.1) and therefore cannot act as both a barrier and a crossing.
- 3.3.10** Options J1, S1, P1 and L1 were accordingly not taken forward for further assessment.

3.4 Discounting of Options

- 3.4.1** In light of the AECOM report a long list of 11 remaining options were assessed in the development of the OBC application. Having selected a long-list of 11 remaining options, it was necessary to undertake further investigation into which did not fulfil the Scheme objectives. The need for the selected Scheme to perform well across the three DfT OBC guidance parameters of economic, environmental and social indicators required a process of sifting and discarding of options to ensure that final options made a significant contribution to achieving the Scheme objectives.
- 3.4.2** During the next stage of sifting some further potential options were discarded because they:
- Did not achieve Scheme objectives;
 - Did not fit with existing national, local or regional strategies and priorities;
 - Would cause severe adverse impacts;
 - Were not considered to be technically sound;
 - Were considered unlikely to be affordable; and
 - Were considered unlikely to be acceptable to stakeholders and the general

public.

3.4.3 The reasons why these remaining 11 options (as shown on Figure 3.1) were narrowed down to three final options are set out in Table 3-2 to Table 3-5 and in Section 3.5. It should be noted that only 10 options are shown on Figure 3.1 with Option E2 excluded. This is because it follows the alignment of E3, but with a connection to Commercial Road and this cannot be shown on the figure. Full details are included within the OBC (document reference 7.4).

Table 3-2 – Western Options

Outline of key environmental issues	Decision outcomes
<p>Impact of Leathes Ham Local Nature Reserve. All western options would create disturbance and land take to this protected water body which is used by breeding wildfowl. Construction within the water body would be likely to have an adverse impact upon water quality and the water environment.</p> <p>All western options would involve running through Brooke Yachts and Jeld Wen Mosaic County Wildlife site which has a known population of reptiles, hosts the only mudflat habitat within Lake Lothing and has suitable habitat for nesting birds.</p> <p>Potential to impact bats and reptiles.</p> <p>Potential disturbance of contaminated land.</p> <p>Increased level of landscape impacts.</p>	<p>W1 and W2 do not effectively connect to the existing road network due to the access along Waveney Drive which is a residential street. Option W3 includes a connection into Riverside Road and hence provides an effective link.</p> <p>W1 and W2 would increase traffic flows on Kirkley Run which is a residential street with corresponding noise, air quality and safety concerns.</p> <p>W3 would require greater land take than the Scheme and greater severance of commercial land both north and south of the Lake.</p> <p>Traffic issues would be likely at Victoria Road as a result of the options.</p> <p>Public consultation undertaken in 2014 showed that the western option had almost 24% support as the preferred location.</p>

Table 3-3 – Central Options

Outline of key environmental issues	Decision outcomes
<p>Potential impact to bats and reptiles although at the time of this assessment in late 2015 species specific surveys had not been undertaken and further, more detailed, assessment was recommended to identify the extent of the constraint.</p>	<p>All central options (except L1) passed assessment criteria and are fairly similar and the high level assessment undertaken at the Discounting of Options stage was not sufficiently detailed to discriminate between them.</p> <p>The central option received over 60% support in public consultation undertaken in 2014 as being the preferred location⁸.</p> <p>Poses a potential problem for river navigation to the port, ABP preferring an eastern option at the OBC stage.</p> <p>Least impact of the four main issues on the Sustainable Urban Neighbourhood development to the south of the Lake (outlined within the Area Action Plan (AAP)) adjacent to the Jeld Wen County Wildlife Site (CWS).</p>

⁸ Lowestoft, Lake Lothing Crossing Study, Consultation Report, WSP, October 2014

Table 3-4 – Eastern Options

Outline of key environmental issues	Decision outcomes
<p>Unknown at the time this exercise was carried out.</p>	<p>All eastern options would not resolve the objective of reducing severance in so far that Lake Lothing would continue to create a barrier of more than 2.5km long between the north and south of the town.</p> <p>All eastern options would encourage more traffic to use the A12 corridor on Horn Hill and Belvedere Road to the south of Lake Lothing whilst also putting more pressure on the existing gyratory system around the town centre.</p> <p>Option E1 would only connect directly into Commercial Road and hence provide no traffic relief to the SRN.</p> <p>A new bascule bridge for option E4 would always need to be opened every time the existing A47 Bascule Bridge opened and hence would provide fewer severance benefits than other western and central options.</p> <p>Option E2 would require the railway station to be relocated.</p> <p>E1, E2 and E3 would not significantly improve access to regeneration areas south of Lake Lothing.</p> <p>Only 8% of respondents considered the collective eastern option as a preferred option for the Scheme.</p>

Table 3-5 – Tunnel Option

Outline of key environmental issues	Decision outcomes
<p>Mitigation to prevent loss of important strategic/ functional floodplain at Leathes Ham and Brooke Yachts and Jeld Wen Mosaic would also be required. The areas are also designated as an important location for biodiversity.</p> <p>The tunnel option runs through the Brooke Yachts and Jeld Wen Mosaic County Wildlife site which has a known population of reptiles, hosts the only mudflat habitat within Lake Lothing and has suitable habitat for nesting birds. This ex-industrial area has a mixture of grassland and ruderal habitats with fringing mudflats. There is therefore the potential to significantly impact upon bats and reptiles.</p> <p>High-level assessments determined that the tunnel option would be likely to cause potentially Large Adverse impacts to floodplain and water abstractions and significant measures to mitigate these impacts would be required.</p> <p>Other impacts considered likely to occur included increased discharge into water bodies and therefore a slight decrease in water quality and an increase in the potential of accidental spillage contaminating groundwater or surface water</p>	<p>The tunnel option is the most expensive option for construction. At the OBC stage, the cost of the tunnel was estimated at £118m compared to £79m for a central option and £85m for a western option.</p> <p>The topography of the area surrounding the tunnel proposal would require additional compulsory acquisition of significant third party land to enable standards compliant entry and exit gradients.</p> <p>The tunnel option does not provide pedestrian or cycle routes and therefore fails to meet key environmental and social objectives.</p> <p>It is also more likely that additional, previously unseen or unknown complications associated with the tunnelling option, such as challenging ground conditions and material disposal requirements could arise than on a bridge project, placing further delays, cost and increasing risk onto the project.</p>

3.5 Final Alternative Locations Shortlisted

3.5.1 Following the above exercise in Section 3.4, three broad proposals were progressed to consideration within the OBC submission made to the Department for Transport (DfT) in December 2015. These were:

- A western bridge option;
- A western tunnel option; and
- A central bridge option.

Western option (Bridge)

3.5.2 Of the three western options, W3 was considered the most viable option and was selected to have further assessment undertaken as part of the OBC process. Options W1 and W2 were rejected as part of the assessment undertaken for the OBC process as they were considered likely to cause additional adverse impacts on local residents and the environment. Of particular note was the need for land take from the Jeld Wen CWS and Leathes Ham LNR from which W1 would take the most land and W3 the least. Furthermore, W3 would lead to fewer vehicles accessing the new Waveney Drive junction, with resulting environmental benefits in noise and air quality to residents in this area as it provided an alternative access via Riverside Road that would spread the flow of traffic.

3.5.3 At the OBC stage, Option W3 was proposed to run from a new roundabout at Peto Way, to the north of Leathes Ham, and span both the East Suffolk line and Lake Lothing on a north-south alignment. In order for the new roundabout and bridge to not sever Peto Way, the existing Peto way traffic would have needed to be diverted under a new underbridge and connect into a new roundabout. To the south of the Lake, the new crossing was proposed to connect into Waveney Drive, to the east of Kimberly Road.

Western Tunnel Option

3.5.4 The tunnel option was proposed to flow in a very similar alignment to the western bridge option⁹, running from a new roundabout on Peto Way, to the north east of Leathes Ham, passing beneath both the railway line and Lake Lothing on a north-south alignment. The existing alignment of Peto Way was proposed to be altered so that it could adjoin the newly created roundabout. To the south of the Lake, the tunnel was proposed to connect to Waveney Drive to the east of Kimberly Road.

Central Option

3.5.5 The central option taken forward for OBC submission followed the same alignments as all central bridge options, although the specific option presented connected into Peto Way to the north and into Riverside Road to the south by means of a bascule bridge. The finished bridge height was proposed to be elevated to span across the

⁹ While it was initially assumed that a tunnel might follow either a western or a central alignment, a central option was ruled out due to the difficulty in achieving a satisfactory vertical alignment

railway line, before linking into a new roundabout and road layout near Denmark Road.

3.6 Comparison of final alternative locations to the Scheme

3.6.1 These three options were considered in the OBC against a combination of the following seven aspects:

- User benefits, based on time and vehicle operating cost savings;
- Cost of construction;
- Benefit to cost ratio;
- Traffic impacts;
- Environmental impacts;
- Public and stakeholder support; and
- Delivery of Scheme objectives.

3.6.2 This Section 3.6 therefore presents the assessment and study of these options that was undertaken and submitted alongside the OBC.

User Benefits

3.6.3 Using the DfT's Transport User Benefit Appraisal (TUBA) model, the Present Value of Benefit (PVB) figures in Table 3-6 below were predicted for each of the three options within the OBC.

Table 3-6 – User benefits

Option	PVB (£)
Western bridge option	338,700
Central bridge option	453,300
Western tunnel option	338,300

Construction Cost

3.6.4 At 2015 prices, the schemes were estimated to have construction costs of:

- Western bridge option - £85 million;
- Central bridge option - £79 million; and
- Western tunnel option - £118 million.

Benefit to Cost Ratio

3.6.5 Adopting the DfT model for assessing transport scheme benefits in the OBC, the following BCRs were calculated¹⁰;

- Western bridge option – 5.9;
- Central bridge option – 8.5; and

¹⁰ A higher BCR represents better value for money.

- Tunnel option – 4.27.

Traffic Impacts

3.6.6 The effectiveness of each option to reduce traffic is shown in Table 3-7.

Table 3-7 - Traffic impacts in peak hours

AM Peak	Forecast traffic (2 way) veh/hr		
	On Mutford Bridge	On new crossing	On A47 Bascule Bridge
Do Nothing	2,763	0	2,742
Western Bridge	1,923 (-30%)	1,579	2,327 (-15%)
Central Bridge	1,814 (-34%)	2,245	1,814 (-34%)
Western Tunnel	1,894 (-31%)	1,619	2,318 (-15%)
PM Peak	Forecast traffic (2 way) veh/hr		
	On Mutford Bridge	On new crossing	On A47 Bascule Bridge
Do Nothing	2,972	0	3,058
Western Bridge	2,318 (-22%)	1,653	2,663 (-13%)
Central Bridge	2,314 (-22%)	2,313	2,053 (-33%)
Western Tunnel	2,201 (-26%)	1,832	2,600 (-15%)

3.6.7 As shown in Table 3-7 there is little to differentiate between the effectiveness of all three options in reducing traffic on Mutford Bridge. However, the central bridge option is clearly more effective than the western bridge and western tunnel option at reducing peak traffic flow upon the existing A47 bascule bridge and thus the SRN.

Environmental Impacts

3.6.8 An Environmental Appraisal Report (EAR) was prepared at OBC stage to accompany the submission to DfT. The submission did not include an assessment of landscape as the location of the three options within the urban area of Lowestoft did not warrant such a level of assessment at that stage for the purposes of informing an OBC submission. The EAR concluded against environmental aspects as follows:

Noise

3.6.9 All three options were considered to be likely to result in slight adverse impacts upon the noise environment with nothing to significantly differentiate between them.

Air Quality

3.6.10 All three options were considered to be likely to result in a neutral change in local air quality given that some roads would experience a reduction in traffic and others were likely to experience an increase.

Greenhouse gases

3.6.11 The TUBA model identified greenhouse gas savings associated with all three options, but the central option provided greater savings than the western tunnel or western bridge options.

Townscape

3.6.12 All three options were considered to be likely to result in slight adverse impacts upon the townscape with nothing to significantly differentiate between them.

Historic environment

3.6.13 All three options were considered to be likely to result in slight adverse impacts upon the historic environment with nothing to significantly differentiate between them.

Biodiversity

3.6.14 All three options were considered to be likely to result in moderate adverse impacts upon biodiversity with nothing to significantly differentiate between them. Even though the western bridge and the western tunnel would require land take from Jeld Wen County Wildlife Site (CWS) and Leathes Ham Local Nature Reserve (LNR), all three options were considered to have moderate adverse impacts due to the limited information that was available on the likely presence or absence of protected species.

Water environment

3.6.15 It was identified that the western bridge and western tunnel options were likely to have large adverse impacts upon the water environment, due to their proximity and the land take from the Leathes Ham waterbody. A moderate adverse impact was concluded for the central option due to the likely impacts from the construction as well as the permanent loss of part of the waterbody.

Summary

3.6.16 It was accordingly concluded that environmentally, there was little to differentiate between the three options based upon the information that was available at the time, although the central option performed slightly better with regard to greenhouse gases and the water environment.

Public Support

3.6.17 Consultation undertaken in 2014 pursuant to an earlier Options Appraisal prepared by WSP had previously considered broad options for a crossing location and the results are shown in Table 3-8. This 2014 consultation¹¹ considered three broad alignments, namely an eastern, central and western option that broadly aligns to those presented in Figure 3.1. A tunnel option was not under consideration at this time.

Table 3-8 – Public consultation (2014)

Preferred location	Percentage
West	23.9%
Central	60.6%
East	8.3%
Other	4.4%
No Response	2.8%

¹¹ Lowestoft, Lake Lothing Crossing Study; Consultation Report; October 2014, WSP

Preferred location	Percentage
TOTAL	100%

Stakeholder support

3.6.18 A survey of businesses was undertaken by Suffolk Business School in October 2015 to support the preparation of the Outline Business Case. It included a question as to which corridor (west, east or central) was preferred for a third crossing. The results of this are shown in Table 3-9.

Table 3-9 – Stakeholder survey

Corridor	First choice	Second choice	Least preferred
West	61 (40%)	61	20
Central	70 (48%)	66	5
East	18 (12%)	9	99
No response	0	13	25
TOTAL	149	149	149

3.6.19 It was however identified during the course of stakeholder engagement with ABP in both 2014 and 2015 that a central option had the potential to impact on the operation of the Port, which would need to be mitigated through the design process, and at this time ABP's opinion was that an eastern crossing would have the least impact upon harbour operations.

Delivery of Scheme objectives

3.6.20 Traffic forecasts undertaken at the OBC stage showed that the western and tunnel options would be less effective than the central option in reducing traffic on the existing crossings. The tunnel option would also be unlikely to be able to deliver any benefits to pedestrians and cyclists.

3.6.21 Paragraphs 3.6.3 to 3.6.16 of this chapter identify the comparison of the three options as identified in the OBC as required by DfT. It was concluded that the central option would most closely align with the Scheme objectives.

Preferred option

3.6.22 The assessment undertaken for the OBC, demonstrated across a number of criteria that the central bridge option should form the Scheme on account of it being the least expensive and delivering the highest BCR, predicted to have fewer environmental impacts and a higher level of public and stakeholder support.

3.7 Central Option Design Alternatives

Constraints

3.7.1 The design of roads is informed by the parameters and criteria that are provided in the Design Manual for Roads and Bridges (DMRB) which is a compendium of document/guides that informs the designer how new roads should be designed. The

Scheme has incorporated these documents/guides as appropriate, with particular reference being made to TD16/07 – Geometric Design of Roundabouts and TD9/93 – Highway Link Design.

- 3.7.2** The design of roundabouts has also been constrained by the Ratio of Flow to Capacity (RFC) requirements for the assessments of junctions. The RFC is a measure used to identify the capacity of a junction through analysis (using ARCADY or PICADY; see Chapter 19), and the ratio of 0.85 has been adopted for all roundabout junctions on the Scheme in the design year. Alternative junction arrangements that did not meet this standard were redesigned accordingly.
- 3.7.3** Within the constraints of the DMRB, the alternative arrangements for the design of the central option are constrained by a number of parameters although ultimately the Scheme design that has been adopted has been a factor of balancing the engineering requirements with the degree of land that is required to achieve that, with a view to minimising the impact of the Scheme on landowners and occupiers in the vicinity (and the associated costs of provision).
- 3.7.4** These are identified in Table 3-10.

Table 3-10 – Design Constraints

Constraint	Implications to the design
Service Tunnel	The main alignment has been moved approximately 10m west from that originally identified during the OBC for option C3. This movement was due to the presence of an existing service tunnel that runs north/south under Lake Lothing and at the request of the owner (UK Power Networks) who indicated that the bridge construction and its associated fenders must be no closer than 5m from the tunnel.
Network Rail minimum clearance requirements	Network Rail has a requirement for a minimum height clearance of 4.98m above the railway line.
Existing ground levels	The Scheme is required to tie in to both Peto Way and Waveney Drive on the north and south respectively at their existing ground levels.
Lake Lothing minimum clearance requirements	Allowing for tie in, a maximum height clearance of 12m above the HAT (Highest Astronomical Tide) is available, and to facilitate the passage of smaller vessels without a bridge lift this has been set as a minimum clearance requirement.
Carriageway gradients	The finished road level should achieve a tie-in to the existing highway network in accordance with DMRB guidance gradients of no greater than 6%. Slacker gradients could be adopted, but they would increase the lengths of the approach ramps considerably and move the tie-in points in a way that could create more interference with the existing highway network.
Carriageway bend radius	To provide a tie-in with both Peto Way/Denmark Road in the north and Waveney Drive in the south, the alignment of the Scheme is constrained by avoiding an existing ABP building adjacent to the west of the Scheme corridor. However deflection (bending) is needed in the carriageway as it approaches the roundabouts to slow vehicles down for safety reasons. Conversely this deflection cannot be too severe and thus constrain visibility.

Constraint	Implications to the design
Minimum land take	The Lake Lothing area both to the north and south of the Lake is reasonably developed with a number of private and public buildings lying in close proximity to the Scheme corridor. Preserving existing buildings, where possible to do so, has been an objective throughout the development of the designs although this has not been possible at the Southern Roundabout.

3.7.5 These constraints when viewed in cumulation have resulted in a very narrow horizontal and vertical corridor in which the Scheme can be constructed, which demonstrates that there are no viable main alternatives to the alignment of the Scheme. The consideration of main alternatives within the central crossing corridor has therefore been focused upon the width of the carriageway (including provision for cyclists & pedestrians), the junction arrangements and the design of the bascule bridge, including pier arrangements.

Carriageway Widths

3.7.6 Notwithstanding the objective for a minimum 7.3m single carriageway, a three or four lane crossing was investigated as part of Scheme development. However, it has been determined that a single carriageway is preferable for the following reasons:

- As identified in Chapter 19, a single carriageway bridge is expected to be able to manage the flow of traffic in the design year and a three or four lane crossing is therefore not required.
- Additional land take would be required from the Port for the increased width and the increased geometric requirements to the northern and southern junctions would lead to other additional land take and the likely requirement for demolition of existing property.

3.7.7 Having identified that the single carriageway central option was the preferred alignment and solution for the Scheme, the design work progressed to developing suitable junction arrangements at the north and the south of the Scheme where connections to Peto Way and Waveney Drive will be respectively provided. Junction design has been taken forward on the basis of achieving the relevant DMRB standard.

Northern Junction

3.7.8 Three junction options were considered comprising the following forms:

- A ghost island¹²;
- Traffic signals; and
- A new roundabout

3.7.9 Design iterations around these three options have been subject to traffic modelling, the results of which have indicated that only a roundabout option will provide sufficient capacity in the design year of 2037.

3.7.10 Design iteration of several different roundabout options of different sizes and Inscribed

¹² A ghost island is one that is delineated by road markings rather than kerbs

Circle Diameter (ICD) have been considered and rejected as they either require too much land take or they do not perform as required in meeting the RFC (see Paragraph 3.7.2).

- 3.7.11 This process has led to the development of a roundabout layout as shown in Figure 5.1 which also includes a dedicated left lane for eastward travelling traffic from Peto way towards Rotterdam Road and Denmark Road.
- 3.7.12 Provision of the dedicated left lane removes eastbound traffic from negotiating this roundabout, improves the capacity of the junction and reduces the size it would otherwise need to be.

Rotterdam Road/Denmark Road Junction.

- 3.7.13 The existing roundabout at the junction of Rotterdam Road with Denmark Road has been modelled to ascertain whether improvements are required to accommodate the change in flow associated with the Northern Junction.
- 3.7.14 Several options were investigated including changing the layout to a ghost island, but, following traffic modelling of the junction, the optimum solution identified was to retain the junction as a roundabout, but to convert it to a smaller roundabout compared to its present size.

Southern Junction

- 3.7.15 Three junction options were considered comprising the following forms:
- A ghost island;
 - Traffic signals; and
 - Roundabout.
- 3.7.16 Design iterations around these three options have been subject to traffic modelling, the results of which have indicated that only a roundabout option will provide sufficient capacity in the design year of 2037. See Chapter 5 for more information on this arrangement.
- 3.7.17 The Applicant has also concluded that a roundabout that meets the RFC capacity and DMRB standards cannot fit within existing highway land and consequently the Scheme requires land take from a number of land owners adjacent to the Southern Roundabout to allow the highway to expand. Consideration of the land take requirements at this location is discussed in further detail in Chapter 15: Private Assets.

Waveney Drive Access Arrangements

- 3.7.18 The Applicant has considered three options for a new junction from Waveney Drive which connects to the retained section of Riverside Road (see Figure 3.2) which will allow continued access to businesses as well as providing access into an allocated development site hence addressing one of the Scheme objectives.
- 3.7.19 The Scheme provides a T-junction on Waveney Drive in the location shown on Figure 5.1. This arrangement was adopted following the consideration of the following alternatives:

- Option A - A road through the car park associated with the offices of Essex and Suffolk Water;
- Option B - A road along the eastern boundary of the former Jeld Wen site; and
- Option C – A road through the former Jeld Wen site further to the west than Option B.

3.7.20 Option A was discounted after discussion with the landowner (who is also likely to be the promoter of the allocated development), who highlighted the importance of continued current parking provision for their operations as well as their longer term plans to extend the current building over the area in question that would have been affected by this option. They also noted that this option would involve the need to reposition the parking area on to adjacent land in its ownership.

3.7.21 Option B was discounted as it would impact on the landowners immediately to the east of the former Jeld Wen site, both through potential land take to achieve satisfactory visibility splays and through road safety concerns given the proximity of its own access points. Additionally, there is utilities infrastructure that could be costly and complicated to relocate in the south east corner of the former Jeld Wen site.

3.7.22 Option C has been chosen as the alignment that forms part of the Scheme due to it being the option that best serves the Scheme, is supported by the landowner and it being beneficial to the future development of the Jeld Wen site which is envisaged and encouraged in the Local Plan and the Area Action Plan.

3.7.23 Preliminary layouts for adding signals to the Waveney Drive junction, were also considered but were discounted due to safety issues in relation to residential property accesses opposite the former Jeld Wen site. Traffic leaving these properties would have become isolated between the signal stop lines and would have been unable to see the signal heads to safely exit. It was also considered to be inappropriate to stop the traffic on Waveney Drive in advance of the new crossing to allow priority to a minor access road.

Durban Road

3.7.24 Three alternatives for Durban Road have been considered as follows:

- Remain open (current two-way flow);
- Remain open one way (entry or exit only); and
- Two way closure.

3.7.25 Retaining the current two way flow was discounted due to the level of traffic flows that were forecasted after implementation through traffic modelling of the Scheme. The geometry of the Southern Roundabout in this location also made the connection to Durban Road non-compliant with DMRB and therefore unusable by some large vehicles such as HGVs and coaches.

3.7.26 Due to the size of the Southern Roundabout, and its optimum location to connect to Waveney Drive, the closure of Durban Road is required. The extent of the Scheme also encroaches on private properties in this location at which land will need to be

acquired as part of the Scheme.

3.7.27 A one-way entry or exit was discounted due to the potential for Durban Road to become a 'rat-run' as traffic in the operational phase will be drawn to the shortest route.

3.7.28 Therefore, as this increase in traffic along Durban Road was considered to be undesirable for highway capacity and safety reasons, especially given the presence of East Point Academy approximately 600m south west of the Order limits, it was considered that the closure of Durban Road to vehicular traffic as it junction with Waveney Drive was required. This does lead also to a reduced flow at the Southern Roundabout with a resulting decrease in queue lengths (see the Transport Assessment (document reference 7.2) for further information).

3.8 Bascule Bridge Design Alternatives

Pier Arrangement

3.8.1 As previously stated in Table 3-10 the minimum clearance between the HAT and the bridge deck is 12m. A width of 35m is required between the bridge piers and a width of 32m between the fenders (see Plate 5-1), as this is the existing width of the navigation channel within the Lake and hence will provide the least disruption to port operations.

3.8.2 For a bridge of such parameters, spanning the width of Lake Lothing, a minimum of two piers are required within the Lake and given that the bridge superstructures also require supporting piers, consideration has been given to whether four piers in the Lake is more appropriate than two piers.

3.8.3 Following investigation of the south quay wall, and particularly the excavation of the ties and the anchor wall, and also obtaining as-built information on the north quay wall, a two pier solution within the Lake was considered the optimum solution rather than a four pier solution. This is primarily because the bridge piers and foundations are located such that they will not adversely affect the quay walls. In addition, the two pier solution offers a lower construction cost and it will result in less disturbance to the lake bed and the potential environmental implications from disturbing a greater amount of sediment.

Deck structure

3.8.4 Three different types of bridge deck have been considered;

- Steel;
- Precast (concrete structures fabricated offsite); and
- In situ (concrete structures fabricated in position).

3.8.5 The precast option would not be suitable for the span over the railway due to the engineering form requiring a thicker deck which would breach the headroom restriction that is required by Network Rail. The steel option allows for the depth of the deck to be reduced, but would require periodic repainting with the associated logistical difficulties that would arise in doing so (e.g. possibly requiring possessions of the East Suffolk Line). This option would also increase the whole life cost of the Scheme.

3.8.6 The post-tensioned deck is therefore what has been included within the Scheme as it allows a more aesthetically pleasing curve as well as having a lower cost, and does not have the same issues discussed in Paragraph 3.8.5.

Single lifting / dual lifting options

3.8.7 Included within Chapter 5 are details of the Scheme that provide for a single lifting bascule bridge with a counterweight structure. Further information is provided in the Design Report (document reference 7.5).

3.8.8 At the time of Scoping (Appendix 6A), it was envisaged that a dual lifting bascule bridge with a simple trunnion would be progressed. However, following a comprehensive design review, it has been concluded that a single leaf with a vertical counterweight would result in the following which makes it a preferable option:

- the possibility of the bascule bridge being supported over (rather than under) the deck resulting in slimmer piers and therefore less impact in the marine environment (particularly hydromorphology);
- less impact on flood risk elsewhere (by virtue of a lower volume of material in the Lake);
- a more readily maintainable opening mechanism; and
- a reduction in construction costs,

3.8.9 It is noteworthy that the FRA, included in Appendix 18A, identifies a reduced risk of flooding from the Scheme compared to that associated with a dual lifting bascule bridge as presented in the PEIR. Furthermore, the Vessel Simulation (see Appendices 15A) and the Navigation Risk Assessment (document reference 6.7) identifies similar findings for vessel movements within Lake Lothing as a result of the Scheme compared to the dual lifting bascule bridge.

3.9 Conclusion

3.9.1 The Applicant has presented within this Chapter the main alternatives that have been considered in the development of the Scheme. This has included information on matters of principle on whether a crossing is required, where it would be best located and the form that the crossing would take i.e. a bridge or a tunnel. The Applicant has also provided information on the alternative arrangements for detailed aspects of the Scheme, including junction arrangements, the form of the bridge and the type of opening arrangement.

3.9.2 Clear reasons for the choices that have been made in the development of the Scheme have been provided by the Applicant in this chapter.

4 The Existing Environment

4.1 Introduction

4.1.1 This Chapter provides an overview of the existing environment in the vicinity of the Scheme. A description of the existing environment relative to each individual environmental aspect is considered in Chapters 8 to 19 and this chapter is not meant to repeat what is included in those chapters, but rather to identify the constraints that are pertinent to all or some of the assessments.

4.1.2 This chapter is supported by Figures 4.1 to 4.3 that show the assets identified in this Chapter as well as Appendix 4A. Figure 4.1 identifies the assets within and adjacent to the Order limits that are mentioned within this chapter.

4.2 Land uses adjacent and within the Scheme boundary

4.2.1 For the purposes of presentation this chapter describes the existing environment affected by the Scheme in three parcels; the land that lies within and adjacent to the Scheme to the north of the Lake, the Lake itself, and the land that lies adjacent to the Scheme to the south.

The north

4.2.2 The Scheme connects into Peto Way adjacent to the North Quay Retail Park. To the north of the new roundabout and realigned roundabout on Denmark Road there are residential properties, industrial and commercial facilities and a play area. The immediate land surrounding the new roundabout is currently vacant hard standing.

4.2.3 Travelling southwards towards Lake Lothing the Scheme crosses the East Suffolk railway line into and from Lowestoft Station and the operational Port of Lowestoft. The land to both the east and west of the Scheme is used for port operations along the northern quay of Lake Lothing with the grain silo building located to the east. This building, of an approximate 50m in height, is a useful visual gauge being of similar height to the Scheme bascule bridge (see Chapter 6) and is also clearly shown in Key Viewpoint Locations 3, 4 and 9 (see Figures 10.8, 10.9 and 10.14). The quay to the west of the Scheme is used for berthing wind farm service vessels.

Lake Lothing

4.2.4 Lake Lothing is operated by Associated British Ports (ABP) and ABP act as both the landowner and operator of the Port as well as the Statutory Harbour Authority (SHA). For the purposes of this ES, references to ABP will identify, where appropriate, whether the assessment is focused upon impacts on their operations or their statutory duties as Harbour Authority. The boundary of the operational Port of Lowestoft is shown on Figure 15.1 whereas the limit of the SHA is the Mean High Spring Tide (MHST) level.

4.2.5 Within Lake Lothing itself, there is a navigation channel, and quays on both sides of the Scheme bascule bridge. The navigation channel is used 24 hours a day by both ABP for commercial purposes and other maritime users. Greater information on the use of the navigation channel is provided in Chapter 15 and Chapter 16.

4.2.6 The Port of Lowestoft is important to both the employment and economic status of Lowestoft in so far that 1,174 jobs and £79 million of revenue per annum are attributable to the port's operations¹³. The area of the Port affected by the Scheme is used as part of the operational Port including as access routes for large commercial vehicles, road transportable cranes and project cargo items.

The south

4.2.7 The quays on the south side of Lake Lothing are presently unused for port operations, although a quay wall is present. Nexen, a manufacturer of fork lift trucks, operates from a building to the immediate east of the Scheme and buildings which house Suffolk County Council and Waveney District Council operations are present to the west.

4.2.8 Travelling south along the Scheme, to the east is a car showroom, operated by Motorlings whilst to the west are buildings which house office based operations of Essex and Suffolk Water and Riverside Business Centre as well as the Waveney registry office. There is also an existing area set aside for biodiversity enhancement (associated with Essex and Suffolk Water's operations) specifically targeting the five banded weevil wasp *Cerceris quinquefasciata* as shown on Figure 11.6.

4.2.9 To the south of the Scheme, where it connects into Waveney Drive, there are residential houses, as well as a beauty clinic business.

4.3 Wider land uses

4.3.1 Beyond the Order limits of the Scheme shown in Figures 4.1 and 4.2, the predominant land uses are dominated by urban development including transport, residential, leisure, commercial and industrial uses. The port operations of ABP cover an area of approximately 40 ha¹⁴ and includes both industrial and recreational uses (see Figure 15.1). There are two existing bridges that cross Lake Lothing. The A47 Bascule Bridge at the east of Lake Lothing and Mutford Bridge to the west. These are shown on Figure 1.1.

4.3.2 Of particular note are the areas of vacant industrial land on the south side of Lake Lothing, Normanston Park and Leathes Ham to the north-west and the marina to the west of Lake Lothing.

4.3.3 Further afield, approximately 1.5km west of the Scheme and along Lake Lothing, lies The Broads National Park (see Figure 10.1).

4.4 Designated Sites

4.4.1 The footprint of the Scheme does not lie within any designated sites at either the national or local level, however, a number of designated sites are present within the initial study areas defined in each environmental topic. Those that have been included within the assessments have been summarised in Table 4-1 and Table 4-2 and shown on Figure 4.2. Where environmental aspects are not included, there are no designated

¹³ Information from ABP's website

¹⁴ Information available from ABP's website.

sites within the relevant study area.

Table 4-1 – Environmental Statutory Designations

Environmental Aspect	Study area (distance from Scheme boundary)	Statutory Designated sites
Cultural Heritage (Chapter 9)	500m	<ul style="list-style-type: none"> • South Lowestoft Conservation Area; • 16-28 Victoria Terrace (Grade II listed building) • Wellington Esplanade (Grade II listed building) • Ashurst (Grade II listed building)
Townscape and Visual Impact (Chapter 10)	3km	<ul style="list-style-type: none"> • The Broads National Park
Nature Conservation (Chapter 11)	2km for nationally designated sites and 30km for internationally designated sites that were agreed with Natural England as being within the scope of the assessment.	<ul style="list-style-type: none"> • Leathes' Ham Local Nature Reserve • The Broads Special Area of Conservation (SAC) • Broadland Special Protection Area (SPA) • Broadland Ramsar • Southern North Sea candidate SAC (cSAC) • Outer Thames Estuary SPA • Outer Thames Estuary proposed SPA (pSPA) Extension • Alde-Ore Estuary SPA; • Benacre to Easton Bavents SPA;
Noise and Vibration (Chapter 13)	2km	<ul style="list-style-type: none"> • Noise Important Area 5003 • Noise Important Area 5004 • Noise Important Area 11285
Water Environment (Chapter 17)	2km	<ul style="list-style-type: none"> • Lake Lothing Main River • Kirkley Stream Main River

4.4.2 Despite Sprat's Water and Marshes Sites of Special Scientific Interest (SSSI) and the Barnby Broad and Marshes SSSI lying outside of the 2km study area for nationally designated sites, (2.1km and 5.1km respectively) they have been included in the assessment because they are constituent parts of the Broadland SPA/Ramsar site. This approach reflects consultation with Natural England.

4.4.3 During statutory consultation, the inclusion of Corton Cliffs SSSI was raised as a site that should be considered given that it is closer than other designated sites that have

been included within the scope of the assessment.

- 4.4.4 Corton Cliffs SSSI is a site designated for being a nationally important site from the Pleistocene era described in Natural England's citation as a "*clear sequence of two tills with non-glacial water-lain sands between, together with a third till and associated deposits above*".
- 4.4.5 As Corton Cliffs SSSI is approximately 3.5km from the Scheme Order limits, and as there will be no direct land take, further assessment in the ES was not considered to be necessary.

Table 4-2 – Environmental Non-Statutory Designated Sites

Environmental Aspect	Study area (distance from Scheme boundary)	Non-Statutory Designated site
Nature Conservation (Chapter 11)	2km for non-statutorily designated sites	<ul style="list-style-type: none"> • Brooke Yachts and Jeld Wen Mosaic County Wildlife Site • Kirkley Ham County Wildlife Site • Outer Harbour County Wildlife Site.

- 4.4.6 In addition to these statutory and non-statutory sites there are two Tree Preservation Orders (TPOs) in place for trees within the Order limits. The location of these is shown in Figure 4.3 although it should be noted that not all trees are now present on site and the approximate location of the previously removed trees is also shown on Figure 4.3.
- 4.4.7 TPO number 269 is an American sweetgum *liquidambar styraciflua* that is a replacement for the original tree that was the subject of the TPO and was felled in 2005. TPO number 61 covers five individual elm trees and a sycamore, as well as an area of four sycamore and two elm trees (shown as G1 on Figure 4.3). The citations are included in Appendix 4A.

5 Description of the Scheme

5.1 Introduction

- 5.1.1 Chapter 5 is a description of the Scheme and any other descriptions in this ES are merely a summary of, or subsidiary to, this Chapter.
- 5.1.2 Accompanying this chapter is Figure 5.1 which shows the Order limits for the Scheme.
- 5.1.3 The SoS in the Scoping Opinion (Appendix 6B) identified that there were seven aspects of the Scheme during the construction and operational phase of the Scheme that needed to be addressed within the ES (amongst other aspects identified elsewhere in the Scoping Opinion). Furthermore, in Paragraph 2.45 of the Scoping Opinion the SoS requested that the environmental effects of wastes to be processed and removed from site should be addressed. For ease of reference these aspects are identified in Table 5-1 below.

Table 5-1 – Scheme aspects

Scheme aspect	Addressed in the ES
Land use requirements	Figure 5.1 and Chapter 15
Site preparation	Paragraph 5.6.4
Construction processes and methods	Section 5.6
Transport routes	Paragraph 5.6.10
Operational requirements included the main characteristics of the production process and the nature and quantity of materials use, as well as waste arisings and their disposal	Section 5.7 and Chapter 14
Maintenance activities including any potential environmental or navigation impacts	Section 5.7 and Chapter 15
Emissions – water, air and soil pollution, noise, vibration, light, heat, radiation.	Water – Chapter 17 Air pollution – Chapter 8 Soil pollution – Chapter 12 Noise – Chapter 13 Vibration – Chapter 13 Light – Chapter 10 and Chapter 11 Heat – Not applicable as there are no significant emissions of heat from the Scheme in the construction or operational phase. Radiation – Not applicable as there are no significant emissions of radiation or electro magnetic frequencies.
Waste	Chapter 14: Materials

5.2 Scheme Description

The Route

- 5.2.1 The Scheme involves the construction, operation and maintenance of a new bascule bridge highway crossing linking the areas north and south of Lake Lothing in Lowestoft.
- 5.2.2 The Scheme would provide a new single-carriageway road crossing of Lake Lothing, consisting of a multi-span bridge with associated approach roads, and would comprise:
- an opening bascule bridge over the Port of Lowestoft, in Lake Lothing;
 - on the north side of Lake Lothing, a bridge over Network Rail's East Suffolk Line, and a reinforced earth embankment joining that bridge, via a new roundabout junction, to the C970 Peto Way, between Rotterdam Road and Barnards Way; and
 - on the south side of Lake Lothing, a bridge over the northern end of Riverside Road including the existing access to commercial property (Nexen Lift Trucks) and a reinforced earth embankment (following the alignment of Riverside Road) joining this bridge to a new roundabout junction with the B1531 Waveney Drive.
- 5.2.3 The Scheme would be approximately 1 kilometre long and would be able to accommodate all types of vehicular traffic as well as non-motorised users, such as cyclists and pedestrians.
- 5.2.4 The opening bascule bridge design would allow large vessels to continue to use the Port of Lowestoft.
- 5.2.5 A new control tower building would be located immediately to the south of Lake Lothing, on the west side of the new highway crossing, to facilitate the operation of the opening section of the new bascule bridge.
- 5.2.6 The Scheme would also entail:
- the following changes to the existing highway network:
 - the closure of Durban Road to vehicular traffic at its junction with Waveney Drive;
 - the closure of Canning Road at its junction with Riverside Road, and the construction of a replacement road between Riverside Road and Canning Road to the west of the Registry Office; and
 - a new access road from Waveney Drive west of Riverside Road (New Access Road), to provide access to property at Riverside Business Park;
 - improvements to Kimberley Road at its junction with Kirkley Run; and
 - part-signalisation of the junction of the B1531 Victoria Road / B1531 Waveney Drive with Kirkley Run;
 - the provision of a pontoon for use by recreational vessels, located to the east of the new highway crossing, within the Inner Harbour of Lake Lothing; and
 - works to facilitate the construction, operation and maintenance of the

Scheme, including the installation of road drainage systems; landscaping and lighting; accommodation works for accesses to premises; the diversion and installation of utility services; and temporary construction sites and access routes.

5.2.7 The works required for the delivery of the Scheme are set out in Schedule 1 to the draft DCO (document reference 3.1), where they are referred to as "the authorised works", with their key component parts being allocated reference numbers, which correspond to the layout of the authorised works as shown on the Works Plans (document reference 2.4). The General Arrangement Plans (document reference 2.2) illustrate the key features of the Scheme.

Reference Design

5.2.8 The Scheme proposals described within this ES are referred to as the Reference Design which has been developed to a stage that is appropriate to prove both engineering and construction feasibility and to inform the assessment within the Environmental Statement.

Limits of Deviation

5.2.9 As discussed in Chapter 1 the 'Rochdale Envelope' provides for robust environmental assessment of NSIPs with 'limits of deviation' for the design parameters of the Scheme. The limits of deviation assessed in this ES are set out in Table 5-2. The assessments within this ES have been based upon the Reference Design that is sufficiently developed to undertake an assessment within the parameters of the limits of deviation (see Table 5-2).

5.2.10 The horizontal and vertical limits of deviation are set out in the draft DCO (document reference 3.1).

Table 5-2 – Limits of Deviation

Item	Parameters
Pier cross sectional area	Pier area of 140m ² +50%. The FRA (Appendix 18A) concludes that there are no significant effects arising from the introduction of two piers of 180m ² each in Lake Lothing or if their sizes were increased by 50%.
Cofferdams (steel piled)	Two steel piled cofferdams have been assessed, although the Scheme may be built without the need for cofferdams. These could project into Lake Lothing to a maximum as far as the navigational channel upon operation i.e. leaving a 32m distance for navigation at all times.
Northern roundabout Diameter Inscribed Circle Diameter (ICD)	The northern roundabout has an ICD of 50m and a tolerance of ±5m
Southern roundabout Diameter (ICD)	The southern roundabout has an ICD of 50m and a tolerance of ±2m
Road Carriageway gradient along centre line of road	A maximum of 6% and a minimum of 0%.
Fender	A minimum of 16 approach fenders, 10 in the passage, but this could be upgraded to a complete barrier with no gaps in it along the profile

Design Standards and Cross Section

5.2.11 The new crossing has been and will continue to be designed primarily using the Design Manual for Roads and Bridges (DMRB) which has informed the limits of deviation in Table 5-2. On the basis of the Reference Design the Scheme has been designed to facilitate:

- Design speed of 30mph (50kph);
- Carriageway width of 7.3m (2 x 3.65m wide traffic lanes), plus associated curve widening on tight radii and at and around the roundabouts where appropriate;
- Safety strip between the proposed footway and carriageway to the east of the crossing and the combined footway/cycleway to the west of the crossing; and
- Combined footway/cycleway on the east and a segregated footway and cycleway on the west.

5.2.12 These elements are shown in Figure 5.1 and the General Arrangement Drawings.

Structures and Earthworks

5.2.13 A new bascule (lifting) bridge will be constructed to allow the passage of vessels within Lake Lothing. When closed, the bridge will have a clearance of no less than 12m above the Highest Astronomical Tide (HAT) level which will enable smaller boats to pass under the bridge as shown in Plate 5-1. This 12m clearance combined with its location west of some of the docks, means that it will have to open less frequently than the existing A47 Bascule Bridge at the harbour entrance as discussed in greater detail in Chapter 16. The frequency of opening will be determined through a Scheme of operation for the Scheme Bascule Bridge which will be developed pursuant to the DCO.

5.2.14 Vessel simulation modelling has been undertaken of the Scheme allowing a clear span between the new bascule bridge piers of 35m, and a clear width of 32m between fenders. This is shown on Plate 5-1. The vessel simulation modelling is discussed in greater detail in Chapter 15 and in Appendix 15A. Also shown in Plate 5-1 is the infinite air draught and the arc of the opening mechanism that is available when the bridge is open to marine vessels. Plate 5-1 also shows the arc of the opening mechanism of the bascule bridge.

5.2.15 The lifting element of the Scheme bascule bridge is designed to operate in a rolling motion rather than pivoting upon a single point. Further information is included in the Design Report (document reference 7.5).

5.2.16 The lifting mechanism of the Scheme Bascule Bridge has been designed to withstand winds of 20m/s (approximately gale force 8).

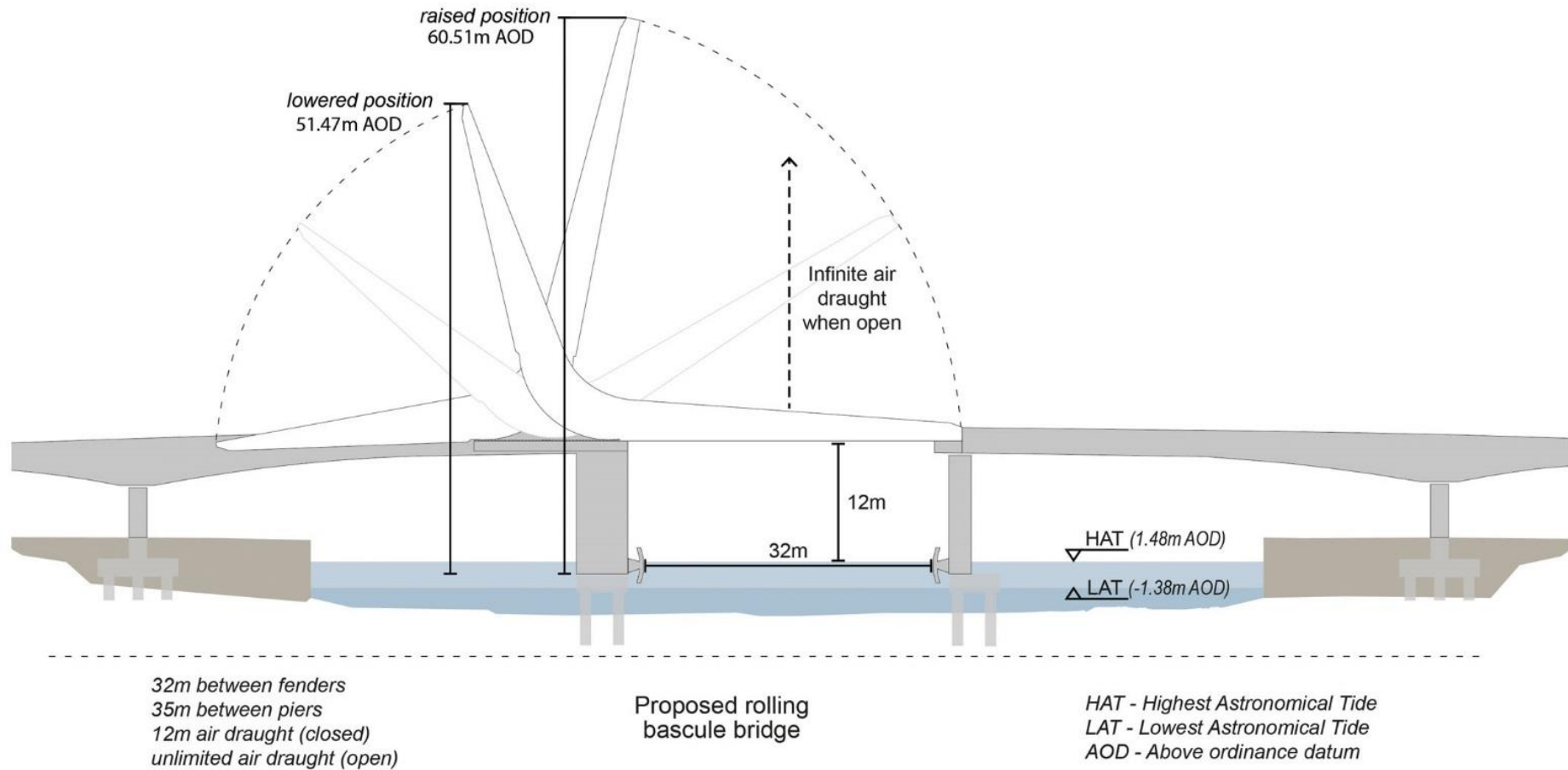


Plate 5-1 – Rolling bascule mechanism

- 5.2.17 The Scheme Bascule Bridge will require two piers within Lake Lothing.
- 5.2.18 ABP, in their capacity as Statutory Harbour Authority, has advised in their response to the Scoping Report (Appendix 6A) that the new bridge will require a continually staffed control tower and the Applicant has developed proposals for this to the south west of the bridge structure as shown on the elevation plans. The control tower will incorporate:
- A bridge control room and all associated welfare facilities;
 - Access to the bridge deck from ground level via a gantry to the embankment;
 - Bridge plant room; and
 - A sub-station.
- 5.2.19 The control tower building will provide the possibility for future access to the bridge deck for pedestrians with access via stairs or a lift subject to appropriate development being brought forward in the locality.
- 5.2.20 A series of fenders will be provided within the Lake to provide protection to the bridge piers against impact from ships. Although subject to detailed design, it is anticipated that there will be up to sixteen discrete collision protection fenders, three each located northwest, northeast, southwest and southeast of the bridge, along with suitable pier protection fendering within the navigation channel. The locations of these are shown in the General Arrangement Drawings.
- 5.2.21 Geotechnical Site Investigations (GI) on land commenced in July 2017 which has provided information to progress the foundation design for the approaches to the Scheme Bascule Bridge.
- 5.2.22 The quantities of material imported to site during the construction stage will depend on the form of construction of the superstructure although for the purposes of this ES, a set of worst case quantities have been identified in Chapter 14.

5.3 Main Junction Arrangements

- 5.3.1 Presented in Figure 5.1 are roundabout arrangements at both the north and south of the Scheme as well as arrangements for access to existing Riverside Road properties as shown on Figure 4.1.

The northern junction

- 5.3.2 On the northern bank, a new roundabout is proposed to be installed to the west of the current Denmark Road roundabout to connect the Scheme with the existing localised road network. This will also necessitate the shrinking of the existing Denmark Road roundabout. Heading south towards Lake Lothing, the new road layout will link into the construction of a new embankment which connects to the elevated bascule bridge, enabling users of the crossing to span the Lake and connect into the new road layout on the southern bank.

The southern junction

- 5.3.3 On the southern shore, the new crossing will follow the line of Riverside Road, initially at a high level, descending to a new roundabout junction at the intersection of Riverside

Road and Waveney Drive, west of the Motorlings showroom. The carriageway will be widened to dual lanes in each direction between the southern roundabout and the existing A12 Tom Crisp Way roundabout. Local roads which presently connect directly to Riverside Road would be served from a new connection to Waveney Drive. Durban Road will be turned into a cul-de-sac and a turning head provided at the limits of the new southern roundabout. Access will be maintained for emergency vehicles via dropped bollards, pedestrians and cyclists.

Access to Waveney Drive Properties

- 5.3.4 A non-signalised 'T' junction will be provided on Waveney Drive (See Figure 5.1) which will provide a New Access Road into the remaining section of Riverside Road which passes the northern access to the Waveney District Council/Suffolk County Council Offices (see Figure 4.1).
- 5.3.5 The new connection to Canning Road will involve the relocation of the current southern access into the existing SCC and Waveney District Council (WDC) car park.
- 5.3.6 Access to the existing Nexen site will be provided from the remaining section of Riverside Road below the new crossing through a bridge structure.
- 5.3.7 Access to Motorlings will be via a 'left in and left out' junction on Waveney Drive near the A12 roundabout. The two existing accesses from Riverside Road will be stopped up.
- 5.3.8 Access to the existing telephone mast and land adjacent to Riverside Road will be provided from the New Access Road connecting Riverside Road with Waveney Drive.
- 5.3.9 The vehicular access to 34 Waveney Drive will be removed.

5.4 Drainage

- 5.4.1 The drainage design is shown on Figure 5.3 and shows how drainage will be managed within the Scheme, and is described further below. This section of the ES should be read alongside the Drainage Strategy provided in Appendix 18B.

Scheme Bascule Bridge

- 5.4.2 On the lifting element of the Scheme bascule bridge surface water will drain to the north of the south approaches from the centre of the Lake. Surface water will then enter the respective drainage systems to the north or the south.

To the North of Lake Lothing

- 5.4.3 Run off from the carriageway including the bridge deck (north of the opening section of the bascule bridge) will be collected by a combined kerb drainage system to the proposed northern junction.
- 5.4.4 North of the crossing run-off from the main carriageway and associated combined footway/cycleway and segregated footway/cycleway will discharge into a Sustainable Drainage System (SuDS) adjacent to the northern roundabout prior to discharge into the Anglian Water (AW) sewer via a hydrobrake or equivalent to restrict the discharge to a rate acceptable to the AW .
- 5.4.5 A separate storage facility will be provided between Denmark Road and the Scheme

to store run-off from the Rotterdam Road area.

- 5.4.6 The junction area itself and the surrounding area will be served by a conventional kerb and gully/manhole system before run-off is discharged into the proposed drainage ponds.

To the South of Lake Lothing

- 5.4.7 The cycle and footways will drain to the carriageway. Run off from the carriageway including the bridge deck (south of the opening section of the bascule bridge) will be collected by a combined kerb drainage system to the proposed southern junction.
- 5.4.8 The discharge of the run-off for the main carriageway and associated footways and combined footway/cycleway will discharge into Lake Lothing at two separate locations, north and south of the Lake.
- 5.4.9 South of Lake Lothing a storage facility; sized to store the run-off from a 1 in 100 year storm with a six hour duration will be provided and this will be located beneath the bridge structure. The tank will then discharge into Lake Lothing with oil interceptors or similar (See Chapter 17) via an existing Anglian Water surface water sewer.
- 5.4.10 South of the proposed bridge serving Nexen, the drainage run-off will be captured by oversized pipes within the vicinity of Waveney Drive, before it is discharged into the existing Anglian Water surface water sewer in Waveney Drive. A hydrobrake or equivalent will be incorporated into the layout to restrict the discharge to a rate acceptable to the appropriate drainage authority. In either scenario, this interaction will be controlled through the provisions of the draft DCO.

Riverside Road

- 5.4.11 The proposed drainage for the new access to the Riverside Business Park will be a conventional highways manhole and gully system. It is assumed that the new systems will outfall into the existing drainage system which is present in Waveney Drive, Canning Road and the remaining length of Riverside Road west of the crossing.

5.5 Other Design Elements

Lighting

- 5.5.1 The full extent of the Scheme will be lit in accordance with DMRB requirements with lighting columns as shown in Figure 5.5. The lighting design will be further developed during detailed design and will utilise LED luminaires with specialised optics in proximity to the waterways to minimise obtrusive light. The final lighting design will be approved pursuant to a DCO requirement and protective provisions for Network Rail and ABP.
- 5.5.2 Feature lighting of the Scheme Bascule Bridge is discussed in greater detail in the Design Report (document reference 7.5). The final feature lighting design will be secured through the DGM (document reference 7.6) will be subject to further detailed design in discussion with ABP and Network Rail pursuant to their protective provisions.

Technology

- 5.5.3 Technology and signalling arrangements will be provided as part of the Scheme

consisting of CCTV monitoring, electronic signage confirming the new bascule bridge status and associated warning signs and barrier systems. The locations of electronic signage will be determined at detailed design pursuant to the DCO requirement for the signage strategy.

Road Restraint

- 5.5.4 New near side road restraint will be provided for the full length of the new crossing as required by SCC and Network Rail.
- 5.5.5 This road restraint over the railway crossing is known as an H4A barrier, is solid, and is a standard specification and requirement of Network Rail for all such road schemes over their infrastructure.

Landscaping

- 5.5.6 The landscaping and public realm proposals are shown on the Landscaping Plans (document reference 2.8 which is secured through the DCO) and allow for a variety of native shrubs and hedgerows, amenity grassland and specimen trees in appropriate locations. Hard landscaping in the form of steps and terraced areas will also be provided to the east of the northern roundabout.
- 5.5.7 The landscaping proposals also allow for an area within the north of the Scheme that is allocated for biodiversity and greater information is provided in Chapter 11.

Non-Motorised User Crossings

- 5.5.8 At the approaches to both the northern and southern roundabouts there will be crossing points allowing both pedestrians and cyclists to cross both Denmark Road, Peto Way and Waveney Drive. Crossing points are also proposed on Rotterdam Road in the north, on the approach to the bascule bridge and on the new access points to Riverside Road Business Park and Motorlings. These are shown on the General Arrangement Drawings.

5.6 Construction

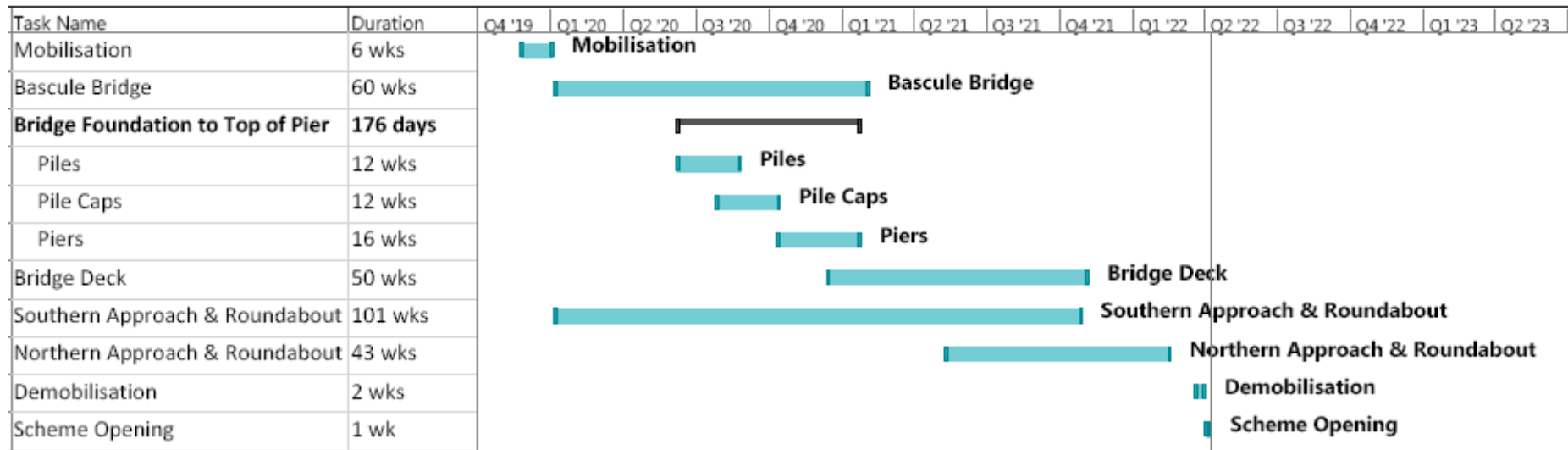
Constructability Advice

- 5.6.1 The Applicant has sought constructability advice on the approach to the construction of the Scheme that allows parameters to be assessed within this ES.

Construction Programme

- 5.6.2 Subject to planning approval, it is anticipated construction of the Scheme would commence in late 2019 and take approximately two years to complete.
- 5.6.3 An approximate programme, based upon a two year construction period, which shows the main construction activities from mobilisation through to Scheme opening is shown in Plate 5-2.

Plate 5-2 – Preliminary construction programme showing likely timings and durations to inform the assessments



Site Clearance

- 5.6.4 Site clearance to facilitate construction, and the establishment of construction compounds will include the breaking of hard standing, the demolition of buildings, the clearance of vegetation and the removal of unsuitable material. Site clearance will be undertaken as the first stage of works for each phase as detailed in Table 5-3.

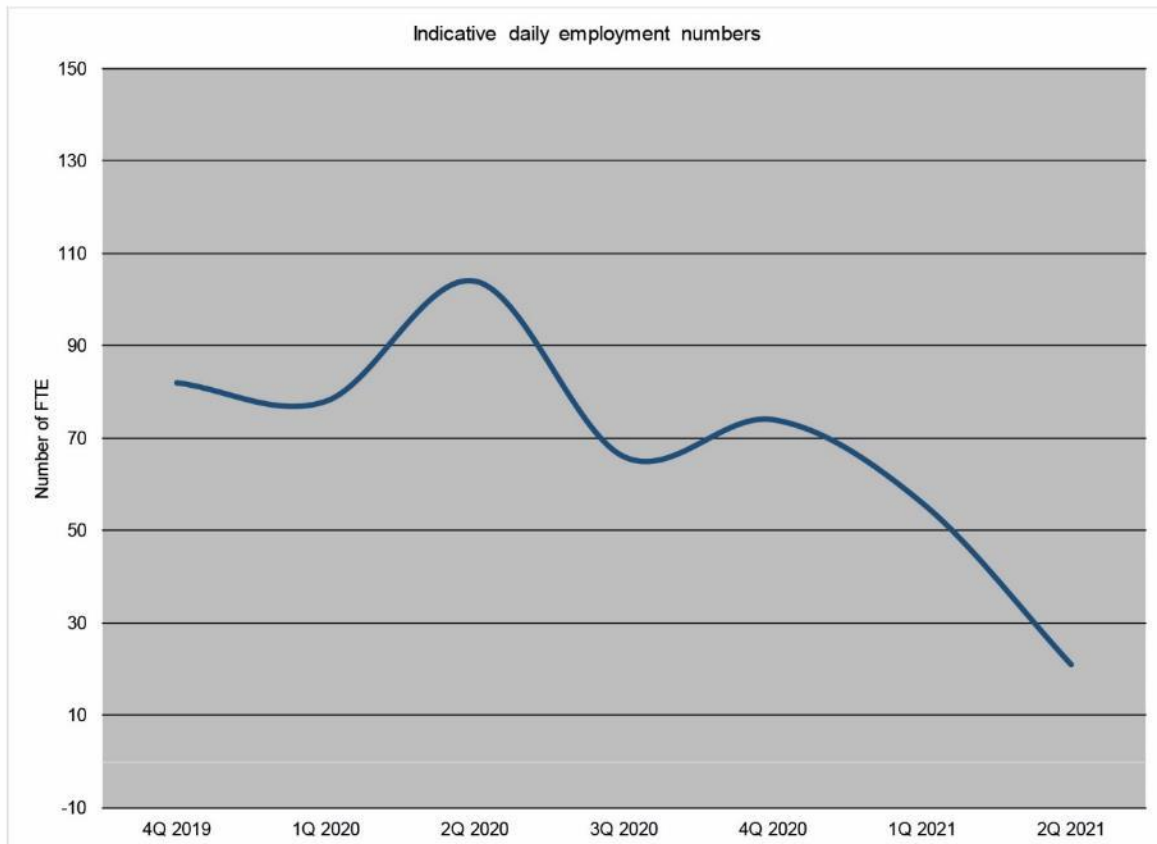
Construction compounds

- 5.6.5 Three construction compounds, that will incorporate car parking and site offices during construction, will be required for the construction of the Scheme, and are all located within the Order limits. These are shown in Figure 5.4 and measure 1.6, 1.2 and 2.5 hectares accordingly from north to south.
- 5.6.6 Access to these compounds will be via Denmark Road, Commercial Road and Riverside Road when construction commences, although access to the southern compound will be via the New Access Road following completion (see Table 5-3 for construction phasing).
- 5.6.7 Compound areas will be restored to previous condition, unless otherwise agreed with the land owner i.e. ABP, Network Rail and WDC.

Construction staffing and transport

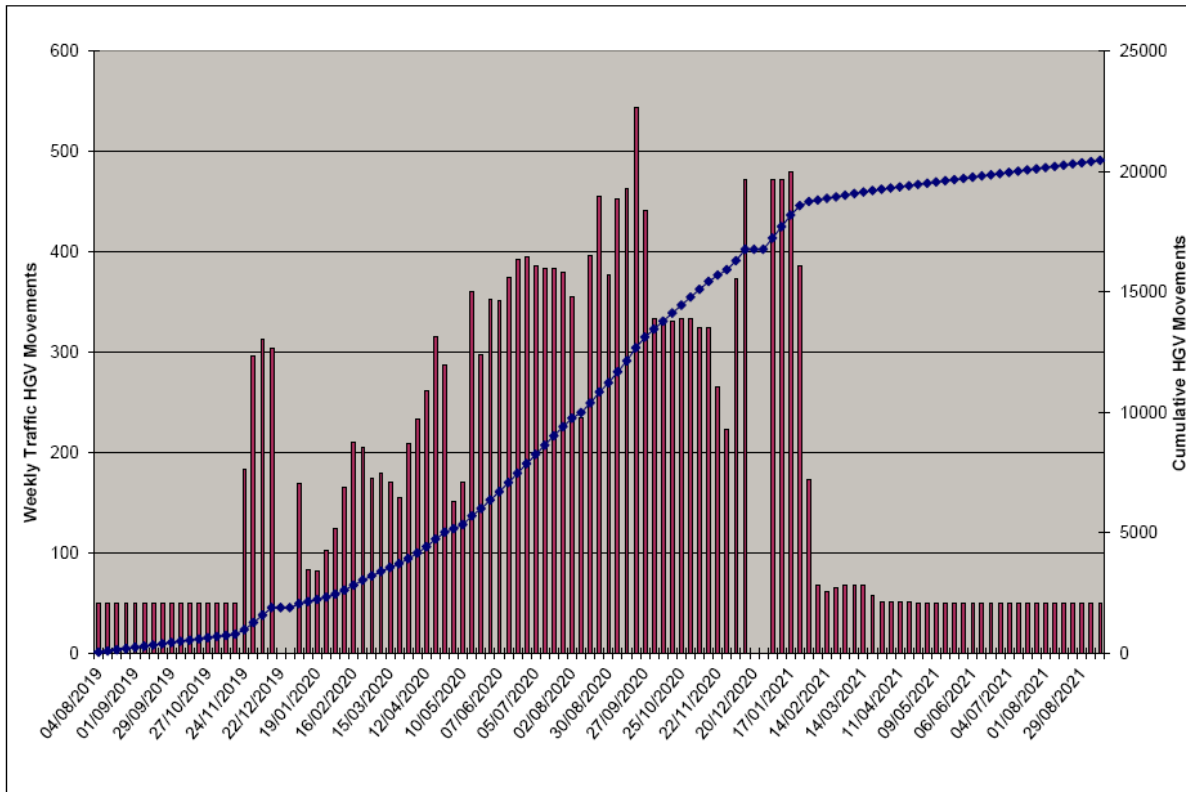
- 5.6.8 In their Scoping Opinion (Appendix 6B), PINS noted that construction related traffic and transportation impacts on the local highway network was one of the three main potential issues that required assessment within the ES. SCC has therefore considered the delivery profile of staff and construction materials as well as an estimate of the number of staff likely to be employed during the construction phase to inform the likely construction traffic movements.
- 5.6.9 An indicative profile of numbers of staff employed on site on a daily basis is therefore included in Plate 5-3 below. As shown, the peak in staff numbers is anticipated about a third of the way through the construction and there is anticipated to be approximately 100 full time equivalents working on site each day.

Plate 5-3 – Indicative daily employment numbers



- 5.6.10 A profile of HGV movements on a weekly basis is shown in Plate 5-4 below based upon an approximate two year construction period. For the purposes of the assessment within this ES, it has been assumed that the split of vehicles is 50% to the north of Lake Lothing and 50% to the south.
- 5.6.11 As shown in Plate 5-4, HGV movements peak at approximately 540 per week (or 108 per day assuming a five day week). Plate 5-4 also shows the cumulative numbers of HGV movements that totals just over 20,000 over the Construction phase of the Scheme. Assuming a 50/50 split of movements there will be 54 HGV movements per week day to both the north and south of Lake Lothing at the peak of construction.
- 5.6.12 It is noteworthy, in order to provide a worst case assessment, that the information presented in Plate 5-4 shows one-way movements associated where a one-way movement is a single access to or egress from a site.

Plate 5-4 – Weekly HGV movements



Construction Code of Practice

5.6.13 The Applicant’s contractor for the Scheme will be required to operate to an approved Construction Code of Practice (CoCP) document which forms a requirement to the DCO. As a CoCP is bespoke and individual to each contractor based upon their methods of working, it is not possible to produce this in advance of the submission of the DCO application. However, an ‘Interim CoCP’ that provides a clear framework and a number of requirements for the contractor is included in Appendix 5A. This interim CoCP forms the basis of the ‘full CoCP’ that the contractor will be responsible for producing and obtaining the necessary approvals contained within the interim CoCP, as is set out by the text of that document. .

The interim CoCP sets out the topic specific construction mitigation measures that the Applicant’s contractor will have to put into place in constructing the Scheme.

Construction phasing – Local highway network

5.6.14 It is currently anticipated (subject to detailed design) that construction will be phased as set out in Table 5-3.

Table 5-3 – Construction phases of the Scheme

South of Lake Lothing	
Phase	Main tasks
1	Construction of the Waveney Drive junction and new road to allow access to the Riverside Business Park.
2	Creation of an alternative route into Nexen
3	Construction of the underpass into Nexen
4	Construction of the internal roads to the Riverside Business Park
5	The construction of the approach from the proposed southern roundabout past Motorlings and NWES's Riverside Business Centre.
6	Construction of the northern elements of the new southern roundabout
7	Construction of the southern elements of the new southern roundabout
North of Lake Lothing	
Phase	Main tasks
1	The embankment to the bridge over the railway will be constructed.
2	The northern roundabout would be constructed off line without need for highway diversions.
3	The northern roundabout is tied into Denmark Road

Construction phasing – bascule bridge elements

5.6.15 The installation of the bascule bridge and the structures on the approach is likely to follow a process as identified in Table 5-4.

Table 5-4 – Construction phases of the Scheme bascule bridge

Phase	Main tasks
1	Installation of cofferdams
2	Piling
3	Construction of temporary decks from north and south piers
4	Shuttering
5	Construction of the piers and fenders
6	Installation of the bascule bridge
7	Surfacing
8	Installation of the mechanical equipment

Installation of the East Suffolk Line Bridge

5.6.16 The installation of the structure over the East Suffolk Line will follow a similar process in so far that the piling of the main pier structures will precede the shuttering. It is presently proposed that the bridge over the East Suffolk Line, and the operational Port will be constructed perpendicular to the main alignment with the bridge then rotated into position.

Construction requirements

5.6.17 The following measures are likely to be required at different stages during the construction phase of the Scheme and are summarised below.

Traffic Management

5.6.18 Traffic Management (TM) will be required to allow existing roads to be kept open during the construction phase and the Contractor may require lane closures and temporary traffic lights to facilitate this. For the purposes of the assessment, it has been assumed that traffic management will need to be in place for over a year at the southern roundabout to divert services.

Possessions

5.6.19 Possessions (i.e. a closure) of the East Suffolk Line and the Navigation Channel of Lake Lothing will be required at some point during the construction phase to facilitate safe construction. Any possession will be with prior notice to the affected parties and constructability advice to the Applicant that in the case of the navigation channel, the closure would be likely to be three weeks and for the East Suffolk Line would be likely to be overnight.

5.6.20 The possession of the navigation channel is required to facilitate safe construction of the installation of the bascule bridge. For the purposes of the assessment it has been assumed that this possession will take place for three consecutive weeks during the summer months when recreational vessel movements in Lake Lothing are likely to be highest. The construction of the Scheme Bascule Bridge may also require occasional narrowing of or other restriction on use of the navigation channel where necessary to do so to facilitate construction.

Cofferdams and temporary piers

5.6.21 The Scheme may be constructed with the use of cofferdams and temporary piers within the cofferdams from both the north and south quay. Whilst it may be possible to build the Scheme without the need for cofferdams, they have been included and assessed to identify a worst case approach to the assessment. The worst case cofferdam arrangement is shown in Figure 5.6 where two cofferdams are constructed; one from each quay.

Statutory Undertaker Diversions

5.6.22 Discussions with the following Statutory Undertakers have taken place and will continue during detailed design and construction, to enable the diversion or extinguishment of services where necessary. This process will be undertaken through the operation of the protective provisions for their benefit within the DCO. Further detail can also be found in the Statement of Reasons (document reference 4.1). The Statutory Undertakers consulted include:

- Anglian Water;
- British Telecommunications;
- Cadent Gas;

- Northumbrian Water;
- UK Power Networks Holdings; and
- Virgin Media.

24 hour construction

5.6.23 Normal operational hours will be:

- Monday to Friday – 07:00 to 19:00; and
- Saturday – 07:00 to 13:00.

5.6.24 Limited 24 hour construction will be required and is considered in the assessment of night time construction noise in Chapter 13.

Piling

5.6.25 Piling of foundations will be required to form the foundations of the Scheme Bascule Bridge and its approaches. Included in Appendix 12C is an Interim Piling Risk Assessment (PRA) that assesses the potential risks to human health and controlled waters from piling.

5.6.26 This assessment has identified that piling incorporating the following is required:

- Temporary casing will be driven to a depth of 6-10m when piling on land;
- Permanent casing may be required to a depth of 2-3m when piling into the lake bed;

5.6.27 Prior to the detailed design stage the assessment has identified that bored piles are the most appropriate piling technique given the ground conditions that are present.

5.6.28 Boring will take place through the temporary casing by augering techniques and progress beneath the base of the casing under the support of a dense fluid such as bentonite to maintain a positive hydrostatic head. Once excavated to the required depth, the concrete will be injected from the base displacing the bentonite at the surface as the pile is formed.

5.7 Operation and Maintenance

Operation

5.7.1 As stated in Paragraph 5.2.13, the frequency of opening will be determined through a scheme of operation for the Scheme Bascule Bridge which will be developed pursuant to the DCO. However, for the purposes of the assessments within the Environmental Statement it is been assumed that there will be no openings of the Scheme Bascule Bridge during the AM and PM peak road traffic period.

Maintenance

5.7.2 Maintenance of the Scheme will be the responsibility of SCC as the highway authority and they will maintain the Scheme for its life as appropriate. It is likely that the maintenance regime of the bascule bridge will require the following which has informed the assessment within this ES:

- Flexible hose replacement on a five year basis that could require the bridge to not lift for two to three days;
- Cylinder and pump refitting on a ten year basis that could require the bridge to not lift for two to three days; and
- Cylinder and pump replacement on a 25 year basis that could require the bridge to not lift for up to seven days.

5.7.3 It is considered that all other routine maintenance operations, including landscape maintenance, can be undertaken without a bridge closure or the need for excessively noisy plant or equipment.

5.8 Decommissioning

5.8.1 The Scheme bascule bridge will be designed to have a life of at least 120 years in accordance with the requirements of BS EN 1990:2002.

5.8.2 Any decommissioning would be likely to be completed in less time than the construction of the Scheme and whilst the Applicant have no plans to decommission and remove the Scheme, were it to be removed, it would be likely to require a similar degree of plant, equipment and disturbance within the navigation channel to that predicted during construction with the processes taking place in reverse to the construction programme.

5.8.3 Likewise, should the Scheme be decommissioned it will be probably be necessary to remove by road the materials that arise from the demolition and these are likely to be greater in frequency than those envisaged during construction given that decommissioning would be carried out over a shorter time frame.

5.8.4 However, given that the Applicant has no plans to decommission the scheme, and as the environmental constraints in the mid-22nd Century cannot be reasonably predicted, further consideration of decommissioning is not considered appropriate, although Chapter 14 provides information the nature of the materials to be used in construction and their suitability.

6 Scoping and Introduction to Environmental Assessments

6.1 Introduction

- 6.1.1 Regulation 8 of the 2009 Regulations makes provision for an applicant to request a scoping opinion from the relevant authority.
- 6.1.2 As noted earlier in Paragraph 1.2.6, an EIA Scoping Report was submitted to PINS in February 2017 which provided an outline approach for the identification and assessment of likely significant effects for each of the identified environmental aspects within the Scoping Report. A copy of this Scoping Report is included as Appendix 6A.
- 6.1.3 On 7 April 2017, PINS, on behalf of the Secretary of State (SoS) provided their Scoping Opinion to the Applicant and this Scoping Opinion is included as Appendix 7B.
- 6.1.4 The executive summary to the Scoping Opinion identified the main potential issues to be considered within the ES to be:
- Impacts on designated ecological sites and their features;
 - Impacts as a result of mobilisation of contaminants and sediments; and
 - Construction traffic and transportation impacts on the local highway network.
- 6.1.5 These three main potential issues have been addressed individually in this Chapter in Paragraphs 6.2.2 to 6.2.11.
- 6.1.6 This chapter provides an introduction to the scope of each assessment that has presented within Chapters 8 to 20 that has been included within this ES. It details the main scope of the assessment within each chapter and how through scoping, S42 consultation and further consultation with stakeholders the assessment has been refined and progressed.
- 6.1.7 Included in Appendix 6C is a matrix of all pertinent environmental comments by consultees that were made at the scoping stage in relation to the issues above and all other environmental issues. This matrix includes reference to where in the ES the comments of the consultees have been addressed within this ES. Responses to the S42 consultation that are not environmental in nature are addressed in the Consultation Report (document reference 5.1) and its associated appendices (document reference 5.2).
- 6.1.8 This Chapter also introduces common themes within the environmental assessments that have been undertaken and to present how the scope has been informed through scoping and consultation.

Transboundary Effects

- 6.1.9 The Scoping Opinion (Appendix 6B), notes in paragraph 4.42 that the ES should identify whether the Scheme has the potential for significant transboundary impacts and, if so, what these are and which EEA states would be affected.
- 6.1.10 However, on 18 July 2017 the SoS published a screening of the Scheme against

whether significant transboundary effects were likely. This screening was undertaken by PINS on behalf of the SoS and concluded that the Scheme was not likely to have a significant effect on the environment in another European Economic Area (EEA) state.

6.1.11 Further to the assessments within this ES, no additional information has been identified warrants any further revision to this Transboundary Effects assessment.

6.2 Main Potential Issues

6.2.1 As discussed in Paragraph 6.1.4, the SoS drew attention to three main potential issues associated with the construction and operation of the Scheme. These are as follows:

Impacts on designated ecological sites and their features

6.2.2 Sites designated for their ecological interest have been identified in Table 4-1, and assessed in both Chapter 11 and the HRA Report (document reference 6.5). The sites that have been considered were proposed within the Scoping Report (Appendix 6A) and following comment from Natural England, two additional Special Protection Areas (SPA), namely Alde-Ore Estuary SPA and Benacre to Easton Bavents SPA, were added to the assessment.

6.2.3 The HRA Report has considered how the Scheme could impact upon the habitats and species for which these sites are designated.

Impacts as a result of mobilisation of contaminants and sediments

6.2.4 The assessment within the ES has included an assessment of the sediment within Lake Lothing and whether it is contaminated in nature and therefore suitable for offshore disposal (see Chapter 12 and Appendix 12B). This assessment should be read in conjunction with the assessment in Chapter 17 where the findings of the Sediment Transport Assessment are presented.

6.2.5 The Sediment Transport Assessment (see Appendix 17C) has been undertaken to assess how the Scheme will alter the movement of sediment in Lake Lothing and to identify if there is a greater mobilisation of sediment as a result.

Construction traffic and transportation impacts on the local highway network

6.2.6 The Applicant obtained constructability advice, see Paragraph 5.6.1 which identified the profile of construction vehicles accessing the Scheme. This identified a peak of 108 HGVs per day, as a two way movement¹⁸ with the movements split between three construction compounds as shown in Figure 5.4. It is therefore highly unlikely that these 108 HGV movements will be along a single access road and as this is the identified peak in movements, it can be considered to be a worst case because it will only have a duration of one week during the approximate two year construction period.

6.2.7 The assessments have assumed that the 108 HGVs will be split with 50% accessing the southern compound on the south of Lake Lothing, and the remaining 50% accessing the northern compounds. The northern compounds have been considered together because, as a worst case assessment, access to both will be via Station Square.

6.2.8 Assuming this 50/50 split of HGVs, 54 two way movements a day at the peak of

construction is the assumed movements of HGVs through Station Square and along Waveney Drive. As the construction hours for the Scheme will be from 07:00 to 09:00, a twelve hour day, this equates to fewer than five HGV movements per hour. For the purposes of this calculation, it has been assumed that no HGV deliveries are made on a Saturday.

- 6.2.9 Traffic data from the SATURN model (see Paragraph 19.3.5) has identified a flow of approximately 8500 vehicles per day using Waveney drive of which approximately 1.5%, or 127, are HGVs. Given that the peak number of HGVs that are likely to access the southern compound is 54, and this is for a very limited period of the construction, it is unlikely that there will be significant effects arising from construction related traffic.
- 6.2.10 The individual topic chapters, where relevant, identify the guidance that has been utilised in scoping out detailed study of construction traffic movements and further to Paragraph 3.114 of the Scoping Opinion (Appendix 6B), a Construction Transport Management Plan (CTMP) is therefore not considered to be necessary.
- 6.2.11 With regard to transportation impacts on the local highway network in the operational phase of the Scheme, this has been considered in detail in Chapter 19 and the change in air quality and noise associated with this change in traffic is considered in Chapters 8 and 13 respectively.

6.3 Environmental Aspects

- 6.3.1 Following receipt of the Scoping Opinion, the following surveys and assessments, described in the following sections, are included in the ES. Further detail on the scope and the aspects of each assessment that has been scoped out following further study and consultation is described.

Air Quality

- 6.3.2 The assessment upon air quality has focused on the following assessments in line with guidance within the Design Manual for Roads and Bridges (DMRB):
- nuisance associated with dust arising from construction activity;
 - potential impacts on local air quality associated with construction vehicle movements on the local road network during construction of the Scheme;
 - potential impacts on local air quality associated with changes in concentrations of traffic-related pollutants, where the introduction of the Scheme will have an effect on the volumes of traffic and the patterns and characteristics of use within the local road network; and
 - potential impacts on regional emissions associated with changes in volumes of traffic and the patterns and characteristics of use within the local road network.
- 6.3.3 The assessments above were presented in the Scoping Report and were agreed as an appropriate scope for the assessment with Waveney District Council (WDC). WDC were also present for the first air quality monitoring visit where appropriate locations for the diffusion tubes were agreed and placed on site.
- 6.3.4 In their response to the Scoping Report, Public Health England (PHE) identified

generic areas of scope that they considered to be appropriate for all Environmental Statements that accompany NSIP applications. Notwithstanding that not all of these suggestions were applicable to the Scheme, PHE had also requested that emissions to air should take account of, the following:

- *“should include consideration of impacts on existing areas of poor air quality e.g. existing or proposed local authority Air Quality Management Areas (AQMAs)*
- *Should include modelling using appropriate meteorological data (i.e. come from the nearest suitable meteorological station and include a range of years and worst case conditions); and*
- *should include modelling taking into account local topography.”*

6.3.5 With regard to the first bullet, the assessment has considered areas of poor air quality, and has identified that no AQMAs are present within the study area.

6.3.6 With regard to using appropriate meteorological data, hourly sequential met data from the closest meteorological site with adequate data capture to enable dispersal modelling has been incorporated in the air quality modelling process. The best available data obtained from meteorological data specialists at ADM Ltd incorporated data from Weybourne situated 67 km north-west of the Scheme, with cloud data from Norwich Airport which is situated 38 km north-west from the Scheme so is considered to be more representative. Weybourne was selected as being representative of coastal wind conditions whereas data from the closer observation station at Norwich Airport would not reflect the coastal conditions of Lowestoft. Following Defra guidance a year as close as possible to the background pollution (i.e. monitoring) and emissions data was used. 2016 data was therefore used as a year of completed measurements is required for input to the air quality model meteorological measurements.

6.3.7 With regard to modelling using local topography, the ADMS Roads model (see Paragraph 8.3.30) can take into account topography through the use of a terrain file in the setup of the model. Sensitivity testing was conducted using this input to together with a varied surface roughness input that lowered the surface roughness over the sea however it considerably lengthened the run time of the models and did not produce worst case results, Therefore the settings that have been used, as detailed in Table 1-1 of Appendix 8B are considered worst case based upon sensitivity testing.

Cultural Heritage

6.3.8 Volume 11, Section 3, Part 2 (HA208/07) of the DMRB sub-divides cultural heritage into three areas of interest for the purposes of undertaking and presenting assessments for major road schemes; archaeology, built heritage and historic landscapes and these three aspects have been assessed accordingly within Chapter 9.

6.3.9 The scope of the assessment has included the following key agreements and clarifications through ongoing consultation.

6.3.10 Geo-archaeological investigations have been agreed with HE to be a requirement to the DCO rather than being included within the assessment within the ES. The scope of this geo-archaeological investigation is included in Appendix 9F.

6.3.11 Similarly, within Appendix 9F are proposals for intrusive investigations prior to ground clearance at the start of construction of the Scheme. The need for such investigations has been discussed and agreed with Suffolk County Council Archaeological Service.

6.3.12 The assessment upon built heritage has made use of the photomontages (see Figures 10.6 to 10.20). Prior to the assessment the locations of these photomontages was agreed with Historic England.

Townscape and Visual Impact

6.3.13 The assessment upon Townscape and Visual Impacts has focused on two areas of potential impact, namely, impacts on townscape character and visual impacts.

6.3.14 In discussion with WDC and SCC in advance of the scoping stage it was agreed that the approach to the assessment should follow the guidance provided in Guidelines for Landscape and Visual Impact Assessment (3rd Edition) with a 3km radius around the Order limits.

6.3.15 Prior to the assessment upon townscape character, the baseline townscape character was agreed with WDC and SCC as appropriate and representative.

6.3.16 With regard to visual impacts, similarly to the assessment upon cultural heritage, the location of the photomontages was agreed with SCC and WDC. Furthermore it was agreed that the information to be presented was to be the Scheme when the bridge is closed i.e. open to traffic, with the Scheme when open shown in red outline.

6.3.17 It is of note that the ZTV and the photomontages in Figures 10.6 to 10.20 are based upon the reference design (see Paragraph 5.2.8) although the assessment in this chapter is unaltered should the limits of deviation in Table 5-2 be required.

Nature Conservation

6.3.18 The assessment upon Nature Conservation has focused upon impacts upon sites designated for their ecological value and impacts upon protected species and habitats that may be affected by the Scheme.

6.3.19 The scope of the assessment has been informed through consultation with both SCC and Natural England to clarify aspects of the assessment following the scoping and consultation phases as well as to advise and discuss emerging conclusions.

6.3.20 The Applicant has met and discussed the findings of the species specific surveys with the nature conservation officer of SCC and based upon the outcome, additional surveys were incorporated into the assessment. As identified in Chapter 11 it was agreed with SCC that the surveys were appropriate to identify the nature of the impact from the Scheme.

6.3.21 Discussions with Natural England have taken place to clarify their expectations for a Phase 2 habitat survey given their advice at the scoping stage for one to be undertaken. Natural England did not identify a particular threshold or indicator for when a Phase 2 survey would be appropriate but did identify that it was a matter of professional judgement.

6.3.22 Included within Appendix 11G is a benthic survey report the scope of which was discussed with MMO and EA and amended as appropriate. Reference samples for

benthic ecology were recommended by the EA, and were taken during sampling but in light of the conclusions of the sediment transport assessment (Appendix 17C) these have not been assessed.

- 6.3.23 Prior to undertaking fish trawl surveys, the EA were consulted on whether they had baseline data with regard to fish in Lake Lothing, but none was available.

Geology, Soils and Contamination

- 6.3.24 The assessment upon geology, soils and contamination has been informed by a Desk Study that was presented at both the Scoping and S42 Consultation stages. This has helped to identify a programme of ground investigation

- 6.3.25 The Applicant has consulted with Waveney District Council in their capacity as both land owner and planning authority and they have supplied relevant information on previous ground investigations that have taken place within the Order limits. This has aided the assessment through further clarifying the baseline environment.

- 6.3.26 With regard to the need for disposal of sediment from Lake Lothing during the construction phase of the Scheme, the Applicant has agreed with the MMO that dredged sediment can be disposed of offshore, but will be subject to further testing at a suitable laboratory approved by MMO.

Noise and Vibration

- 6.3.27 The assessment upon noise and vibration has involved the assessment of the change in noise and vibration in both the construction and operational phases of the Scheme.

- 6.3.28 Baseline noise monitoring has been undertaken at six locations around the Order limits of the Scheme. These locations were agreed with Waveney District Council as suitably representative of the nearest noise sensitive receptors to any construction works that will take place.

- 6.3.29 The Applicant has also included an assessment of the change in noise at businesses within and adjacent to the Order limits of the Scheme following a request to do so at consultation.

Materials

- 6.3.30 An assessment upon material usage, their embedded carbon emissions and waste generation from the construction of the Scheme was proposed in the Scoping Report as suitable to be scoped out due to the negligible impacts predicted. However, following the Secretary of State's recommendation in the Scoping Opinion, a materials assessment has been included within the ES.

- 6.3.31 A materials assessment is dependent upon a reference design upon which to base the assessment of material usage and carbon emissions. Waste generation has been informed by the ground investigation.

- 6.3.32 The Applicant has consulted with the waste management departments of Suffolk County Council and Norfolk County Council with regard to information on operational landfills within their planning jurisdiction.

- 6.3.33 An assessment of material usage and waste generation during the maintenance of the

Scheme in the operational phase has been scoped out of the assessment because the nature of materials usage and waste generation from highway maintenance are not likely to be significant.

Private Assets

- 6.3.34 The assessment upon Private Assets has focused upon the impacts that the Scheme would have upon businesses and land uses within the Order limits.
- 6.3.35 To aid the assessment process the Applicant has engaged with ABP and land owners and businesses within the Order limits to further understand the nature of their operations and how the Scheme would impact upon them.
- 6.3.36 To further understand the needs of users of Lake Lothing, the Applicant has instigated a Navigation Working Group which has advised on the nature of the interests and how the Scheme could impact upon them.

Socio Economics Including Recreation

- 6.3.37 The socio-economic including recreation assessment within the ES has focused on the effects upon recreational users of Lake Lothing as well as the effects of the Scheme upon employment, the demand for temporary accommodation from construction workers, the change in access to the town centre of Lowestoft and the change in access for users of the local and strategic road network and how this can have a consequential effect on tourism.
- 6.3.38 The assessment has been based upon a variety of sources which are identified in the chapter, as well as a survey of vessels using Lake Lothing which was undertaken by the Applicant and is presented in greater detail in Appendix 15A.

Road Drainage and the Water Environment

- 6.3.39 The assessment has focused upon the impacts of the Scheme, during both the construction and operational phase, upon the water environment, principally Lake Lothing.
- 6.3.40 The assessment has utilised DMRB assessment methodologies including the HAWRAT (see 17.3.8) spreadsheet tool for assessing the impacts of highway runoff upon a receiving watercourse. Through consultation with the EA, the Applicant has agreed that the use of HAWRAT is an appropriate tool for a saline receiving watercourse such as Lake Lothing.

Flood Risk

- 6.3.41 The scope of the Flood Risk Assessment (FRA) has been subject to further consultation and review by the Environment Agency prior to submission of the DCO application. This has included a review of the model files upon which the assessment is based to agree appropriate input parameters to the EA's satisfaction. The FRA included in Appendix 18A has been updated in light of the EA's comments and the Hydraulic Modelling Report (appended to the FRA) clarifies how the comments have been incorporated.
- 6.3.42 The model that has been used within the assessment that CH2M have utilised for the Lowestoft Tidal Barrier (see Paragraph 20.4.1) was reviewed to identify whether it was

suitable for use in the assessment. However, as it had been developed for a different purpose it did not meet the requirements of the assessment and a bespoke hydraulic model has been built to determine the impact of the Scheme on flood risk.

Traffic and Transport

- 6.3.43 The assessment upon traffic and transport has two key aspects: the impacts that the Scheme will have on road junction capacity within Lowestoft, and the impacts upon road users as identified in the IEMA Guidelines (see Paragraph 19.1.2) for assessment of transport effects.
- 6.3.44 The assessment upon junction capacity is an assessment that draws upon the findings of the Transport Assessment (document reference 7.2) which has been subject to consultation with the Highways Authority (Suffolk County Council) to agree the scope of the assessment and the junctions that were to be assessed.
- 6.3.45 With regard to 'Effects on All Travellers' the Applicant has noted the Secretary of State's recommendation in the Scoping Opinion that a single assessment of overlapping themes related to traffic and transport is provided in the ES.

Cumulative Impacts

- 6.3.46 Cumulative impacts have been identified within a discrete chapter (Chapter 20) and not within the topic chapters following a request from the SoS in the Scoping Opinion (Paragraph 3.18) for this to be provided consistently in the ES.
- 6.3.47 The assessment has been informed by PINS Advice Note 9 and PINS Advice Note 17 and the projects that have been considered in cumulation with the Scheme have been previously presented to SCC and WDC at the scoping stage (Appendix 6A) although since the Scoping Opinion was published the Local Development Order (LDO) that was included within the scope has expired and has therefore not been considered further. In addition, the proposed Great Yarmouth Third River Crossing (GYTRC) has been included and further information that has become available on the Brooke Yachts and Jeld Wen development has been incorporated into the assessment.
- 6.3.48 In response to the request for a scoping opinion, Suffolk County Council (SCC) and Waveney District Council (WDC), agreed the Applicant's list but advised that the "*recent retail planning permission on Rotterdam Road*" should be considered although no extant retail permission can be identified and this has therefore not been included within the assessment.
- 6.3.49 Therefore, to address PINS request for the list of developments to be agreed with the local authority, it can be confirmed that the same projects that were proposed at the scoping stage have been considered with the exception of those that are not now applicable and additionally now includes the GYTRC which did not have suitable information available at the scoping stage or for inclusion in the PEIR.
- 6.3.50 Synergistic impacts are considered in the relevant topic chapters, particularly ecology, and are also considered in Chapter 20.

6.4 Format of the Assessments

- 6.4.1 A common format has been adopted for the reporting of the assessments undertaken

for each of the environmental aspects investigated in Chapters 8 to 20 of this ES, utilising the structure set out below.

Scope of the Assessment

6.4.2 Each assessment presented in Chapters 8 to 20 describes the potential impacts identified during scoping, specific to the aspect reported in the chapter. It explains the nature of the potential impacts, the specific assessments considered appropriate, extent of the study area for each of the assessments and where appropriate, the timescales considered.

Study Areas

6.4.3 The extent of the study area for the assessments varies according to the specific assessment. They have been determined in light of an initial review of the relationship of the Scheme to sensitive receptors (people, environmental features or fauna as defined by that topic area) and the likelihood of consequential impacts. In some cases, the spatial extent has been agreed with the relevant consultees and, where this is the case, details are provided in the relevant assessment chapter. For some assessments, the study area is relatively localised to the proposed alignment. For others it may extend out to the surrounding road network, along watercourses or include more distant communities and environmentally sensitive areas. The extent of the study area for each assessment is described in each assessment chapter and summarised below in Table 6-1.

Table 6-1 – Study areas within the assessment

Environmental Aspect	Sub-Topic	Study Area
Air Quality	Construction	350m from dust generating activities.
	Operation	200m from roads due to experience a change in traffic as per Design Manual for Roads and Bridges (DMRB) criteria.
Cultural Heritage	Construction and operation	500m from the Scheme and as identified from the Zone of Theoretical Visibility
Townscape	Townscape character	A 3km radius around the Scheme.
	Visual impact	The Zone of Theoretical Visibility (ZTV) has been calculated using computer software. Figures 10.2-10.4 show an indicative area where the Scheme will be visible in part.
Nature Conservation	Main study area	A 500m radius around the Scheme that considers habitats and species that may be affected.
	Broad study area	A 2km radius to identify locally and nationally designated sites.
	Extended study area	A 30km radius to identify internationally designated sites.
Geology and Soils	Contamination	The Order limits.
Noise and Vibration	Construction	350m from noise generating activities.

Environmental Aspect	Sub-Topic	Study Area
	Operation	600m from roads due to experience a change in traffic as per DMRB criteria.
Private Assets	Construction and operation	The Order limits and adjoining land parcels
Socio-economics and recreation	Construction and operation	The area administered by Waveney District Council and Great Yarmouth Borough Council.
Road Drainage and the Water Environment	WFD surface waters	2km buffer from the Scheme boundary.
	WFD groundwaters	1km buffer from the Scheme boundary.
	Tidal regime	The extent of Lake Lothing between Mutford Lock and the A47 Bascule Bridge.
Flood Risk	Flood risk assessment	The study area for the flood risk assessment is based upon the extent of flooding in the 1:1000 year flood event, plus climate change.
Traffic and Transport	Junction capacity	Determined based upon the junctions that are affected through a change in traffic flow.
Cumulative Impacts	N/A	As established through CEA Stage 1 (see Chapter 20).

6.4.4 As stated in the Scoping Opinion, the study areas that are adopted in the assessment should be agreed with relevant consultees and the Applicant provided details of these study areas within the PEIR for their consideration. Where an emerging assessment, or a comment from a consultee has amended the study area proposed, this has been identified in the chapter.

Timescales

6.4.5 Similarly, the timescales adopted for the assessments vary according to the environmental aspect being considered. For environmental aspects related to traffic (i.e. noise and air quality), the DMRB guidance calls for an assessment based on predicted changes during construction, as the Scheme would be opened to use (the Opening Year) and 15 years subsequent to the Opening Year (the Design Year). The latter represents the period adopted for forecasting the volumes of traffic using the road and within parts of the wider road network as the basis for designing the Scheme. The specific timescale for each assessment is described in each assessment chapter.

6.4.6 The adopted Opening and Design Years for the Scheme are 2022 and 2037 respectively.

Directives, Regulations and Relevant Policy

6.4.7 Each Chapter identifies directives, regulations and policies which have informed the conduct of the assessments, with particular reference to the NPS for National Networks (NNPS). It is noteworthy that not all chapters will have directives or regulations that are pertinent to informing the assessment within that chapter. However, to maintain consistency across each ES chapter, the heading is kept consistent.

Methods of Assessment and determination of impacts

6.4.8 Each Chapter details the methods of assessment adopted for the various

assessments. It explains the nature of the data relied on and the surveys, models and calculations used and undertaken to validate:

- the baseline environment with particular reference to environmental resources and receptors; and
- predicted impacts associated with the introduction of the Scheme into the baseline environment with embedded mitigation included.

6.4.9 There is an explanation of the quantitative and qualitative criteria adopted to evaluate impacts and determine the order of beneficial and adverse impacts. Methodologies are predominantly sourced from the DMRB, except where clearly identified in each individual chapter. This is an appropriate approach because the Scheme is a highways project and the DMRB is the national standard for such developments.

6.4.10 The SoS in the Scoping Opinion advised “that the overarching methodology and criteria used for the EIA should be described in a discrete ES chapter, and any departure from that should be described in individual topic chapters as appropriate”.

6.4.11 A common methodology for the determination of significant effects was included as Table 7-2 of the PEIR and the Applicant requested consultation responses on the appropriateness of this approach. Following the completion of assessments within this ES, it has been determined that individual chapter and topic specific assessment criteria have been used instead because it was considered that the common methodology did not address the requirements of the assessments and a bespoke approach was more appropriate. These criteria have been developed from relevant guidance for the topic areas.

6.4.12 With regard to the determination of whether a significant effect will occur, unless otherwise stated in the individual assessment, a significant effect is deemed to occur when a moderate or greater impact (either positive or negative) is identified.

Baseline Environment

6.4.13 This section includes a description of the context, key components, characteristics and status of the baseline environment relevant to the environmental aspect discussed within the chapter and with specific consideration to the potential impacts being assessed.

Predicted Impacts

6.4.14 This section describes the predicted impacts in accordance with the criteria detailed in the methods of assessment. The assessment considers likely (and worst case as appropriate) impacts during construction and once the Scheme is operational.

6.4.15 Impacts comprise identifiable changes in the existing environment (the baseline environment) which would occur or be likely to occur as a consequence of implementation of the Scheme (e.g. the loss of a habitat or the pollution of a watercourse). Impacts are described in the form of ratings (thresholds) appropriate to the nature of the environmental aspect and in accordance with accepted terminology where standardised methodologies are used.

6.4.16 Impacts may be direct (e.g. the loss of a habitat to accommodate the Scheme) or indirect (e.g. pollution downstream arising from silt deposition during earthworks). They may be short-term / temporary (e.g. dust associated with construction) medium-term (e.g. the loss of vegetation prior to re-establishment) or long-term / permanent (e.g. improvement in local air quality). They may be beneficial (e.g. reduction in noise levels) or adverse (e.g. loss of a private asset).

6.4.17 The prediction of impacts has been based on:

- the known or likely presence of environmental receptors / resources;
- the environmental value of the resources / receptors, as determined through their designated status along with qualitative criteria such as rarity, status and condition;
- the vulnerability or sensitivity of affected resources;
- the number and sensitivity of affected receptors;
- the extent, nature and duration of physical change resulting from the construction or operation of the Scheme;
- the ability of the resource / receptor to respond to change; and
- the adaptability, and thus effectiveness, of the resource / receptor to controlled change (i.e. mitigation).

6.4.18 In the context of a road scheme, such as Lake Lothing, a number of mitigation measures that reduce the impact of the Scheme upon the environment have been included. The definition used to describe embedded mitigation is mitigation that is provided because it is integral to the bridge and the road structure and therefore the assessment of impacts is undertaken and presented following the embedded mitigation. Each Chapter identifies the embedded mitigation that is included within the Scheme design that is appropriate to the assessment in question.

6.4.19 All of the assessments are based on comparisons between the environment at the assessment stage prior to the construction of the Scheme and the predicted environment, assuming the Scheme is built and mitigation has been successfully implemented.

Further Mitigation and Residual Effects

6.4.20 The principles adopted during the identification of mitigation measures is one of avoidance if possible, reduction where avoidance cannot be achieved or compensation where reduction cannot be achieved or would not achieve practicable levels of mitigation.

6.4.21 Further mitigation differs from embedded mitigation insofar that it is defined in this assessment as being additional measures that are required because of the Scheme being in this location and because of its particular environmental sensitivities. In the assessment chapters, further mitigation is identified and presented in this part of the Chapter. It is clearly distinguished from embedded mitigation.

6.4.22 Where mitigation measures have been discussed and agreed with statutory consultees, this is clearly stated within the relevant chapter. Commentary is also provided, where applicable, on how mitigation requirements will be secured.

6.4.23 Ongoing monitoring measures are also identified where the assessment has identified that it would be appropriate to include monitoring of significant effects.

Conclusion

6.4.24 This section describes which, if any, of the impacts are predicted to have a significant environmental effect. It describes the nature of any such effects and their geographic influence of the predicted effect such as local or national.

6.4.25 Where it is considered to be beneficial to do so for the purposes of clarity and understanding, conclusions have been tabulated within each chapter, as recommended by the SoS in the Scoping Opinion in paragraph 3.16.

Cumulative and synergistic effects

6.4.26 Whilst, as discussed above, cumulative effects are not included as a distinct section in each chapter, synergistic impacts have been addressed within chapters as and where appropriate to do so and are also considered in Chapter 20. This is to ensure that the ES considers the inter-relationship between factors, for example the effects of air quality upon ecological assets.

7 Consultation

7.1 Introduction

- 7.1.1** This Chapter details the consultation that has been undertaken prior to the submission of the DCO application for the Scheme and how consultees have been identified and their feedback incorporated within the assessments.
- 7.1.2** The main details of the consultation are included within the Consultation Report (document reference 5.1) and this Chapter is intended to provide a summary of the elements that are pertinent to the environmental assessments that are contained in the ES.
- 7.1.3** Section 50 of the Planning Act (2008) (as amended) requires applicants to have regard to guidance for pre-application consultation. PINS Advice Note 3, (see Paragraph 1.2.18) details the SoS advice on the approach to consultation as part of the EIA process. The Department for Communities and Local Government (DCLG) Planning Act 2008: Guidance on the pre-application process has also been followed during non-statutory and statutory consultation.
- 7.1.4** As detailed in Chapter 6, the Applicant prepared a Scoping Report for formal consultation on the scope of the ES.
- 7.1.5** In addition to the formal and statutory consultation, and in line with best practice, ongoing engagement with relevant parties with regard to particular matters of agreement or disagreement has been undertaken. Where appropriate, this has been detailed within the relevant assessments.

7.2 Non-statutory Consultation

Consultation undertaken

- 7.2.1** The following organisations were contacted or consulted prior to submission of the Scoping Report (Appendix 6A) and consultation and engagement has been ongoing since then in order to gather further information regarding the environmental baseline, environmental constraints, mitigation measures and other considerations:
- The Planning Inspectorate (PINS);
 - Suffolk County Council (SCC) planning department;
 - SCC Archaeology Officer;
 - SCC Landscape Officer;
 - SCC Senior Ecologist;
 - Waveney District Council (WDC) planning department;
 - WDC Landscape Officer;
 - WDC Environmental Health;
 - Natural England;

- Environment Agency;
- Highways England;
- Associated British Ports (ABP);
- Network Rail;
- Anglian Water;
- UK Power Networks (UKPN);
- National Grid;
- Marine Management Organisation (MMO); and
- Historic England.

7.2.2 In addition to those above the following responded to the Scoping Report (Appendix 6A);

- Civil Aviation Authority;
- Great Yarmouth Borough Council;
- Health and Safety Executive;
- National Air Traffic Services;
- Norfolk County Council;
- Public Health England;
- Royal Mail;
- Suffolk Coastal District Council;
- Suffolk Fire and Rescue; and
- Trinity House.

7.2.3 Appendix 2 of the Scoping Opinion (Appendix 6B) lists all consultees that were consulted by PINS on the Scoping Report (Appendix 6A). This list includes those consultees that did not respond to the Scoping Report.

7.3 Statutory Consultation

Pre-application statutory consultation

7.3.1 The Planning Act 2008 (as amended) requires applicants for NSIPs (see Chapter 1) to undertake pre-application consultation as follows:

- Section 42 consultation with statutory consultees (e.g. Natural England, Environment Agency, Historic England), host and neighbouring local authorities at district, county and unitary level (namely Suffolk County Council, Waveney District Council, Suffolk Coastal District Council, Great Yarmouth Borough Council, Mid Suffolk District Council, South Norfolk District Council, The Broads Authority, Cambridgeshire County Council, Essex County Council and Norfolk County Council); landowners, leases, tenants or occupiers or those with an

interest within land or with the power to sell and convey or release the land within the Order limits for the Scheme, and those persons eligible to make a relevant claim for compensation under section 44 of the Planning Act 2008 (as explained below);

- Section 47 consultation with the local community which should be in accordance with a Statement of Community Consultation (SoCC) developed in consultation with the host local authorities Waveney District Council and Suffolk County Council. The SoCC was also sent to the Broads Authority, South Norfolk Council, Great Yarmouth Borough Council and Norfolk County Council (as near neighbours) asking for comments
- Section 48 publicity of the application (i.e. press advertisements).

7.3.2 The Section 42, 47 and 48 consultations for the Scheme ran concurrently from 4 September 2017 to 23 October 2017; a total of 50 days. Information about the Scheme was available on Suffolk County Council's website, at a number of locations in the area (e.g. local libraries) and a series of consultation events were scheduled as detailed in the Consultation Report (document reference 5.1).

7.3.3 Preliminary Environmental Information (PEI) in the form of Preliminary Environmental Information Report (PEIR) accompanied this consultation.

7.4 Section 42 Consultation

7.4.1 Section 42 of the Planning Act specifies the parties that the Applicant must consult during consultation and a full list of the Section 42 consultees that were consulted is included in the Consultation Report (document reference 5.1).

7.4.2 A full list of Section 42 (1)(a-c) consultees is included in Appendix 5 of the Consultation Report (document reference 5.1). This identifies the bodies prescribed in the table in Schedule 1 of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009, which the Planning Inspectorate will notify or consult in accordance with the EIA Regulations. In addition the Appendix identifies the bodies which the Planning Inspectorate and the Applicant interpret to fall within the category of 'relevant statutory undertakers' and those who are not defined as consultation bodies under the EIA Regulations, but are considered under Regulation 9 of those regulations by the Planning Inspectorate to have relevant functions and responsibilities which are akin to other consultation bodies.

Statutory Consultees

7.4.3 As presented in the Scoping Opinion (Appendix 6B), and in accordance with Regulation 9 of the EIA regulations, a number of statutory consultees were consulted upon the scope of the assessments within this Environmental Statement.

7.4.4 The Applicant subsequently consulted these statutory consultees during the Consultation and has incorporated their responses within the assessment as appropriate. The Consultation Report (document reference 5.1) and its corresponding appendices (document reference 5.2) identifies how these responses have been addressed.

Landowners

- 7.4.5 Section 42(1)(d) requires the Applicant to consult each person who is within one or more of the categories set out in section 44 of the Planning Act 2008. This includes those who have an interest in properties within the Order limits (as expressed at statutory consultation), but also those outside those limits who can make a relevant claim for compensation due to the impacts of the Scheme.
- 7.4.6 A relevant claim under the Planning Act 2008 is one able to be made under Part 1 of the Land Compensation Act 1973; section 10 of the Compulsory Purchase Act 1965 and/or section 152(3) of the Planning Act 2008.
- 7.4.7 The Applicant defined an area 300m from the centreline of the proposed alignment for the land referencing extents 'the referencing limits'. In addition, all properties adjacent to Lake Lothing between the A47 Bascule Bridge and Mutford Bridge were also included in the referencing limits. It was anticipated that the extent of the 300m referencing limits would be sufficient to include all Category 3 persons i.e. who may have a relevant claim for compensation under Part 1 of the Land Compensation Act 1973, compensation for depreciation of land value by physical factors caused by the use of the Scheme. These include:
- Noise;
 - Vibration;
 - Smell;
 - Fumes;
 - Smoke;
 - Artificial lighting; and
 - Discharge of any solid or liquid substance onto land.
- 7.4.8 It was also anticipated that the extent of the 300m referencing limits would be sufficient to include all Category 3 persons who may have a relevant claim for compensation for injurious affection during construction and operation of the Scheme, including persons with potentially affected / interference with rights of access under section 10 of the Compulsory Purchase Act 1965 and / or section 152(3) of the Planning Act 2008. In setting the 300m referencing limits the Applicant took a conservative approach to identifying Category 3 persons.
- 7.4.9 These referencing limits were taken forward and used to instruct the limit within which parties were consulted under section 42(1)(d) of the Act. The Order limits are encompassed by the referencing limits and include the extent of land to be acquired and used for the construction, operation and maintenance of the Scheme.
- 7.4.10 Following the consultation period, the Applicant reviewed the referencing limits for the Scheme based on updated information on the extent of the area within which there were considered to be persons who would or might be entitled to make a relevant claim for compensation.
- 7.4.11 The amendment to the referencing limits of Category 3 persons is one of the reasons

why the section 42(1)(d) consultation list in Appendix 6 of the Consultation Report (document reference 5.1) does not wholly align with the Book of Reference (document reference 4.3).

7.4.12 The consultee list has been cross checked against the Book of Reference. The list of section 42(1)(d) consultees in Appendix 6 of the Consultation Report is not identical to the list of parties in the Book of Reference as there are many additional parties that were consulted who are no longer considered to be an affected party in the submitted Book of Reference.

7.4.13 This area was taken forward and used to instruct the limit within which parties were consulted under section 42(1)(d) of the Planning Act. A list of these consultees is included in Appendix 6 of the Consultation Report (document reference 5.1).

Consultation material

7.4.14 All section 42 consultees received a hard copy of the following documents:

- **Consultation Leaflet** – providing a summary of the Scheme and details of the consultation events and how respondents could provide their comments;
- **Consultation Brochure** – provided a more detailed summary of the Scheme and its potential impacts and a summary of the next stages of the process under the 2008 Act;
- **Questionnaire** – a survey to comment on the Proposed Application; and
- **Return envelope.**

7.4.15 All identified section 42 consultees also received a copy of the above documents listed in paragraph 7.4.14 on an enclosed USB stick, which also included:

- **Questions and Answers** – provided answers to frequently asked questions;
- **Design Process Summary** – explaining the design rationale for the Scheme
- **PEIR and Technical Appendices** – setting out the likely significant effects of the Scheme as understood at that time;
- **Non-technical summary of the PEIR-** a summary of the key information as presented in the PEIR; and
- **Section 48 Notice** - containing a summary of the proposals for the Scheme, detail of where the Consultation Documents could be viewed and how consultees could request copies of the documents, and details of how to respond to the consultation, including the deadline for such responses.

7.4.16 Chapter 6: Scoping, Appendix 6C and Appendix 34 of the Consultation Report (document reference 5.1) and where appropriate the topic chapters within this ES summarise the contact with stakeholders. This information presents how the proposals and assessment process has responded to comments received on the PEIR and the statutory consultation materials, whilst also including feedback received in meetings and correspondence before and after the statutory consultation period.

7.5 Section 47 Consultation

- 7.5.1** Section 47(1) of the Planning Act requires the Applicant to prepare a SoCC. The SoCC sets out how the Applicant intends to consult the people living in the vicinity of the proposed application. There is a duty to consult the host local authorities in respect of the content of the SoCC as outlined in section 47(2) because their knowledge of the local area may influence decisions on the geographical extent of the consultation and the methods that will be most effective in the local circumstances.
- 7.5.2** Section 47(3) of the Planning Act states that the local authorities' responses to the consultation on the SoCC should be received by the Applicant within a 28 day period (commencing on the day after the day on which the local authority receives the request for comments. The Applicant also has to take account of any responses received before the deadline (as outlined in section 47(5)).
- 7.5.3** As part of the process to develop the SoCC, meetings were held with planning officers at WDC and SCC, as the host local authorities, to discuss and agree an appropriate approach. On 7 March 2017, the project team formally consulted SCC (Planning Department) and WDC (Planning Department) about the proposals to consult the local community as set out in the draft SoCC. On 27 March a joint response was received. These comments requested that the SoCC should set out where the consultation would be advertised; a non-technical summary of the PEIR should be produced and details of photocopying charges included. These comments were actioned in the final SoCC.
- 7.5.4** Local communities within the vicinity of the Scheme were then consulted in accordance with the SoCC. Chapter 5 of the Consultation Report (document reference 5.1) outlines how the Applicant delivered the consultation in line with the SoCC.
- 7.5.5** As part of this, residents within the 'Consultation Area', shown in Figure 7.1 were sent, via post, information about the consultation through a cover letter and the Consultation Leaflet mentioned above.
- 7.5.6** The consultation was publicised through a range of channels including local media articles, social media, the council's website, posters and third parties. In addition a number of briefings took place with interested groups including some parish council's, Lowestoft Chamber of Commerce, Lowestoft Rotary Club and Waveney Youth Council.
- 7.5.7** Alongside the consultation events below, consultation materials were also available to view at Lowestoft, Oulton Broad and Kessingland Libraries, the combined SCC and WDC council offices at Riverside, Waveney District Council's Marina Customer Service Centre and Suffolk County Council's Endeavour House in Ipswich throughout the statutory consultation period.
- 7.5.8** Eight public consultation events were undertaken in the Lowestoft area as detailed in the Consultation Report (document reference 5.1).
- 7.5.9** At these events the PEIR was available to be viewed and all attendees were able to take away a copy of the PEIR Non-Technical Summary. The consultation leaflet, brochure, Q&A, questionnaire, Compulsory purchase and compensation information,

and Design Process Summary were also available to take away.

7.5.10 In addition to the eight public consultation events a number of stakeholder briefings were held with various local interest groups in the Lowestoft area.

7.6 Consultation Response

7.6.1 Consultees were able to respond online by filling out a questionnaire that was available on the website, at deposit locations and at the exhibitions, and could return them by phone, post or email.

7.6.2 In total 1454 responses were received in the Scheme consultation, including those accepted until 1 November 2017 allowing for late submissions. This does not include responses to the additional section 42 consultations with a response deadline after 1 November 2017; these are outlined in chapter 12 of the Consultation Report.

Table 7-1 – Number of consultation responses received by format

Response format	Number of responses
Questionnaire responses via the webpage	713
Questionnaire responses received by post or email	414
Questionnaire responses received at Deposit Locations	99
Questionnaire responses received at consultation events	109
Bespoke emails and letters	119
Total	1454

7.6.3 The written comments provided were analysed and categorised into themes. Of these responses categorised, 11% were on the environmental theme.

7.6.4 As detailed in the Consultation Report (document reference 5.1), sub-topics within the themes were identified, and for the environmental theme, comments were provided on the following sub-topics:

- Port Workings (31%);
- Cultural Heritage (6%);
- Visual Impact (2%);
- Water and Environment (9%);
- Geology (1%);
- Nature Conservation (8%);
- Noise and Vibration (9%);
- Air Quality(12%); and
- Other (22%).

7.6.5 This breakdown demonstrates that Port Workings were the leading concern which is likely due to Lake Lothing being used by a number of commercial and leisure vessels.

- 7.6.6 Traffic matters are not incorporated within the environmental theme, but were considered under a separate Traffic and Highways theme. In total 42% of comments made were categorised under the Traffic and Highways theme.
- 7.6.7 The issues raised by the statutory consultees on the PEIR are identified in Chapter 12 of the Consultation Report (document reference 5.1) and appendix 34 and are not repeated within the ES, except where it has been appropriate within each chapter to identify how the Consultation has further informed the scope of the assessment. Greater information on ongoing engagement with consultees on environmental matters is included in Chapter 6.

8 Air Quality

8.1 Scope of the Assessments

- 8.1.1 This chapter describes the air quality impact assessment undertaken for the Scheme, the outcomes of which are used to determine the likely significant effects of the Scheme on local and regional air quality to ecological and human health receptors; and the impact of the Scheme on national air quality objectives (both exceedances and the ability of zones to comply with them).
- 8.1.2 The level of air pollution adjacent to roads and within urbanised areas is typically a function of vehicle emissions. Emissions of nitrogen oxides (NO_x, including nitrogen dioxide, NO₂) and particulate matter (PM₁₀ and PM_{2.5})¹⁵ from vehicles are of greatest concern with respect to human health. Concentrations of these pollutants are subject to air quality standards, established by UK legislation¹⁶ for the protection of human health.
- 8.1.3 The Air Quality Standards Regulations set out national air quality objective and limit values for pollutants as explained in Section 8.2. The assessment presented in this Chapter considers the predicted changes to Local and Regional air quality with the Scheme in the context of compliance with the Air Quality Standards Regulations.
- 8.1.4 There is the potential for impacts to regional emissions, including those of NO_x, PM₁₀ and carbon dioxide (CO₂), as a result of changes to vehicle flow characteristics across the roads affected by the Scheme.
- 8.1.5 The air quality assessment considers likely significant effects associated with the following activities;
- Emissions associated with the construction phase of the Scheme with a focus on construction dust emissions; and
 - Emissions associated with the operational phase of the Scheme with a focus on vehicle emissions.
- 8.1.6 This chapter is supported by Figure 8.1 to 8.21 and Appendices 8A to 8G.

Study Areas

- 8.1.7 The study area for the assessment of construction phase dust emissions and associated potential local air quality impacts (the Construction Study Area) is defined by the location of sensitive receptors identified within 350m of the Order limits as detailed in paragraph 8.3.10 and shown in Figure 8.2. At the ES stage, the exact number of construction vehicles utilised throughout the construction phase is unknown, nor the construction traffic routes. The 350m study area incorporates the worst case receptors located closest to the construction site entrances, where the worst effects from any trackout related to construction vehicles would be experienced, a cautious

¹⁵ PM₁₀ assessed as the fraction of airborne particles of mean aerodynamic diameter less than 10 micrometres. PM_{2.5} assessed as the fraction of airborne particles with an aerodynamic diameter less than 2.5 micrometres.

¹⁶ HMSO, 2010, *Air Quality Standards Regulations 2010*.

approach has been taken in assessing the capacity for trackout as large within a high sensitivity area for trackout, further detail of the construction phase assessment is given in Section 8.3.

- 8.1.8** The local air quality assessment for operational phase emissions has considered changes in concentrations of NO₂, PM₁₀ and PM_{2.5} at sensitive receptors identified within 200m of roads that will be affected by the implementation of the Scheme (the Operational Study Area), with reference to the criteria given by the Design Manual for Roads and Bridges (DMRB, HA207/07). Further information on the definition of an affected road is given in Paragraph 8.3.25 and the extent of the Operational Study Area is presented in Figure 8.1.
- 8.1.9** The regional emissions assessment has considered changes in emissions of NO_x, PM₁₀, PM_{2.5} and CO₂ as a result of operation of the Scheme with reference to the criteria given by the Design Manual for Roads and Bridges (DMRB, HA207/07). Further information on the criteria defining an affected road regional assessment is given in Paragraph 8.3.49.

Limitations

- 8.1.10** The modelling of future air quality has associated uncertainties. In future years, one such uncertainty relates to the projection of vehicle emissions and, in particular the rate at which emissions per vehicle will improve over time. This assessment has utilised the most recent version of Defra's Emissions Factors Toolkit (EFT) to provide the most up to date estimate of current and future vehicle emissions projections.
- 8.1.11** Current projections for vehicle emissions factors are only available until 2030, which covers the Scheme opening year (2022), but precedes the Scheme future design year (2037). Therefore, following standard practice, vehicle emissions factors adopted for the future design year scenarios in the regional emissions assessment were based on the 2030 projected factors which provides a worst case assessment because it is assumed that the trend of improvement in vehicle emissions will continue from 2030 to 2037.

8.2 Directives, Statutes and Relevant Policy

Directives

European Ambient Air Quality Directive 2008

- 8.2.1** The 2008 Ambient Air Quality Directive (2008/50/EC) is the primary driver for managing and improving air quality for each member state of the EU. The Directive sets legally binding limit values for concentrations in ambient (outdoor) air of pollutants that can impact public health, including NO₂ and particulates (PM₁₀ & PM_{2.5}).
- 8.2.2** EU limit values are set for individual pollutants and comprise a concentration value, an averaging time over which it is to be measured, the number of allowed exceedances per year (if any), and a date by which it must be achieved. Some pollutants (e.g. PM₁₀) have more than one limit value covering different averaging times.

Regulations

Air Quality Standards Regulations (England)

- 8.2.3 The EU Directive was transposed into English law via the Air Quality Standards Regulations 2010, as amended in 2016.
- 8.2.4 The responsibility for meeting the prescribed air quality limit values is devolved to the national administrations. In England, the Secretary of State for Environment, Food, and Rural Affairs has responsibility for adhering to the limit values, whilst the Department for Environment, Food and Rural Affairs (Defra) co-ordinate the assessment of compliance with limit values and development of Air Quality Plans for the UK (last updated in 2017).
- 8.2.5 A draft Clean Air Strategy was issued for consultation in May 2018 outlining ambitions to reduce air pollution, make air healthier to breathe and for nature protection. The draft strategy sets out how the UK Government will work towards meeting reductions in England. The final UK Clean Air Strategy and detailed National Air Pollution Control Programme is expected to be published in March 2019 and therefore has not been considered in this assessment.
- 8.2.6 Under the 2017 Air Quality Plan, certain local authorities are required under the Environment Act to undertake feasibility studies to identify options to deliver compliance with EU limit values. Waveney District Council was not included in the list of authorities required to do this.

The Environmental Protection Act 1990

- 8.2.7 The Environmental Protection Act (EPA) (Section 79, Chapter 43, Part III - Statutory Nuisance and Inspections), contains a definition of what constitutes a 'statutory nuisance' with regard to dust and places a duty on Local Authorities to detect any such nuisances within their area. Dust arising from construction works could lead to statutory nuisance if it is 'prejudicial to health or a nuisance' i.e. affects people's wellbeing, even though it may not be prejudicial to health.

Policy and Guidance

National Policy Statement for National Networks

- 8.2.8 The National Policy Statement for National Networks (NNNPS) provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State.

Paragraph 3.8 of the NNNPS states that "the impact of road development on aggregate levels of emissions is likely to be very small. Impacts of road development need to be seen against significant projected reductions in carbon emissions and improvements in air quality as a result of current and future policies to meet the Government's legally binding carbon budgets and the European Union's air quality limit values." Specifically regarding air quality Paragraph 3.8 of the NNNPS also states that "aggregate air quality impacts from delivering a programme of investment on the Strategic Road Network of the scale envisaged in Investing in Britain's Future are small. Total PM₁₀ and NO_x might be expected to increase slightly, but this needs to be seen in the context of projected

reductions in emissions over time. PM₁₀ and NO_x are expected to decrease over the next decade or so as a result of tighter vehicle emission standards, then flatten, with further falls over time due to greater levels of electric and other ultra-low emission vehicles.”

- 8.2.9 The NNNPS in Paragraph 5.17 explains that “It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets. However, for road projects applicants should provide evidence of the carbon impact of the project and an assessment against the Government’s carbon budgets.” Paragraph 5.18 explains that the Governments national carbon reduction strategy includes a range of non-planning policies which should “ensure that any carbon increases from road development do not compromise its overall carbon reduction commitments. The Government is legally required to meet this plan. Therefore any increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed Scheme are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets.”
- 8.2.10 The NNNPS in Paragraph 5.6 states the requirement for an Environmental Statement (ES) where “the impacts of the project (both on and off-scheme) are likely to have significant air quality effects in relation to meeting EIA requirements and / or affect the UKs ability to comply with the Air Quality Directive, the applicant should undertake an assessment of the impacts of the proposed project as part of the environmental statement.” Paragraph 5.7 states that “The ES should describe;
- *existing air quality levels;*
 - *forecasts of air quality at the time of opening, assuming that the scheme is not built (the future baseline) and taking account of the impact of the scheme; and*
 - *any significant air quality effects, their mitigation and any residual effects, distinguishing between the construction and operation stages and taking account of the impact of road traffic generated by the project.”*
- 8.2.11 NNNPS Paragraph 5.8 explains that “The applicant’s assessment should be consistent with Defra’s published future national projections of air quality based upon evidence of future emissions, traffic and vehicle fleet.”
- 8.2.12 NNNPS Paragraph 5.9 states that “In addition to information on the likely significant effects of a project in relation to EIA, the Secretary of State must be provided with a judgement on the risk as to whether the project would affect the UK’s ability to comply with the EU Ambient Air Quality Directive.”

National Policy Statement for Ports

- 8.2.13 The National Policy Statement for Ports (PNPS) requires applicants to consider the effects of a project during both the construction and operational phases upon air quality taking into account the existing air quality levels.

Clean Air Strategy

- 8.2.14 The draft Clean Air Strategy (dCAS), currently under consultation, proposes actions to reduce air pollution and its effects. Proposals in the draft strategy relating to roads

include an emphasis on clean growth and innovation such as plans to encourage the development, manufacture and use of zero exhaust emission vehicles. The dCAS has an increased focus on particulate matter emissions with a draft target to reduce emissions of particulate matter by 30% by 2020. The draft Air Quality strategy introduces a future strategy for reducing exhaust emissions from road vehicles called 'Road to Zero' which is unpublished. The dCAS has not been considered in this assessment.

Local Air Quality Management

8.2.15 Local authorities in England are required to review air quality within their jurisdiction, under *Part IV of the Environment Act 1995*, and designate air quality management areas (AQMAs) where air quality standards are not being met and/or where air quality improvement is needed. Local authorities are then required to work towards achieving the national Air Quality Strategy objectives and standards as prescribed in the *Air Quality Standards Regulations 2016*.

8.2.16 Under the *Environment Act 1995*, the UK Government and the devolved administrations are required to prepare and publish a national *Air Quality Strategy*. The most recent version of the Strategy was published in 2007 and establishes the UK's air quality standards and objectives, in addition to providing guidance, where needed, on air quality action planning at national, regional and local scales. Air quality standards are concentrations recorded over a given averaging period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutants on health and the environment. An objective is the target date on which exceedances of a standard must not exceed a prescribed number.

Relevant UK Air Quality Objectives and EU Limit Values

8.2.17 The national air quality objectives and European Directive limit values that the UK must comply with, specifically for traffic-related pollutants NO₂, PM₁₀, and PM_{2.5}, are presented in Table 8-1. The respective UK objective and EU limit value concentration standards and averaging periods are numerically identical for each pollutant, based on air quality standards set for the protection of human health. For NO_x, the objective and limit value is set for the protection of ecosystems and vegetation.

Table 8-1 – National (England) air quality objectives and European Directive limit values

Pollutant	Objective / Limit Value Concentration	Concentration Measured As	Date to be achieved by:	
			UK Air Quality Strategy Objective	EU Ambient Air Quality Directive
Nitrogen Dioxide (NO ₂)	200µg/m ³ not to be exceeded more than 18 times a year	1 hour mean	31.12.2005	01.01.2010
	40µg/m ³	Annual mean	31.12.2005	01.01.2010

Pollutant	Objective / Limit Value Concentration	Concentration Measured As	Date to be achieved by:	
			UK Air Quality Strategy Objective	EU Ambient Air Quality Directive
Particulate Matter (PM ₁₀)	40µg/m ³	Annual mean	31.12.2004	01.01.2005
	50µg/m ³ not to be exceeded more than 35 times a year	24 hour mean	31.12.2004	01.01.2005
Particulate Matter (PM _{2.5})	25µg/m ³	Annual mean	2020	01.01.2015
8.2.18 Nitrogen oxides (NO _x)*	30µg/m ³	Annual mean	31.12.2000	19 July 2001

* For the protection of ecosystems and vegetation

United Nations Economic Commission for Europe Critical Loads

8.2.19 The United Nations Economic Commission for Europe (UNECE) defines the critical load for nitrogen deposition as “a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on sensitive elements of the environment do not occur according to present knowledge”.

8.2.20 The UNECE provides critical load values for nutrient nitrogen deposition as a range based upon the habitat type, the critical load is used as a component of the assessment to identify the ecological impacts of the Scheme.

Guidance Informing the Assessment of the Significance of the Scheme upon Local Air Quality

8.2.21 The following guidance documents set out the circumstances of when an assessment may be required providing details of the information required to undertake such an assessment and the steps required to assess the significance of a Scheme upon Local Air Quality.

- Design Manual for Roads and Bridges (DMRB) HA207/07 Air Quality;
- Institute of Air Quality Management (IAQM) Land Use Planning and Development Control Planning for Air Quality (2017);
- Highways England IAN 174/13 Updated advice for evaluating significant local air quality effects (2013).

Risk Assessment related to Compliance with the EU Directive on Ambient Air Quality

8.2.22 Highways England IAN 175/13 provides advice on conducting risk assessments related to compliance with the EU Directive on ambient air quality. The IAN is

withdrawn pending the issue of new guidance; however, the compliance risk assessment for the Scheme has been conducted following the methodology of IAN 175/13 in the absence of updated guidance¹⁷. The compliance risk assessment is summarised in Appendix 8C.

8.3 Methods of Assessment

Baseline Environment

- 8.3.1 The 2017 Air Quality Annual Status Report (ASR) published by Waveney District Council was reviewed to establish baseline air quality conditions within the Operational Study Area. The ASR provides the annual mean NO₂ monitored levels at a number of monitoring sites relevant to the Scheme location. In addition, a Scheme specific baseline NO₂ monitoring survey was completed between December 2016 and December 2017 to inform the review of existing conditions. These monitoring data were used to enable model verification and adjustment as part of the atmospheric dispersion modelling study.
- 8.3.2 Background air pollutant concentrations corresponding to the 1 km² grid squares covering the Operational Study Area were obtained from Defra's published national pollutant mapping data. Background concentrations for 2016, 2018, and 2022 were obtained to represent current and future baseline air quality conditions within the assessment scenarios.
- 8.3.3 Ordnance Survey (OS) mapping and address layer data were used to identify potentially sensitive receptors in proximity to the Scheme and surrounding areas. The OS address layer data gives a coordinate point location for each building with a code describing the use of the building. When visualised with OS mapping the use of each building can be determined and this information was used to collate the locations of sensitive receptors for the local air quality assessment given in Paragraph 8.3.3.
- 8.3.4 Information on the locations of designated ecological sites was obtained from the Defra Magic website and the ecological information provided in Chapter 11 of this ES.

Construction Phase

- 8.3.5 The assessment of local air quality impacts due to the release of fugitive dust, including particulates (PM₁₀), during the construction phase was informed by the methodology detailed in the Institute of Air Quality Management (IAQM) guidance, with reference to DMRB HA207/07. Full details of the construction assessment methodology are provided in Appendix 8A.
- 8.3.6 In terms of emissions from construction vehicles on the local road network and associated traffic management measures, DMRB HA 207/07 states that these should be considered where construction is predicted to last for more than 6 months. Information on specific traffic management measures, the precise location of construction site entrances, and the precise number of vehicle movements related to construction were not available at the time of assessment. However, as discussed in

¹⁷ This approach was recently approved by the Secretary of State's decision on the application for the Silvertown Tunnel Order 2017.

the Transport Assessment (document reference 7.2) and as shown in Plate 5-3 , the following has been assumed for the purposes of the assessment:

- a peak of 108 construction related two way HDV movements per day¹⁸ is anticipated, based on an assumed five day week; and
- these peak movements would be split between the construction compounds to the north of Lake Lothing and the construction compound to the south of Lake Lothing.

8.3.7 The criteria provided by DMRB HA207/07 stipulates that further assessment of vehicle emissions is required where a change in vehicle flow volume of 1,000 annual average daily traffic (AADT) movements or more is expected, or the heavy duty vehicle (HDV) flow will change by 200 AADT or more. As the above peak construction traffic figure is well below these criteria, further assessment of construction phase vehicle emissions has been scoped out of this assessment.

8.3.8 The assessment during the Construction phase has therefore focussed on potential impacts associated with fugitive dust and particulate emissions from the following types of activity that will occur throughout the works:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (dust generating material which leaves the site via attachment to vehicle tyres).

8.3.9 Dust impacts associated with annoyance due to soiling have been assessed, in addition to potential human health effects due to an increase in exposure to PM₁₀ and PM_{2.5}, and potential harm to identified ecological receptors. Factors including the scale and nature of the activity, in addition to the sensitivity of the area, have been considered when assessing the risk of dust impacts, which are determined prior to assigning mitigation measures.

8.3.10 The Construction Study Area has been defined by the location of sensitive receptors identified within 350m of the Order limits; this being the worst case maximum distance from source to receptor for any construction activities that could be a source of dust emissions, as defined by the screening criteria within Box 1 of the IAQM guidance and Section 7.3, Step 2B.

8.3.11 Box 1 states that “an assessment will normally be required where there is a ‘human receptor’ within:

- *350 m of the boundary of the site; or*
- *50 m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).”*

8.3.12 Box 1 of the IAQM guidance also states that an assessment is required where there is

¹⁸ Two way vehicle movements incorporate each vehicle travelling to and travelling from the construction site.

“an ‘ecological receptor’ within:

- 50 m of the boundary of the site; or
- 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).”

8.3.13 Following the screening criteria provided in Box 1 of the IAQM guidance the construction phase of the Scheme does require an assessment. In determining the study area further criteria are provided in Section 7.3, Step 2B of the IAQM guidance.

8.3.14 Section 7.3, Step 2B of the IAQM guidance to define the sensitivity of the area considers the number of human receptors: “exact counting of the number of ‘human receptors’ is not required. Instead it is recommended to use professional judgement to determine the number of receptors in each band”. The distance bands are given in Table 2 of the guidance as shown in Table 8-2 below. The sensitive receptor counts for the Scheme are presented in Table 8-10.

Table 8-2 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

8.3.15 When considering the sensitivity of the construction study area to impacts from demolition, earthworks, construction and trackout, matrices based upon the distance from source to receptor for assessing each activity are given in Section 7.3 Step 2B of the IAQM guidance. In Table 2, Table 3 and Table 4 of the guidance, for each level of sensitivity “only the highest level of area sensitivity from each table needs to be considered.” as stated in the footnotes to Table 1-3, Table 1-4 and Table 1-5 given in Appendix 8A. Receptors sensitive to trackout from a large construction site can be situated on roads up to 500m from the construction site exits. The precise construction traffic routes were not available at the time of the assessment however it is known that there are receptors within 20m of the proposed site exits therefore following the principle of assessing until the highest level of area sensitivity is met, a sensitivity of high for trackout has been assigned and hence is a worst case scenario.

8.3.16 The findings of the demolition element of the construction assessment have been incorporated as a component of step two of the assessment as detailed in Appendix 8A Paragraph 1.3.3.

8.3.17 The outcomes of the construction phase assessment are used to enable appropriate mitigation measures to be defined. The requirement to undertake the measures given

in Section 8.6 are set out in the interim CoCP (Appendix 5A) which sets out that the details of these measures will be developed through an air quality management plan, for which the contractor will be responsible for creating and submitting to the county planning authority for approval, following consultation with Waveney District Council.

Significance Criteria

- 8.3.18 The significance of any dust emissions from the construction of the Scheme has been assessed in accordance with Section 9 Step 4 of guidance provided by IAQM.
- 8.3.19 Step four of the IAQM guidance states that "...For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation."
- 8.3.20 The outcomes of the construction dust assessment are used to define appropriate mitigation measures as identified in Section 8.6 to reduce the possibility of adverse effects from the construction phase of the Scheme and, as such, does not identify specific assessment significance criteria.
- 8.3.21 The IAQM guidance states in Section 2 in the terminology definition of effects that "in the context of construction impacts any effect will usually be adverse, however professional judgement is required to determine whether this adverse effect is significant based on the evidence presented" and in the Section 1 introduction text that "it is anticipated that with the implementation of effective site-specific mitigation measures the environmental effect will not be significant in most cases".

Operational Phase

- 8.3.22 The assessment of local air quality and regional emissions impacts associated with the operation of the Scheme has been informed by the approaches detailed in DMRB HA207/07 and relevant Highways England Interim Advice Notes (IAN's) with reference to respective Defra air quality technical guidance and IAQM guidance.

Local Air Quality Assessment

- 8.3.23 The local air quality assessment has focused on the following scenarios, for which traffic data has been provided from the Transport Assessment (document reference 7.2) to facilitate atmospheric dispersion modelling of vehicle emissions:
- Base year (2016);
 - Opening year (2022) without Scheme (Do Minimum); and
 - Opening year (2022) with Scheme (Do Something).
- 8.3.24 The Do Minimum (DM) and Do Something (DS) scenarios provide a contrast of the air quality with and without the Scheme and contribute to the conclusion of significance with regard to air quality. The Base year scenario is modelled for model verification purposes. During verification the outputs from the Base model for the verification air quality monitoring locations were compared to monitoring to produce a factor accounting for under prediction in the model which is applied to the results for the modelled sensitive receptors. Further details are provided in Appendix 8B. A conservative approach to the construction of the Base model has been taken where worst case parameters have been used.

8.3.25 Screening of the DM and DS traffic data was completed to identify affected road links that adhere to the following criteria as provided by DMRB HA207/07:

- Road alignment will change by 5 m or more; or
- Daily traffic flows will change by 1,000 AADT or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

8.3.26 It should be noted that the Scheme would also have been screened in for an assessment based upon the more extensive criteria given in Table 6.2 of the IAQM guidance. The DMRB criteria were applied initially as the thresholds for assessment are higher and therefore, as these were met, there was no need to carry out further screening against the lower thresholds prescribed by the IAQM, given the criteria requiring an assessment had been met. Conducting the assessment in this way is also helpful as the DMRB criteria also define the affected road network.

8.3.27 Traffic data for the Scheme opening year were screened to identify the Operational Study Area for the local air quality assessment and is presented in Figure 8.1. Details of the traffic conditions and traffic model are provided in Chapter 6 and Chapter 19.

8.3.28 Emissions inventory databases for each pollutant (NO_x, PM₁₀, PM_{2.5}) were developed for all three of the above scenarios using Defra's latest EFT (v8.0.1), which accounts for vehicle flow characteristics, such as:

- Link flow volumes as annual average daily traffic (AADT);
- Link average speed (km/hr);
- Vehicle type composition (e.g. percentage HDVs); and
- Link (i.e. road section) length.

8.3.29 It was proposed during scoping (see Chapter 6) that the emissions from traffic within the Operational Study Area would be calculated using the Defra EFT v7, which WDC and SCC raised as potentially underestimating the emissions from diesel vehicles. In January 2018, the latest EFT v8.0.1 was released, which incorporates updated emission functions from the European Environment Agency COPERT V5 model. Therefore, EFT v8.0.1 incorporates the most up to date information that is available on the emissions from the national fleet and it is this version that has been used in the assessment.

8.3.30 Each scenario emissions database was entered to an atmospheric dispersion model (ADMS-Roads v4.1) to enable prediction of pollutant concentrations at the identified sensitive receptor locations. The modelling exercise utilised the following key inputs:

- Pollutant emission rates for each affected road link within the Operational Study Area;
- Geometry of each affected road link;

- Representative time-varying emissions based on diurnal variation in traffic flow for the affected roads;
 - Hourly sequential meteorological data obtained from the closest representative coastal meteorological measurement station at Weybourne for 2016; and
 - Coordinates of each sensitive receptor at which the model calculated pollutant concentrations.
- 8.3.31** Verification of the ADMS-Roads model outputs was undertaken using the annual mean NO₂ base year (2016) outputs and the annual mean NO₂ Scheme specific monitoring data obtained over 12 months. This enabled appropriate adjustment factors, derived with reference to Defra’s technical air quality guidance, to be applied to model outputs to improve the performance of the dispersion model within the context of the monitoring data presented in Appendix 8D and at the locations shown on Figure 8.4.
- 8.3.32** Verification of PM₁₀ and PM_{2.5} has been completed using the same factor determined through verification of NO₂ concentrations, in accordance with LAQM TG(16) technical guidance, which states “...*In the absence of any PM₁₀ (and PM_{2.5}) data for verification, it may be appropriate to apply the road-NO_x adjustment to the modelled road-PM₁₀ /_{2.5}*”.
- 8.3.33** Further detailed information of the modelling process, input data and the model verification and adjustment procedure are presented in Appendix 8B.
- 8.3.34** The results of the atmospheric dispersion modelling at each identified sensitive receptor (as discussed below) has been compared to the respective air quality objective values, set for the protection of human health and, where applicable, ecosystems, to evaluate the potential for exceedances in all scenarios.
- 8.3.35** The magnitude of change of predicted concentrations at each location, as a result of the Scheme, has been derived through analysis of the opening year (2022) Do Something versus Do Minimum scenario data. The significance of potential changes to local air quality has been determined in accordance with the criteria provided by IAQM and Highways England.
- 8.3.36** Highways England Guidance Interim Advice Note 174/13 sets out magnitudes of change in concentrations of NO₂, PM₁₀ in order to categorize a significant effect for receptors where the concentration of a pollutant is within 10% of the relevant objective with the Scheme. The magnitude of change criteria are presented in Table 8-3.

Table 8-3 Magnitude of Change Criteria

Magnitude of Change in Concentration	Value of Change in Annual Average NO ₂ and PM ₁₀
Large (>4)	Greater than 10% of the air quality objective (4 µg/m ³)
Medium (>2 to 4)	Greater than 2 µg/m ³ but less than 10% of the objective (4 µg/m ³)

Magnitude of Change in Concentration	Value of Change in Annual Average NO ₂ and PM ₁₀
Small (>0.4 to 2)	Greater than 1% of the objective (0.4 µg/m ³) but less than 5% of the objective (2 µg/m ³)
Imperceptible (≤ 0.4)	Less than or equal to 1% of objective (0.4 µg/m ³)

Sensitive Receptor Identification

8.3.37 There is the potential for vehicle emissions to impact local concentrations of air pollutants at the identified sensitive receptors situated within the Operational study area, (see Figure 8.1).

8.3.38 According to DMRB HA207/07 the influence of vehicle emissions on ambient air quality is negligible beyond 200m of the respective road source, predominantly due to horizontal and vertical atmospheric mixing. As such, a desk-based review of potentially sensitive receptors to air quality was undertaken using OS mapping and address layer plus data as explained in Paragraph 8.3.3 to identify those located within 200m of the Scheme alignment and associated affected links.

8.3.39 Sensitive receptors as defined in the Design Manual for Roads and Bridges (DMRB) Section 11.3.1 (DMRB HA207/07) include:

- Residential dwellings;
- Designated ecological sites;
- Locations of the young and elderly;
- Hospitals; and
- Schools.

8.3.40 Designated ecological sites (Ramsar, SPAs, SACs or SSSIs) given in Paragraph 8.4.16 have been assessed with reference to the DMRB HA207/07 Annex F, which provides the relevant assessment procedure. At the request of the Secretary of State, a number of non-statutory designated sites given in Paragraph 8.4.17 have also been assessed using this approach.

Significance Criteria

8.3.41 The IAQM Guidance describes the magnitude of incremental concentration change (Do Minimum versus Do Something) at each individual sensitive receptor as a proportion of a relevant Air Quality Assessment Level (AQAL). In this assessment, the AQALs are the annual mean NO₂, PM₁₀ and PM_{2.5} objectives.

8.3.42 The magnitude of incremental concentration change (Do-Minimum versus Do-Something) is considered at each individual sensitive receptor as a proportion of a relevant air quality assessment level (AQAL). The incremental change at each sensitive receptor is examined in the context of the total predicted annual mean concentration and its relationship with the AQAL as detailed within Table 8-4. This allows an impact descriptor to be assigned to each receptor, with overall significance of the effects of any impacts assigned by professional judgement. The significance of the local air quality assessment results were evaluated based on this guidance.

Table 8-4 Impact Descriptors for Modelled Sensitive Receptors (annual mean NO₂ and PM₁₀)

Annual mean NO ₂ /PM ₁₀ /PM _{2.5} concentration at receptor	% Change in concentration relative to NO ₂ /PM ₁₀ AQAL*			
	1%	2-5%	6-10%	>10%
≤75% of AQAL (≤30µg/m ³)	Negligible	Negligible	Slight	Moderate
76-94 of AQAL (30-38µg/m ³)	Negligible	Slight	Moderate	Moderate
95-102% of AQAL (38-41µg/m ³)	Slight	Moderate	Moderate	Substantial
103-109% of AQAL (41-44µg/m ³)	Moderate	Moderate	Substantial	Substantial
≥110% of AQAL (≥44µg/m ³)	Moderate	Substantial	Substantial	Substantial

*AQAL in this assessment refers to the annual mean air quality objective for NO₂ and PM₁₀.

- 8.3.43** In instances where a sensitive receptor is found to be in exceedance of the objective concentration for a pollutant, or within 10% of the objective concentration, then the significance of the local air quality assessment results for NO₂, PM₁₀, and PM_{2.5} would be evaluated based on IAN 174/13.
- 8.3.44** Where IAN 174/13 is used, changes in pollutant concentrations greater than imperceptible (more than 0.4 µg/m³) at each identified receptor, based on the Do Minimum versus Do Something opening year (2022) model results, are compared with guideline bands that inform the potential significance of the Scheme. The guideline band ranges set the upper level of likely non-significance and the lower level of likely significance. Between these two levels are the ranges where likely significance is more uncertain, and greater onus is afforded to professional judgement.
- 8.3.45** However the results of this assessment do not meet the criteria for the application of IAN 174/13 as no sensitive receptors were found to be within 10% of the objective concentration as demonstrated in Paragraph 8.5.17 and Figure 8.9.
- 8.3.46** Whilst the approach contained within IAN 174/13 focusses on receptors already exceeding an annual mean objective, or within 10% of exceeding the objective, guidance for determining the impact of the operational phase of the Scheme on each of the individual local air quality sensitive receptors is provided by IAQM as described in Table 8-4.
- 8.3.47** However information on the magnitude of change, applying the increments given in Table 8-3 in the results given for the sensitive receptors, has been given in the context

of IAN 174/13 for information purposes in Table 8-12 and Paragraph 8.5.29 .

Regional Emissions

8.3.48 The regional emissions assessment has focussed on total annual mass emissions of NO_x, PM₁₀, PM_{2.5}, and carbon dioxide (CO₂) associated with the aforementioned opening year scenarios, in addition to:

- Design year (2037) without Scheme (Do Minimum); and
- Design year (2037) with Scheme (Do Something).

8.3.49 Screening of the Do Minimum and Do Something traffic data was undertaken to identify affected road links that adhere to the following criteria as provided by DMRB HA207/07:

- A change of more than 10% in AADT; or
- A change of more than 10% to the number of heavy duty vehicles; or
- A change in daily average speed of more than 20 km/hr.

8.3.50 The affected road links identified through screening are presented in Figure 8.5. Traffic data for affected road links in each scenario were entered to Defra's EFT v8.0.1, enabling the calculation of total annual mass emissions of the respective vehicle exhaust species. This allowed the magnitude of change of total mass emissions associated with the operation of the Scheme to be predicted.

8.3.51 There are no relevant published significance criteria in relation to regional emissions assessments and DMRB HA207/07 acknowledges that changes in regional emissions associated with road schemes such as the Scheme are expected to be small within the context of national emissions. As stated in the NNNPS, see Paragraph 8.2.9, it is very unlikely that the impacts of a road project will, in isolation affect the Government's ability to meet its carbon reduction targets. However, regional and national emissions data published by the National Atmospheric Emissions Inventory (NAEI) have been utilised to provide context to the predicted change in emissions during the operational phase of the Scheme.

Assessing Implications for UK Compliance with the EU Ambient Air Quality Directive

8.3.52 The Defra Pollution Climate Mapping (PCM) model is used to fulfil the UK's requirements to report on the concentrations of particular pollutants in the atmosphere to the EU. The PCM model contains key road sources across the UK for which projected representative roadside pollutant concentrations are published. Highways England Interim Advice Note IAN 175/13 provides guidance on how to assess the risk from a road development upon compliance with the EU Directive on ambient air quality and clean air for Europe (2008/50/EC). IAN 175/13 has a status of 'withdrawn' pending an update, however, in the absence of updated or an alternative guidance, it is still considered appropriate to apply it to this assessment¹⁹.

8.3.53 The compliance assessment is included in Appendix 8C.

¹⁹ This approach was recently approved by the Secretary of State in relation to the Silvertown Tunnel DCO.

8.4 Baseline Environment

Local Air Quality Management Review

8.4.1 A review of the latest LAQM report published by WDC confirms that there are no AQMAs declared within the District and there is no requirement for WDC to progress to a detailed assessment of air quality for any pollutant. There are no AQMAs declared within the region of Great Yarmouth Borough Council and the AQMA's for NO₂ declared within the region of Suffolk Coastal District Council at Woodbridge Junction in Woodbridge, Dooley Inn near the Port of Felixstowe and Long Row in Stratford St Andrew are considered too far away to be of relevance to this assessment.

Background Pollutant Concentrations

8.4.2 The background air pollutant data published by Defra for the UK accounts for a multitude of local emissions sources including road vehicles, industrial installations, domestic heating and other transport modes, in addition to regional sources and imported emissions. The modelled background data is available for years 2015 to 2030 inclusive.

8.4.3 For the purposes of reviewing the existing background and predicted future background levels, the maximum, minimum and average annual mean concentrations of each pollutant (NO₂, PM₁₀, PM_{2.5}) based on the 1 km² grids encompassing the Operational study area, are presented in Table 8-5.

Table 8-5 - Defra Mapped Background Annual Mean Concentrations for each Pollutant in Base (2016), Current (2018) and Opening (2022) Years

Pollutant	2016 Background Concentration (µg/m ³)			2018 Background Concentration (µg/m ³)			2022 Background Concentration (µg/m ³)		
	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.	Average
NO ₂	14.7	8.9	10.8	13.8	8.4	9.5	12.4	7.6	9.0
NO _x	20.5	11.9	14.6	19.2	10.5	12.6	17.0	9.9	12.0
PM ₁₀	21.1	12.0	14.3	20.8	11.3	13.4	20.4	11.5	13.8
PM _{2.5}	16.5	8.3	10.2	16.2	7.9	9.3	15.7	7.9	9.7

8.4.4 The predicted current and future background concentrations presented in Table 8-5 are well below the respective health-based annual mean objective values for NO₂ (40 µg/m³), PM₁₀ (40 µg/m³), and PM_{2.5} (25 µg/m³). Similarly, the annual mean NO_x objective value (30 µg/m³) set for the protection of vegetation and ecosystems, is not predicted to be exceeded.

8.4.5 Existing operations at the Associated British Ports (ABP) Port of Lowestoft generate funnel emissions and dust. The funnel emissions are included within the Defra Local Air Quality Management (LAQM) background maps.

Local Air Quality Monitoring

8.4.6 WDC does not operate an automatic continuous air quality monitor and does not monitor levels of PM₁₀ and PM_{2.5}.

8.4.7 WDC does operate a network of NO₂ diffusion tube monitoring sites, fifteen of which are located adjacent to roads that are likely to experience a change in air quality during the operational phase of the Scheme, as shown in Figure 8.4 and Table 8-6.

8.4.8 The annual mean NO₂ concentrations at these locations, obtained from WDC and shown in Table 8-6 for the period 2010 – 2016 inclusive, demonstrate that there has not been an exceedance of the air quality objective value (40 µg/m³). The maximum monitored annual mean concentration recorded in the last two years (2015/2016) was 35.8 µg/m³ adjacent to Pier Terrace at monitoring location PT4.

Table 8-6 – Local Authority NO₂ Monitoring Results

Site ID	Site Name	Site Type	X,Y	Annual Mean Concentration (µg/m ³)						
				2010	2011	2012	2013	2014	2015	2016
DT1	Castleton Avenue	Roadside	650608, 290476	16.7	16.7	15.7	16.2	15.2	19.5*	15.2*
DT2	Fir Lane	Roadside	653220, 293794	20.8	21.1	20.1	19.5	19.4	21.8*	18.1*
DT3	Dutchman's Court	Roadside	651885, 292105	26.5	23.5	21.7	21.7	22.8	20.9*	21.9*
DT4	Golden Court	Roadside	652242, 292955	33.6	31.9	27.3	29.4	27.7	25.1*	24.5*
DT6	Yarmouth Road	Roadside	653049, 295534	18.2	18.6	16.8	17.8	18.2	17.7*	14.5*
DT7	Mill Road	Roadside	654470, 292395	26.1	22.8	20.9	19.6	18.7	19.6*	18.1*
DT8	St Margaret's Church Yard	Urban Background	654305, 293914	-	17.8	16.3	16.5	16.5	12.3	15.0*
DT9	Belvedere Rd 1	Roadside	654651, 292619	34.0	32.8	29.2	24	29.3	31.1	28.5
DT10	Belvedere Rd 2	Roadside	654619, 292619	34.8	32.8	30.0	25.7	31.2	29.5	29.3
DT11	Pier Terrace 1	Roadside	654658, 292598	37.1	35.1	30.8	35.3	29.9	27.8*	27.2*
DT12	Pier Terrace 2	Roadside	654658, 292598	-	-	25.8	26.0	25.2	24.7	27.0
PT1	Pier Terrace	Roadside	654788, 292824	-	-	-	-	-	-	27.9*
PT2	Pier Terrace	Roadside	654781, 292814	-	-	-	-	-	-	26.4*
PT3	Pier Terrace	Roadside	654703, 292636	-	-	-	-	-	-	31.0*

Site ID	Site Name	Site Type	X,Y	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)						
				2010	2011	2012	2013	2014	2015	2016
PT4	Pier Terrace	Roadside	654685, 292621	-	-	-	-	-	-	35.8*

**values have been adjusted for fall off with distance from the road by the Local Authority using the Defra "NO₂ fall off with distance calculator" to assess relevant public exposure.*

*** values have been annualised and distance corrected by the WDC*

Scheme Specific Monitoring (NO₂)

8.4.9 A Scheme specific NO₂ baseline air quality monitoring survey, comprising 45 diffusion tubes, was established for a twelve month monitoring period from December 2016 to December 2017, covering the operational study area. Details of the monitoring locations and data processing are provided in Appendix 8D and the monitored annual mean NO₂ concentrations are summarised in Table 8-7.

8.4.10 The locations of these tubes were agreed through consultation with WDC and Suffolk County Council (SCC) and are presented in Figure 8.4.

8.4.11 All monitored values are well below the respective annual mean NO₂ objective, with the highest concentration (29.7 $\mu\text{g}/\text{m}^3$) recorded adjacent to Bridge Road on the approach to the Mutford Bridge.

Table 8-7 – Summary of Scheme Specific Monitored NO₂ Annual Mean Concentrations (December 2016 to December 2017)

Site	Location Description	X	Y	Annual mean NO ₂ concentration ($\mu\text{g}/\text{m}^3$) [*]
WSP1	The Street	646969	289448	11.1
WSP2	Keel Close	650658	290542	14.9
WSP3	Ark Close	652043	286689	13.2
WSP4	Cranleigh Road	652627	290378	16.9
WSP5	Laxfield Road	652933	290798	14.2
WSP6	The Avenue	653463	291452	15.5
WSP7	Long Road	652989	291235	16.3
WSP8	Ranworth Avenue	652264	291476	13.5
WSP9	Clarkes Lane	651286	291552	12.1
WSP10	Winston Avenue	652174	292221	12.9
WSP11	Dell Road	652694	292311	15.5
WSP12	Kirkley Run	653291	291968	16.3
WSP13	Notley Road	653665	292175	15.4

Site	Location Description	X	Y	Annual mean NO ₂ concentration (µg/m ³)*
WSP14	Durban Road	653921	292379	16.2
WSP15	Waveney Crescent	653770	292370	15.3
WSP16	Crompton Road	652406	292476	13.7
WSP17	Victoria Road	652144	292483	20.8
WSP18	Bridge Road	652230	292922	29.7
WSP19	Lakeland Drive	652728	293347	14.7
WSP20	Princess Walk	653310	293434	13.0
WSP21	Peto Way	653533	293136	20.4
WSP22	Rotterdam Road	653873	293148	19.9
WSP23	Denmark Street	654159	292951	22.8
WSP24	Denmark Road	654661	292916	27.7
WSP25	Battery Green Road	655011	292965	28.6
WSP26	A47	655111	293373	27.7
WSP27	Milton Road East	654909	293431	19.5
WSP28	Minden Road	654164	293603	17.9
WSP29	High Beech	653600	293805	15.0
WSP30	Sands Lane	652570	293874	19.4
WSP31	Lime Avenue	651656	293963	12.7
WSP32	Lavenham Way	652975	294138	13.3
WSP33	Dunston Drive	652123	294561	11.6
WSP34	Union Lane	652351	295278	9.7
WSP35	Jenkins Green	653081	295367	12.9
WSP36	Leonard Drive	653264	295954	12.7
WSP37	Blyford Road	653439	295274	14.7
WSP38	Thirlmere Road	653165	294640	15.7
WSP39	Woods Loke East	653252	294147	12.8
WSP40	Bramfield Road	653221	294263	13.1
WSP41	Ashley Downs	654226	294460	15.4
WSP42	Church Road	654538	294044	16.4
WSP43	A47	654595	294747	**

Site	Location Description	X	Y	Annual mean NO ₂ concentration (µg/m ³)*
WSP44	Hubbard's Loke	654492	295716	12.0
WSP45	Old Lane	653630	296575	12.0
*Bias adjustment factor of 0.77 applied (see Appendix 8D for details) **Inadequate data capture				

Particulate Monitoring (PM₁₀ and PM_{2.5})

8.4.12 The Defra 1km x 1km gridded background pollutant concentrations for Lowestoft demonstrate that the background PM₁₀ and PM_{2.5} concentrations given in Table 8-5 are not near to exceedance of the respective objective values. The contribution to PM₁₀ and PM_{2.5} road sources is not dominant in the background mapping for Lowestoft, which are dominated by sea salt, calcium and iron rich dusts. It was agreed with WDC to monitor NO₂ only. WDC agreed that scheme specific monitoring of PM₁₀ and PM_{2.5} was not considered to be necessary.

8.4.13 The scoping report (Appendix 6A) explained that Scheme specific monitoring for PM₁₀ and PM_{2.5} would not be undertaken and neither the Scoping Opinion nor the consultation responses suggested that such monitoring was required.

Identified Sensitive Receptors

8.4.14 The distribution of identified sensitive receptors specific to the operation phase assessment of the Scheme, according to type, is presented in Table 8-8. These include locations included following consultation responses representative of Port working areas, offices and control tower adjacent to the Scheme, which otherwise would not have been considered with reference to the DMRB HA20707 criteria. These further receptors are shown in Figure 8.3 and comprise:

- Port working areas closest to the Scheme;
- Nexen (company premises);
- Council Offices;
- Motorlings (company premises);
- Riverside Business Centre (company premises); and
- Essex and Suffolk Water (company premises). The Port of Lowestoft is within and adjacent to the Order limits of the Scheme. In addition to the operational phase impacts, the Port has been considered as a receptor which could be sensitive to construction dust.

Table 8-8 – Identified Potentially Sensitive Receptor Locations

Property Type	Count
Residential	32,395
Designated ecological sites	3*

Property Type	Count
Education	49
Health Care (Hospitals, Care Homes etc.)	49
Other (businesses)	7
Other ecological sites	5

**as defined by DMRB HA207/07 (SACs, SCI's, cSCI's, SPA's, pSPA's, SSSI's and Ramsar sites).*

8.4.15 Receptors were selected for modelling where they were situated within 200m of an affected road link (Paragraph 8.3.25). The local air quality model area is slightly larger than the affected road network (ARN), as shown in the figures. This captures the influence from emissions of roads covered by the traffic model study area within a distance of 200m upon the modelled receptors.

Identified Designated Sensitive Sites

8.4.16 The following designated sites, which are also depicted in Figure 8-6, were identified within 200m of the affected road network and have been considered in this assessment²⁰:

- Barnby Broad and Marshes SSSI;
- The Broads SAC; and
- The Broadland RAMSAR.

8.4.17 In the Scoping Opinion (Appendix 6B), the Secretary of State requested that Local Nature Reserves (LNR) and County Wildlife Sites (CWS) should be included in the assessment. Although these are not statutory designated ecological sites, the following LNR and CWS sites are located 200m of affected roads links and therefore have been assessed:

- Leathes Ham LNR;
- Gunton Warren LNR;
- Kirkley Ham CWS; and
- Brooke Yachts & Jeld Wen CWS.

8.4.18 The Gunton Wood LNR was not considered in this assessment as it is situated beyond 200m from the nearest affected road.

8.4.19 The outcomes of the designated sites assessment are provided in Appendix 8G.

8.4.20 The base year NO_x concentrations and Nitrogen deposition rates for the ecological sites considered in this assessment are given in Table 8-9.

²⁰ The results are reported for the Barnby Broad and Marshes SSSI, but are also applicable to the RAMSAR and SAC sites at the same location

Table 8-9 - Base Year 2016 NO_x Concentrations and Nitrogen Deposition Rates for Ecological Sites

Ecological Site	Habitat Description	Habitat Critical Load (kg N ha ⁻¹ yr ⁻¹)	Base Year Background NO _x Concentration (µg/m ³)	Baseline Nitrogen Deposition Rate (kg N ha ⁻¹ yr ⁻¹)*
Barnby Broad and Marshes SSSI**	Fen marsh and swamp	15-30	11.8	16.1
Brooke Yachts and Jeld Wen CWS***	Grassland, dwarf shrub heath,	10-20 (heath) 10-15 (non Mediterranean grasses)	14.6	14.8
Gunton Warren LNR***	Inland dune pioneer/siliceous grassland	8-15	12.6	14.3
Kirkley Ham CWS***	Acid/neutral grassland	20-30 (neutral grassland) 5-25 (acid grassland)	14.6	14.8
Leathes Ham CWS***	Fen, marsh & swamp	15-30	14.4	14.8

*Baseline conditions Nitrogen deposition rate obtained from APIS for site specific coordinates.
 **Designated site as defined by DMRB HA207/07 (SACs, SCI's, cSCI's, SPA's, pSPA's, SSSI's and Ramsar sites). Base conditions also apply to areas of The Broads SAC and the Broadland RAMSAR site.
 ***Non designated site assessed by request from consultees and Secretary of State

8.5 Predicted Impacts

Construction Phase: Dust Impacts

- 8.5.1** Construction works have the potential to generate fugitive dust emissions during earthworks and construction activities, as well as from the trackout of dust and dirt by vehicles onto public highways. Dust emissions can cause annoyance through soiling of buildings and surfaces and/or adversely impact human health.
- 8.5.2** Potential construction phase air quality impacts assessed in this section are considered prior to the application of site-specific mitigation measures.
- 8.5.3** Major construction activities that are likely to be required during construction phase of the Scheme will include the following:
- Site clearance (assessed as earthworks and demolition as appropriate);

- Topsoil strip (assessed as earthworks);
- Excavation (assessed as earthworks);
- Landscaping (assessed as earthworks and construction as appropriate);
- Material import/export (assessed as trackout);
- Demolition (assessed as demolition);
- Temporary stockpile of resources (assessed as construction, potentially dusty materials);
- Construction of compounds and access points (assessed as trackout); and
- Construction of road/bridge and footway (assessed as construction).

8.5.4 The main potential air quality impacts that may arise from the aforementioned activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Dust plumes, affecting visibility and amenity; and
- Elevated ambient PM₁₀ concentrations due to fugitive dust releases.

8.5.5 The potential for sensitive receptors to be affected is dependent on the scale and locations of the dust generating activities, the nature of the activity, and local meteorological conditions when the activity is taking place.

8.5.6 There are sensitive residential receptors located within 350m of the Order limits and located on approach roads within 350m of the Order limits, where the aforementioned activities could occur. The nearest sensitive residential receptors are located within 20m of the Order limits.

8.5.7 Distance bandings contained within Table 8.1-3, Table 8.1-4 and Table 8.1-5 of Appendix 8A were analysed based on the Order limits of the Scheme. The number and location of existing dust sensitive receptors from the Order limits is shown in Table 8-10.

Table 8-10 – Receptor Count within 350m of Earthworks and Construction Activities

Distance Bandings				
Distance from construction boundary (m)	Sensitive Receptor Count			
	Residential	Educational	Medical	Total
<20	69	2	0	71
20-50	35	0	0	35
50-100	170	0	0	170
100-200	454	0	0	454
200-350	1,209	1	1	1,211

8.5.8 A distance of 50m from the source of construction dust is specified in IAQM guidance as appropriate for the assessment of the sensitivity of the area to ecological impacts from construction dust. There are two CWSs within 50m of the Order limits and there

are no statutory designated ecological sites within 50m. The IAQM guidance categorises sites with a local designation such as CWSs and LNRs with dust sensitive features as a low sensitivity receptor.

- 8.5.9 The Port of Lowestoft is situated within and adjacent to the construction compound sites on the southern and northern bank of Lake Lothing (see Figure 5.4) and operations at the Port could be adversely affected by construction dust.
- 8.5.10 The highest risk receptors are those that are downwind of potential dust-generating construction activities. A wind rose derived from data recorded at Weybourne meteorological station for the year 2016 demonstrates a prevailing south-westerly wind. Therefore, those receptors located to the northeast and east of, and within proximity to, the construction activities (see Paragraph 8.5.3), are more likely to be affected by fugitive dust releases. As the precise location of dust generating activities within the construction site is not known, a conservative approach was taken assuming that these activities could occur up to the site boundary. A wind rose showing the recorded data is presented in Appendix 8E.
- 8.5.11 The effects of construction dust generated during dry conditions could lead to annoyance through dust deposition and also localised increases in PM₁₀ concentrations with the potential to adversely impact human health. The maximum background annual mean PM₁₀ concentration for the Construction study area – as predicted by Defra is 21.0 µg/m³ (2017), which is well below the annual mean objective value of 40 µg/m³. Therefore, it is unlikely that the short-term construction operations would cause the daily (50 µg/m³) or annual mean (40 µg/m³) objective value to be either approached or exceeded at sensitive receptors near to the Scheme construction area.
- 8.5.12 The overall risk of construction dust impacts occurring; namely annoyance due to soiling (deposition) and impacts to human health, in the absence of mitigation, is detailed in Appendix 8A and was undertaken with reference to the IAQM guidance document.
- 8.5.13 In summary, the risks of dust soiling and human health impacts caused by the Scheme construction activities were identified to be medium to high and mitigation proposals that will reduce this impact are included in Section 8.6. With appropriate mitigation applied impacts from dust soiling and human health impacts are not expected to be significant.

Operational Impacts

Local Air Quality Assessment

- 8.5.14 A total of 32,493 sensitive receptors (see Table 8-8) were selected for inclusion in the atmospheric dispersion modelling assessment, most of which are situated in the urban area of Lowestoft. The Operational Study Area incorporating the sensitive receptors is presented in Figure 8.3.
- 8.5.15 A summary of the modelled annual mean NO₂, PM₁₀ and PM_{2.5} concentrations across the assessment study in the base year (2016) and Scheme opening year (2022) is provided in Table 8-11.

Table 8-11 – Summary of Predicted Annual Mean NO₂, PM₁₀ and PM_{2.5} Concentrations at Sensitive Receptor Locations in Base (2016) and Opening Year (2022)

		Parameter	NO ₂	PM ₁₀	PM _{2.5}	
		Annual mean Objective	40 µg/m ³	40 µg/m ³	25 µg/m ³	
Number exceedances of the respective objective by scenario		Base 2016 Exceedance	14*	0	0	
		DM Exceedance	0	0	0	
		DS Exceedance	0	0	0	
		New Exceedance	0	0	0	
Total number of receptors with:		Improvement in Concentration	11,613	6,850	2,108	
		Deterioration in Concentration	12,139	5,975	1,080	
		No Change in Concentration	8,741	19,668	29,305	
DS-DM Annual Mean Change (µg.m ⁻³)		Maximum Worsening	+4.9	+1.2	_0.2	
		Maximum Benefit	-8.8	-2.3	-0.4	
Maximum	Receptor	X	Y	DM	DS	Change
Worsening	16217	653906.5	292443.9	13	17.9	+4.9
Benefit	13594	654116.3	290878.0	29.7	20.9	-8.8

8.5.16 It should be noted that the monitoring results presented in Table 8-6 and Table 8-7 for the Base year represent monitoring locations where measurements from ambient air were taken. The Base scenario results presented in Table 8-11 are a prediction of pollutant concentration at sensitive receptor locations based upon modelling the dispersal of emissions from traffic.

8.5.17 The dispersion modelling results demonstrate that there are 14 predicted exceedances of the annual mean NO₂ objective in the base year scenario, all of which are in proximity to the existing crossing point at the inlet to the harbour and Lake Lothing, these properties consist of flats above shops and although there are 14 address points given for these locations, in terms of separate buildings defined by coordinates, there are six. The maximum predicted exceedance in the Base year is 41.7 µg/m³ (1.7 µg/m³ over the objective concentration) and the minimum exceedance is 40.2 µg/m³ (0.2 µg/m³ over the objective concentration). However, as a result of decreased emissions these exceedances are predicted to be removed by 2022 in both the DM and DS scenarios, with no exceedances of any pollutant predicted.

8.5.18 The dispersion model has been verified against Scheme-specific and local authority monitoring of NO₂. Variations in the adjusted modelled versus monitored NO₂ values still occur due to the extent of the operational study area and the number of monitoring locations used in the verification process. Therefore, whilst the baseline monitoring has not recorded any exceedances of the NO₂ annual mean objective within the operational study area, predicted exceedances at other locations within the model domain can occur where the road to receptor distance is lower and/or due to variations in modelled traffic flows, composition and speed particularly closer to junctions.

-
- 8.5.19 The model verification process is detailed in Appendix 8B and, through appropriate adjustment, has been shown to be performing within the recommended guidelines stated by Defra in LAQM TG(16), page 132 'Model Uncertainty'.
- 8.5.20 In the Opening Year, 11,613 receptors are predicted to experience an improvement in NO₂ annual mean concentrations, with 8,741 receptors experiencing no change, and 12,139 receptors experiencing a deterioration (see Figure 8.10).
- 8.5.21 The predicted magnitude of changes in annual mean NO₂, PM₁₀ and PM_{2.5} concentrations across all modelled sensitive receptors is presented in Figures 8.10, 8.14 and 8.18.
- 8.5.22 The majority of improvements in annual mean NO₂ concentrations are predicted to occur along the access routes to the A47 Bascule Bridge and Mutford Bridge. The maximum improvement (-8.8µg/m³) is predicted to occur at a receptor situated adjacent to the A12 on the approach to the A47 Bascule Bridge, with the resulting annual mean value remaining well below the objective value.
- 8.5.23 Conversely, the locations predicted to experience the maximum worsening of NO₂ levels comprise properties along Waveney Drive and along routes that traffic will use to access the Scheme (see Figure 8.10). The maximum change in deterioration of NO₂ (+4.9µg/m³) is predicted to occur on Waveney Drive, although the total annual mean value is predicted to remain below the objective value.
- 8.5.24 For the 1-hour mean objective for NO₂, in LAQM TG(16), Paragraph 7.91 Defra advises that if the annual mean NO₂ concentration is less than 60µg/m³, the hourly mean objective is not likely to be exceeded. The predicted maximum annual mean NO₂ concentration in the DS scenarios is 23.4µg/m³ at a sensitive receptor adjacent to the A47 and in proximity to the junction with Commercial Road. As such, the 1-hour mean objective is considered unlikely to be exceeded in the operational phase and has not been considered further in this assessment.
- 8.5.25 With regard to PM₁₀ annual mean concentrations, 6,850 receptors are predicted to experience an improvement, with 19,668 receptors predicted to experience no change in concentration and 5,975 receptors experiencing a worsening in the operational phase (see Figure 8.15).
- 8.5.26 The IAQM and Defra guidance provides an approach to assessing the relationship between annual mean and 24-hour mean concentrations of PM₁₀. Potential exceedances of the 24-hour objective are more likely where the annual mean concentration is over 32 µg/m³. Given that all predicted annual mean PM₁₀ values are well below this level, exceedances of the 24-hour objective are very unlikely both with and without the Scheme in operation and has not been considered further in this assessment.
- 8.5.27 For PM_{2.5}, 2,108 receptors are predicted to experience an improvement in PM_{2.5} annual mean concentrations, 29,305 receptors are predicted to experience no change, and 1,080 receptors to experience a worsening, in the operational phase (see Figure 8.18).
- 8.5.28 The predicted magnitude of changes in annual mean NO₂, PM₁₀ and PM_{2.5} concentrations across all modelled sensitive receptors are summarised in Table 8-12. These were calculated with reference to the magnitude of change criteria provided in

IAN 174/13 and IAQM guidance. However, given that there are no predicted exceedances of any pollutant in the Opening Year scenarios, it has not been necessary to use IAN 174/13 guidance to inform significance.

8.5.29 In terms of changes in annual mean NO₂, 18,146 of the 32,493 sensitive receptors are predicted to experience an *imperceptible* change in annual mean concentrations in accordance with IAN 174/13, with 5,009 sensitive receptors experiencing a *small* magnitude of change and 451 sensitive receptors experiencing a *medium* magnitude of change. The increasing change in concentration at 3 sensitive receptors results in a *large* magnitude of change with the Scheme in operation, however all predicted concentrations remain well below the NO₂ objective, with NO₂ concentrations with the Scheme at the 3 large magnitude of change sensitive receptor locations below 20 µg/m³ (50% of the objective). The large magnitude of change receptors are situated at the junction of Waveney Drive where the Scheme will join the existing road network.

8.5.30 For both PM₁₀ and PM_{2.5}, the annual mean changes are predominantly imperceptible in the operational phase.

Table 8-12 – Predicted Magnitude of Change in Annual Mean Concentrations in the Opening Year

Magnitude of Change (+/-)	Descriptor	NO ₂	PM ₁₀	PM _{2.5}
0 µg/m ³	No Change	8,741	19,668	29,305
Between 0 to 0.4 µg/m ³	Imperceptible	18,146	5,856	1,080
Between 0.4 to 2 µg/m ³	Small	5,009	119	0
Between 2 to 4 µg/m ³	Medium	451	0	0
Over 4 µg/m ³	Large	3	0	0

8.5.31 The local air quality assessment results for the ABP operational areas and the consultee premises, which do not constitute sensitive receptors as per DMRB HA207/07, are given in Appendix 8F.

Ecological Assessment

8.5.32 An assessment of change in air quality at the designated sites, LNR and CWS sites was undertaken with reference to the DMRB HA207/07 guidance. The detailed results for modelled transects representing each individual ecological site are given in Appendix 8G and the results are visualised in Figure 8.19 and 8.20.

8.5.33 The annual mean NO_x objective (30 µg/m³) is not predicted to be exceeded at the Barnby Broad and Marshes SSSI designated ecological site and associated SAC and Ramsar.

8.5.34 With respect to the non-statutory ecological sites (namely the LNR and the CWS), the NO_x objective is predicted to be exceeded at the Kirkley Ham CWS by 10.7 µg/m³ and at Leathes Ham LNR by 1.5 µg/m³ in the Base (2016) scenario. Neither Kirkley Ham

CWS nor Leathes Ham LNR are predicted to be in exceedance of the objective in the Opening Year (2022) DM scenario. However, both CWS sites exceed the objective by $8.5 \mu\text{g}/\text{m}^3$ and $1 \mu\text{g}/\text{m}^3$, respectively, in the DS scenario. The maximum increase in NO_x concentration at the Kirkley Ham CWS is $9.5 \mu\text{g}/\text{m}^3$ and the maximum increase in NO_x at Leathes Ham LNR is $6.9 \mu\text{g}/\text{m}^3$. Although these are not statutory designated sites as per the definition given by Annex F of the DMRB HA207/07 guidance, these sites were included in this assessment following the Scoping Opinion (see Appendix 6B). The impact of increased NO_x at the Kirkley Ham CWS is considered as significant in the context of contributing to the increased N-deposition however the increased NO_x concentration alone would not be likely to cause harm. This is further discussed in Chapter 11 of the ES.

- 8.5.35** The predicted rates of nitrogen deposition with and without the Scheme in the Opening year were compared to the respective critical loads (CL) for the habitats within each ecological site to determine the potential for significant effects.
- 8.5.36** The nitrogen deposition rates predicted at the statutory designated sites (Barnby Broad and Marshes SSSI) and the non-statutory sites (Leathes Ham LNR and Kirkley Ham CWS) are within the relevant critical loads for the habitat in the Base, Opening Year DM and DS scenarios at each site as given in Table 8-9 with the exception of the acid grassland habitat at the Kirkley Ham CWS for which the lower end of the critical load range for nitrogen deposition is exceeded in the Base, DM and DS scenarios. The detailed nitrogen deposition rates for each of the ecological sites assessed are given in Appendix 8G. In the DS scenario the highest nitrogen deposition rate of $14.1 \text{ kg N ha}^{-1} \text{ yr}^{-1}$ was calculated for the Barnby Broad and Marshes SSSI at a distance of 58.5m from the nearest modelled road, the A146. Nitrogen deposition rates at the Barnby Broad and Marshes SSSI did not change with the Scheme. A Nitrogen deposition rate of $14.1 \text{ kg N ha}^{-1} \text{ yr}^{-1}$ was also calculated for the Kirkley Ham CWS at a distance of 6m from the nearest modelled road, Tom Crisp Way. At the Kirkley Ham CWS the increase in N-deposition attributed to the Scheme in the DS scenario is predicted to be $0.5 \text{ kgN.ha}^{-1}.\text{yr}^{-1}$ at a distance of 6m from the road, which exceeds 1% of the lower CL of $20 \text{ kgN.ha}^{-1}.\text{yr}^{-1}$ for Neutral Grasslands, and 1% of the lower CL of $5 \text{ kgN.ha}^{-1}.\text{yr}^{-1}$ for Acid Grasslands, thereby indicating the potential for harm to vegetation, this is considered a significant adverse effect.
- 8.5.37** See Chapter 11 for more discussion on the impacts upon Kirkley Ham CWS.

Regional Assessment

- 8.5.38** A regional assessment of total emissions was undertaken for the opening year (2022) and design year (2037), focussing on the change in emissions of NO_x, PM₁₀, and CO₂ between the DM and DS scenarios for the Opening year and Design Year. The results of the assessment are presented in Table 8-13.
- 8.5.39** Overall, total emissions of each pollutant and CO₂ are predicted to increase between the DM and DS scenarios in both the Opening (2022) and Design (2037) years. In the Opening Year (2022), this increase in emissions equates to 1.6 tonnes per year for NO_x, 0.2 tonnes per year for PM₁₀, and 776 tonnes per year for CO₂.
- 8.5.40** In the Design Year (2037), the predicted increases in NO_x PM₁₀ and CO₂ emissions in the DS scenario relative to DM equate to 1.2 tonnes per year for NO_x, 0.3 tonnes per

year for PM₁₀ and 934 tonnes per year CO₂.

8.5.41 The National Atmospheric Emissions Inventory²¹ (NAEI) compiles data on UK CO₂ emissions by local authority and national data for emissions of NO_x and PM₁₀. The total emissions of CO₂ from the road sector within Waveney for the most recent available year (2015) were 144,458 tonnes. In the context of the overall regional emissions, the predicted increase in annual emissions of CO₂ (776 tonnes and 934 tonnes, respectively) attributed to the operational phase of the Scheme represent less than 1% of the 2015 road sector total, thus are not considered to represent a significant environmental effect.

8.5.42 The reported national emissions of NO_x and PM₁₀ for the most recently available year (2016) were 890,000 tonnes and 170,430 tonnes, respectively. The predicted increase in annual emissions of NO_x (1.6 tonnes and 1.2 tonnes) and PM₁₀ (0.2-0.3 tonnes) in each assessment year are therefore not considered to be significant in the context of the national emissions.

Table 8-13 – Regional Emissions Assessment Outputs

Scenarios	Pollutant Emission (tonnes per year)		
	NO _x	PM ₁₀	CO ₂
Base Year (2016)	188.2	16.4	69,746
Do-Minimum (2022)	130.0	16.4	69,988
Do-Something (2022)	131.6	16.6	70,764
% Change from DM-DS (2022)	+1.3%	+1.3%	+1.1%
Do-Minimum (2037)	81.0	19.1	78,265
Do-Something (2037)	82.6	19.4	79,199
% Change from DM-DS (2037)	+1.5%	+1.6%	+1.2%

* based on vehicle emissions factors for 2030, which is the latest future year for which projected vehicle emission factors are currently published by Defra.

Significance Assessment- Local Air Quality

8.5.43 The significance of local air quality changes as a result of the Scheme has been assessed with reference to IAQM guidance. Assessment against Highways England guidance is not required as IAN 174/13 only applies where the concentrations with the Scheme are within 10% of the objective for an assessed pollutant.

8.5.44 As such, the 3 properties that experience a large magnitude of change in NO₂ concentration do not contribute to significance as the DS scenario concentration is not within 10% of the objective as the large magnitude of change sensitive receptors have a maximum concentration below 20 µg/m³.

²¹ National Atmospheric Emissions Inventory 2018. CO₂ dataset: <https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-2015> and NO_x and PM₁₀ annual emissions dataset: <https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-2015>

- 8.5.45 The change in annual mean concentrations of NO₂ at the sensitive receptors is shown in Figure 8.10, for PM₁₀, Figure 8.14 and for PM_{2.5} Figure 8.17. A summary of the predicted changes in pollutant concentrations at the sensitive receptors is provided in Table 8-11, Table 8-12 and Table 8-13 which have been used to inform the judgement on whether the Scheme is likely to have a significant effect on local air quality.
- 8.5.46 Of the 32,493 sensitive receptors assessed, there are no receptors predicted to exceed the annual mean objective value for each pollutant in the opening year (2022).
- 8.5.47 No sensitive receptors have been identified as “*at risk*” (within 10% of objective value) of exceeding the NO₂ objective value as the highest annual mean NO₂ concentration predicted at a sensitive receptor with the Scheme is 23.4 µg/m³. Consequently, IAN174/13 guidance has not been adopted to assess significance.
- 8.5.48 The impact descriptors provided by the IAQM guidance⁵ have been adopted to describe the potential impact of the Scheme on local air quality at each of the identified relevant receptors. The predicted impact at each receptor is described in Table 8-14 for the opening year (2022).
- 8.5.49 The local air quality impacts associated with the operation of the Scheme are predicted to be predominantly *negligible*, with more properties predicted to experience an improvement in air quality as opposed to a worsening.
- 8.5.50 Based on the results of the local air quality assessment and evaluation within the context of the significance criteria, the Scheme will not constitute a significant environmental effect with respect to local air quality.

Table 8-14 – Predicted sensitive receptor impact (IAQM)

Impact Descriptor (IAQM)	Pollutant		
	NO ₂	PM ₁₀	PM _{2.5}
Substantial Improvement	0	0	0
Moderate Improvement	148	0	0
Slight Improvement	263	0	0
Negligible	32,019	32,493	32,493
Slight Worsening	60	0	0
Moderate Worsening	3	0	0
Substantial Worsening	0	0	0

- 8.5.51 The Scheme has no predicted exceedances of the health based air quality objectives for air pollutants NO₂, PM₁₀ and PM_{2.5} as a result of the Scheme. Similarly, there are no AQMAs that are predicted to be impacted detrimentally by the Scheme.
- 8.5.52 In terms of PCM compliance and compliance with the *EU Ambient Air Quality Directive* air pollutant limit values, based upon an assessment given in Appendix 8C, the Scheme will not result in a zone becoming non-compliant or affect the ability of the region to achieve compliance.

Significance Assessment- Regional Emissions

- 8.5.53 The predicted magnitude of increases in emissions associated with the operational Scheme for both the opening year (2022) and future year (2037) are likely to be insignificant within the context of total regional emissions. This is evidenced through the comparison of predicted increases associated with the Scheme to the most recently published regional and annual emissions reported by NAEI (see Paragraph 8.5.41 and 8.5.42).
- 8.5.54 Therefore, changes in regional emissions as a result of the Scheme are not considered to constitute a significant environmental effect.

8.6 Mitigation and Residual effects

Construction

- 8.6.1 In the absence of further mitigation, construction of the Scheme is considered to represent a *medium to high* risk with respect to potential dust impacts at nearby sensitive receptors. As such, a number of mitigation measures are recommended; with reference to IAQM guidance, that are commensurate to the scale and nature of the construction activities.
- 8.6.2 Given the proximity of receptors considered sensitive to construction dust and the medium to high risk rating with respect to potential dust impacts monitoring of dust and PM₁₀, mitigation measures have been incorporated into the interim CoCP for development into an air quality management plan at detailed design, which have been focussed on particularly sensitive locations adjacent to likely construction activity areas.
- 8.6.3 Dust and PM₁₀ monitoring is also included within the interim CoCP for medium to high risk sites, as defined by IAQM. This is to include:
- Regular onsite and offsite inspection where receptors are nearby, to monitor dust, record inspection results, and make the log available to the local authority when requested;
 - Increasing the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry and/or windy conditions;
 - Agreeing dust deposition and/or real-time continuous PM₁₀ monitoring locations with the county planning authority in consultation with Waveney District Council, with baseline monitoring taking place at least three months before construction works commence.
- 8.6.4 The mitigation measures focus on controlling fugitive releases of construction phase dust and will be implemented by the contractor through the air quality management plan required by the interim CoCP. Such measures include, but may not be limited to:
- Dust generating activities (e.g. cutting, grinding and sawing) will be minimised and weather conditions considered prior to conducting potentially dust emitting activities;

-
- Fine material will not be stockpiled to an excessive height in order to prevent exposure to wind and/or dust nuisance;
 - Roads and accesses will be kept clean;
 - Where possible, plant will be located away from site boundaries that are close to residential areas;
 - Water will be used as a dust suppressant, where applicable;
 - Drop heights from excavators to crushing plant will be kept to a minimum;
 - Distances from crushing plant to stockpiles will be kept to the minimum practicable to control dust generation associated with the fall of materials;
 - Skips will be securely covered;
 - Soiling, seeding, planting or sealing of completed earthworks will be completed as soon as reasonably practicable following completion of earthworks;
 - Dust suppression and the maintenance of the surface of access routes will be appropriate to avoid dust as far as practicable, taking into account the intended level of trafficking;
 - Wheel wash facilities to minimise trackout of dust;
 - Material will not be burnt on site; and
 - Engines will be switched off when not in operation.

8.6.5 The interim CoCP requires that the full CoCP stipulates the following to ensure the aforementioned mitigation is implemented effectively, continually monitored and updated accordingly:

- Identification of a responsible environmental manager
- Notification procedures where potentially significant dust generating activities are required;
- Method statements for the control of dust in such locations; and
- Management procedures to ensure issues are addressed should they be raised by the public.

8.6.6 The mitigation measures will reduce both the magnitude and duration of fugitive dust releases throughout the construction phase. With these measures in place, the residual dust impact will be, at worst, slight adverse at the highest risk receptors located downwind and within 50m of construction activities.

8.6.7 Any such, impacts are expected to be intermittent and temporary for the duration of the respective activities and therefore would not constitute a significant environmental effect.

Operation

8.6.8 As there are no likely significant effects identified during the operation of the Scheme, no mitigation measures for operational Air Quality are required.

8.7 Conclusion and Effects

Baseline Air Quality

- 8.7.1 Air quality monitoring undertaken by WDC and Scheme specific monitoring has demonstrated that NO₂ annual mean concentrations are greatest on the approaches to the A47 Bascule Bridge. However, there were no monitored exceedances of the annual mean objective for NO₂ throughout Lowestoft.
- 8.7.2 Background air quality in Lowestoft is good, with NO₂, PM₁₀ and PM_{2.5} annual mean background concentrations reported to be well below the respective objective values.
- 8.7.3 There are no Air Quality Management Areas (AQMA) designated within Lowestoft.

Construction Phase

- 8.7.4 The construction phase air quality assessment has demonstrated that, in the absence of mitigation, the scale and nature of the Scheme construction, excluding demolition represent a *medium to high* risk of dust related impacts. The highest risk sensitive receptors are those located within 50m and downwind of potential dust-generating activities.
- 8.7.5 Further mitigation measures will be implemented and secured via the full CoCP to prevent or minimise potential fugitive dust emissions. With these measures in place, the residual dust impact will be, at worst, slight adverse at the highest risk receptors.
- 8.7.6 Any such impacts are expected to be intermittent and temporary for the duration of the respective activities only and would not constitute a significant environmental effect.

Operation Phase

- 8.7.7 Operational phase air quality impacts are expected to be associated with changes to vehicle emissions caused by the implementation of the Scheme. Given that vehicle emissions are predicted to decrease with time as a result of more stringent regulation of petrol and diesel engines, local air quality impacts attributed to the Scheme are likely to be worst in the opening year.

Local Air Quality

- 8.7.8 The assessment has demonstrated that the operational Scheme would not result in any new exceedances of the air quality objectives for NO₂, PM₁₀ and PM_{2.5} at all sensitive receptor locations included in the detailed atmospheric dispersion modelling study. Indeed, there are predicted to be no exceedances of these objectives in both the Do Minimum and Do Something Opening Year (2022) scenarios.
- 8.7.9 Of the 32,493 sensitive receptors included in the modelling study, an improvement in annual mean pollutant concentrations is predicted to occur at 11,613 receptors (NO₂), 6,850 receptors (PM₁₀), and 2,108 receptors (PM_{2.5}) with the Scheme in operation when compared to without in the Opening Year (2022).
- 8.7.10 In contrast, 12,139 sensitive receptors are predicted to experience a worsening in annual mean concentrations of NO₂, 5,975 to experience a worsening in PM₁₀, and 1,080 receptors to experience a worsening PM_{2.5}.
- 8.7.11 The majority of the predicted changes in air pollutant concentrations, both improving

and worsening, are classed as *imperceptible* or *small*, with a relatively low number of changes corresponding to a *medium* and *large* classification. In all cases, the predicted total pollutant concentrations in the 2022 Do Something scenario are well below the respective health-based national air quality objective.

- 8.7.12 Through adopting the significance criteria in the guidance provided by IAQM, the local air quality impacts associated with the operation of the Scheme (see Paragraph 8.5.49) would not constitute a significant environmental effect.

Regional Emissions

- 8.7.13 The assessment has demonstrated that emissions of oxides of nitrogen, particulates (PM₁₀) and carbon dioxide would all be greater during the operational phase of the Scheme in the opening year (2022) and the design year (2037). Increases in regional emissions with the Scheme are not considered to constitute a significant environmental effect within the context of the total regional and national emissions.

Designated Sites

- 8.7.14 No significant environmental effects are predicated within any of the assessed statutory designated ecological sites, as defined by the DMRB, during the operational phase of the Scheme. Significant environmental effects have been predicted for the Kirkley Ham CWS which is not designated, but is an ecological receptor. Further discussion on this point is provided in Chapter 11.

NNNPS Compliance

- 8.7.15 The Scheme is not predicted to cause non-compliance with the NNNPS. There are no predicted impacts upon an existing AQMA and the Scheme would not affect the UK's ability to comply with the *EU Ambient Air Quality Directive*.

9 Cultural Heritage

9.1 Scope of the Assessments

Introduction

- 9.1.1** This chapter addresses the likely significant effects of the construction and operational phases of the Scheme on Cultural Heritage and the identification of mitigation of impact to Heritage Assets where relevant. It is supported by Figure 9.1 to Figure 9.4 and Appendix 9A to 9G. Appendix 9G, is the Gazetteer of Cultural Heritage Assets and each asset is assigned as Asset Reference Number, referred to throughout this chapter in the form (n). This chapter should be read in conjunction with Chapter 10: Townscape and Visual Impact and Chapter 12: Geology and Soils.
- 9.1.2** The baseline for Cultural Heritage presented in Section 9.4 is derived from information collated for a desk-based assessment (Appendix 9A), results of subsequent research and consultation responses received from the Secretary of State (SoS) in the Scoping Opinion (Appendix 6B) and consultation responses from Historic England (HE), Suffolk County Council Archaeological Services (SCCAS) and Waveney District Council (WDC).
- 9.1.3** The assessment has been completed with reference to HE good practice advice to implementing historic environment legislation, policy and guidance, and the National Policy Statement for National Networks. The value and significance of Cultural Heritage is assessed, a staged approach to examination of setting is used, and management of the impact of the Scheme on heritage assets is addressed. Further information on the methods used is included in Section 9.3.
- 9.1.4** The assessment results are presented as a discursive, iterative and non-technical narrative in Sections 9.6 – 9.9. For ease of reference the results of the assessment are also summarised in tabular format in section 9.9.
- 9.1.5** The Scheme comprises a bridge structure and supporting link roads, therefore the assessment has also considered Highways England's Interim Advice Note (IAN) 125/15, which provides supplementary advice to sections of the Design Manual for Roads and Bridges (DMRB) relevant to Cultural Heritage. The summary tabular format used and the terminology employed to describe the significance of the Cultural Heritage, the impact and the significant effects of the development are derived from those used by the DMRB.

The Study Area

- 9.1.6** This assessment focuses on the nature and extent of the heritage assets located within a 500m buffer around the Order limits (Figure 9.1). The 500m study area includes parts of the Inner Harbour and Entrance Channel, the Inner Harbour – North, and the Inner Harbour – South character areas, as defined by a recent HE study of the port of Lowestoft²². The 500m study area has been selected to include the area where direct physical impact to heritage assets may occur during the construction phase of the Scheme and where the Scheme is likely to have significant effects upon the setting of

²² Historic England 2016. Lowestoft: Port Heritage Summary

built heritage assets.

- 9.1.7 A few areas beyond 500m have been identified, using the Zone of Theoretical Visibility (ZTV) (see Chapter 10 and Figure 9.2), where the Scheme will be visible from designated and non-designated built heritage assets when the Scheme Bascule Bridge is in the raised position, and hence at its tallest point. Using the ZTV and photomontages (see 9.3.14), and with the qualification that the ZTV identifies views from rooftops, (see 10.3.30) professional judgement guided by legislation, policy, acknowledged standards and designation criteria (see 9.3.15) has then been applied to incorporate these assets into the scope of the assessment within this chapter. The selected study area is consistent with SoS's Scoping Opinion (Appendix 6B), directing that the Applicant should "*ensure that [the study area] is sufficiently wide to capture all cultural heritage features that could be significantly affected by the Proposed Development*" (paragraph 3.45).
- 9.1.8 The built heritage assets situated outside the 500m study area with views of the Scheme, which are included in the assessment are all located within the South Lowestoft Conservation Area (shown on Figure 9.1) and comprise:
- Port House (Listed Building: Grade II);
 - Royal Norfolk and Suffolk Yacht Club (Listed Building: Grade II*);
 - Central Railway Station (locally listed);
 - 18-32 Station Square (locally listed);
 - Terraced Houses (19th Century) (fronting north side of Commercial Road) (local interest building);
 - 7-11 Station Square (locally listed);
 - RNLI Statue (locally listed); and
 - 1-8 Pier Terrace (locally listed).
- 9.1.9 The number of conservation areas considered by the original desk based assessment (Appendix 9A) was three, but it was subsequently agreed during scoping (Appendices 6A & 6B) that Oulton Broad Conservation Area and North Lowestoft Conservation Area would be screened from the Scheme by topography and the existing built environment and their setting would not be impacted upon. The subsequently completed ZTV (see Figures 10.2 - 10.4) for the Scheme shows very limited inter-visibility between the Scheme and the North Lowestoft Conservation Area, but this inter-visibility is restricted to the rooftops of buildings located within the CA and it is not considered in this assessment but due to the negligible impact at ground level where the heritage asset is best appreciated, this does not warrant inclusion of these heritage assets into this assessment. . In contrast, distant views of the Scheme may be possible from ground level at parts of the Oulton Broad Conservation Area and therefore this Conservation Area has been reintroduced to the assessment. The three conservation areas are shown in Figure 9.2.

9.2 Directives, Statutes and Relevant Policy

9.2.1 The following national legislation, policies and guidelines have been considered.

National Legislation

Ancient Monuments and Archaeological Areas Act 1979

9.2.2 This legislation defines sites that warrant protection due to their being of national importance as 'ancient monuments'. These can be either Scheduled Monuments or "any other monument which in the opinion of the Secretary of State is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attaching to it". The Act states that consent must be obtained from Historic England (formerly English Heritage) for works of demolition, repair and alteration that might affect heritage assets which are designated as Scheduled Monuments (SM) or assets being considered for adoption as an SM. Heritage assets which are not designated as SMs are protected through the development management process under the TCPA 1990 and the NPPF.

Planning (Listed Building and Conservation Areas) Act 1990

9.2.3 This Act makes provision for the protection and conservation of historic buildings and areas by way of a process of listing and designation. Listed buildings are classified as being Grade I, Grade II* or Grade II and historic areas are designated as conservation areas. Once listed, Listed Building Consent must be obtained from the local planning authority before works to demolish, alter or extend a listed building can be carried out. Similarly, consent must be obtained for the demolition of buildings in a Conservation Area. New developments in a Conservation Area are also expected to adhere to strict design criteria to ensure the character of the area is maintained or enhanced.

The Historic Buildings and Ancient Monuments Act 1953

This Act authorises Historic England to compile a register of 'gardens and other land' situated in England that appear to be of special historic interest. Registered Parks and Gardens are graded I, II* or II along the same line as listed buildings. A registered park or garden is not protected by a separate consent regime, but applications for planning permission will give great weight to their conservation.

The Infrastructure Planning (Decisions) Regulations 2010

9.2.4 These Regulations require the Decision Maker (in this case, the SoS) to have regard towards the desirability of preserving the setting and features of listed buildings and the desirability of preserving or enhancing the character or appearance of Conservation Areas when determining applications for development consent.

National Policy

National Networks: National Policy Statement

9.2.5 The National Networks National Policy Statement (NNNPS) sets out national policy relevant to decisions on development consent applications for national networks nationally significant infrastructure projects in England. The NNNPS clarifies that a heritage asset can be a building, monument, site, place, area or landscape and that the significance of the asset is a factor both its physical presence as well as its setting.

9.2.6 Within an Environmental Statement, paragraph 5.126 of the NNNPS states that an applicant is required to “undertake an assessment of any likely significant heritage impacts of the proposed projectand describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset’s importance.”

9.2.7 Paragraphs 5.128 to 5.133 of the NNNPS set out the matters relevant to the Secretary of State’s determination of applications where heritage matters are relevant.

National Policy Statement for Ports

9.2.8 The National Policy Statement for Ports (PNPS) sets out national policy relevant to decisions on development consent applications for Port and related infrastructure. Similarly to the NNNPS, an applicant is required to provide a description of the significance of affected heritage assets affected by a proposed development and the level of detail should be proportionate to the importance of the heritage asset.

National Planning Policy Framework, 2012

9.2.9 The NPPF requires developers to assess Heritage Assets as part of their planning applications and to record assets that cannot be conserved as part of the works. This includes both designated and undesignated assets.

East Inshore and East Offshore Marine Plan

9.2.10 Policy SOC2 of this Marine Plan requires applications that may affect heritage assets to demonstrate, in order of preference:

- a) “that they will not compromise or harm elements which contribute to the significance of the heritage asset
- b) How if there is compromise or harm to a heritage asset, this will be minimised
- c) How, where compromise or harm to a heritage asset cannot be minimised it will be mitigated against, or
- d) The public benefits for proceeding with the proposal if it is not possible to minimise or mitigate compromise or harm to the heritage asset.”

Heritage Guidance and Standards

9.2.11 The following guidance documents have informed the assessment upon Cultural Heritage.

Historic England

- Historic England 2015. Managing Significance in Decision-Taking in the Historic Environment. Historic Environment Good Practice Advice in Planning: 2;
- Historic England 2017. The Setting of Heritage Assets. Historic Environment Good Practice Advice in Planning: 3;
- Historic England 2015. Tall Buildings: Historic England Advice Note 4; and
- Historic England 2008. Conservation Principles, Policies and Guidance.

Chartered Institute for Archaeologists

- ClfA 2017. Standards and Guidance for Historic Environment Desk-Based Assessment.

Highways England

- Highways England 2015. Interim Advice Note 125/15: Environmental Assessment Update; and
- Highways England Design Manual for Roads and Bridges. Vol11/section3/Part 2. HA 208/7: Cultural Heritage.

9.3 Methods of Assessment

- 9.3.1 This assessment has been completed with reference to HE advice to implementing historic environment legislation, policy and guidance comprising Historic Environment Good Practice Advice in Planning Notes 2-3, Historic England Advice Note 4 (tall buildings) and Conservation Principles, Policies and Guidance. The results of the assessment are presented as a discursive, iterative and non-technical narrative in sections 9.6 to 9.11.
- 9.3.2 The assessment has referenced the NNNPS, NPSP and the NPPF. The NNNPS and NPSP require a description of the significance of heritage assets affected by proposed development, and the contribution of their setting to that significance, and that sufficient information is provided to enable adequate understanding of the extent of impact of proposed development on heritage assets. The NNNPS differentiates between “*substantial harm*” and “*less than substantial harm*” to designated heritage assets (paragraphs 5.132-134).
- 9.3.3 The Scheme comprises a bridge structure and supporting link roads, therefore consideration has also been given to the guidance provided by Highways England’s Interim Advice Note (IAN) 125/15, which sets out supplementary advice to relevant sections of the Design Manual for Roads and Bridges (DMRB).
- 9.3.4 The assessment has also referenced the Chartered Institute for Archaeologists (ClfA) standards and guidance documents, including the Standards and Guidance for Historic Environment Desk-Based Assessments.

Stages in the Assessment Process

- 9.3.5 Following consideration of HE guidance, and taking into account the baseline for the Scheme, the assessment has been undertaken in the following six key stages, as agreed with Historic England:
- Establish the baseline environment through desk based review and site survey;
 - Identify which heritage assets and their settings within the baseline environment may be affected by the Scheme;
 - Assess the value and significance of affected heritage assets, including the degree to which settings and views make a contribution to their significance;
 - Assess the impact of the Scheme, whether beneficial or harmful, on the significance of affected heritage assets and their settings;

-
- Identify ways to mitigate the impact of the Scheme; and
 - Describe the residual significant effects of the Scheme.

Methodology for Stage 1 - Establishment of the baseline environment

9.3.6 The identification and description of the baseline environment has involved a combination of desk-based review of plans, records and other documents, consultation with statutory consultees and completion of mostly non-intrusive site surveys.

9.3.7 Descriptions of all of the heritage assets examined for the heritage baseline, including those subsequently selected for assessment in this chapter, are presented in the Gazetteer (Appendix 9G). Where these heritage assets are identified in this chapter they are referenced as a bold number in brackets utilising a Scheme specific numbering system to allow ease of cross referencing to the figures and the Gazetteer (Appendix 9G).

9.3.8 For ease of reference the baseline environment includes a section identifying designated and non-designated heritage assets, and is broadly presented as three heritage asset topics areas:

- Built heritage considers architectural, designed or other structures with historical significance, such as listed buildings or structures of local historic interest;
- Archaeological remains consider those materials created or modified by past human activities, which include a wide range of visible and buried artefacts, field monuments, structures and landscape features in both terrestrial and marine environments. They also include areas which have been identified as being of archaeological potential; and
- The historic landscape concerns perceptions that emphasise evidence of the past and its significance in shaping the present landscape.

9.3.9 In relation to Historic Landscapes, the baseline environment focuses on historic landscape types and historic landscape units within the study area where human, social and economic activity has shaped the landscapes and there is a discernible awareness of their evolution. Historic landscape types are distinctive areas of the landscape with a consistent overarching theme, such as 'woodland' or 'enclosed land'. Historic landscape types usually contain a number of historic landscape unit subdivisions, which take account of variations such as morphology, location and time depth, for example long established woodland and recent commercial forestry.

Desk based review

9.3.10 The following sources of information have been consulted to establish the baseline environment:

- Information on designated heritage assets, which comprise World Heritage Sites, SMs, Listed Buildings, Registered Parks and Gardens, and Registered Battlefields, assets held on Historic England's National Heritage List for England (NHLE);
- Information on known undesignated heritage assets held by the Suffolk Historic Environment Record (HER);

-
- Details of previous archaeological investigations which have been undertaken within the study area (held by the HER);
 - Information on Conservation Areas and other built heritage assets that were worthy of inclusion within the assessment (held by the HER and through consultation with WDC);
 - Documentary and photographic sources (including aerial photographs) held by the HER, Historic England's National Record of the Historic Environment (NHRE) and the Suffolk Archive Service;
 - Historic Mapping held by the HER and the Suffolk Archive Service; and
 - Historic Landscape Characterisation (held by Suffolk HER).

9.3.11 A preliminary geoarchaeological deposit model was completed in February 2017 (Appendix 9B) from desk based review of historical borehole logs situated along the route and in proximity to the Scheme. The preliminary geoarchaeological deposit model will be refined as further GI becomes available to further inform the approach to mitigation, which will be completed pre-construction as set out in the Written Scheme of Investigation for Evaluation and Mitigation presented in Appendix 9F.

Site surveys

9.3.12 Walkover surveys of the study area were conducted on 20 November 2015 and on 30 June 2017. Sites of known heritage assets were visited to confirm their location and condition. During this walkover survey the study area was searched for previously unknown heritage assets which are not recorded on the HER. New assets which are not currently recorded on the HER are presented in the Gazetteer in Appendix 9G and solely consist of non-designated buildings of local historic interest present on 19th and early 20th century Ordnance Survey (OS) maps (the 'Local Interest' buildings shown on Figure 9.1). These Local Interest buildings have been included within the scope of this assessment following consultation with WDC.

9.3.13 An archaeological watching brief was undertaken in 2016 and 2017 during Geotechnical Investigation (GI) comprising trial trenching and trial pitting along the route of the Scheme (Figure 9.4) in accordance with a Written Scheme of Investigation (WSI) (Appendix 9C). Any further trial pits that will be completed pre-construction will be supervised in accordance with the WSI included in Appendix 9C and this is secured as a requirement to the DCO. The findings of the watching brief undertaken to date are included in reports presented in Appendices 9D and 9E and these results are incorporated into the assessment.

Methodology for Stage 2 - Identification of heritage assets and settings within the established baseline (stage 1) affected by the Scheme

9.3.14 The identification of heritage assets and settings which may be affected by the Scheme has been completed through consideration of the construction of the Scheme, examination of the Scheme design, and results of other assessments such as traffic, noise and townscape; and comparison of this information with the distribution and setting of heritage assets recorded in the baseline environment, the ZTV and photomontages taken from the viewpoints that were selected in consultation with HE.

The photomontages were taken from locations in proximity to, but not directly adjacent to assessed heritage assets and provide an example of how views to the Scheme would be experienced from areas in proximity to those heritage assets. Heritage assets are scoped out of further assessment where the traffic, noise and townscape assessments consider effects to be neutral or slight, where photomontages show that views of the Scheme would be distant and screened from heritage assets by existing landscape features or the built environment, and where the ZTV has shown that views between heritage assets and the Scheme would only be possible from the highest point of the heritage asset (e.g. rooftops) and would not be experienced from locations where visual appreciation of the heritage asset and its setting would be usual (e.g. ground level).

Methodology for Stage 3 - Assessment of the value and significance of heritage assets

9.3.15 Professional judgement, guided by legislation, policy, acknowledge standards and designation criteria regarding the archaeological, architectural, historic and artistic interested of assessed heritage assets and the contribution of their setting has informed the assessment of value and significance, as discussed in Section 9.6 and summarised in Table 9-10, Table 9-11, Table 9-12 and Table 9-13

9.3.16 It is noteworthy that the assessment has been undertaken with reference to HE guidance for determining the impacts upon a heritage asset and this guidance specifically uses the term 'significance' where elsewhere in this ES the term 'sensitivity' is used. To provide consistency with HE terminology the term significance has been used within this chapter.

9.3.17 The value of a heritage asset to this and future generations is derived from its heritage interest. That interest derives not only from a heritage asset's physical presence, but also from its setting and is influenced by a range of high level inter-related heritage values, which contribute to the significance of heritage assets. The assessment of the value of heritage assets has involved consideration of four categories, which are summarised as:

- Aesthetic value, the ways in which people draw sensory and intellectual stimulation from heritage assets;
- Communal value, the meanings of a heritage asset for the people who relate to it, or for whom it figures in their collective experience or memory;
- Evidential value, the potential of the heritage asset to yield evidence about past human; and
- Historical value, the ways in which past people, events and aspects of life can be connected through heritage assets to the present.

9.3.18 The assessment of the significance of heritage assets has involved consideration of:

- Understanding the nature of the significance of the heritage asset;
- Understanding the extent of the significance of the heritage asset;
- Understanding the level of the significance of the heritage asset; and
- Understanding the contribution made by the setting and context of the heritage

asset to its significance.

Six ratings of significance are used for heritage assets, very high, high, medium, low, negligible, unknown; the ratings and criteria of the significance of heritage assets is presented in three topic areas, which comprise archaeological remains in Table 9-1, built heritage in Table 9-2 and historic landscapes in Table 9-3.

Table 9-1 – The significance of archaeological remains

Significance	Example
Very High	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Monuments (including proposed sites) Undesignated assets of scheduled quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or undesignated assets that contribute to regional research objectives
Low	Designated and undesignated assets of local importance Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest
Unknown	The importance of the resource has not been ascertained

Table 9-2- The significance of built heritage assets

Significance	Status and Definition
Very High	International importance i.e. World Heritage Sites.
High	National importance i.e. listed buildings at Grade I and II*, Scheduled Monuments with standing remains, conservation areas containing very important buildings and undesignated structures of clear national importance.
Medium	Regional importance i.e. listed buildings at Grade II, conservation areas containing buildings that contribute significantly to its historic character, historic townscape with important integrity in their buildings, or built settings and undesignated structures of clear regional importance.
Low	Local importance i.e. undesignated assets of modest quality in their fabric or historical association and historic townscape of limited historic integrity (including buildings and structures included in a local list prepared by the local authority).
Negligible	Assets of no architectural or historical note
Unknown	Assets with some hidden i.e. inaccessible potential for historic or architectural significance.

Table 9-3 – The significance of historic landscapes

Significance	Status and definition
Very High	World Heritage Sites inscribed for their historic landscape qualities. Historic landscapes of international value, whether designated or not. Extremely well preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s).
High	Designated historic landscapes of outstanding interest. Undesignated landscapes of outstanding interest. Undesignated landscapes of high quality and importance, and of demonstrable national value. Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	Designated special historic landscapes. Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value. Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s).
Low	Robust undesignated historic landscapes. Historic landscapes with importance to local interest groups. Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations.
Negligible	Landscapes with little or no significant historical interest.

Methodology for Stage 4 - Assessment of magnitude of impact

9.3.19 The assessment of magnitude of impact has included consideration of the setting of heritage assets, their vulnerability, current state of survival/condition and the nature of the potential impact of the Scheme upon them.

9.3.20 Impacts on heritage assets can be indirect or direct and occur during the construction and operational phases of the Scheme, i.e. during groundworks, clearance, landscaping, ground compaction, service installation, stockpiling, storage, visual intrusion (including lighting), alteration to traffic volumes and associated noise and vibration. These activities include the following impacts:

- Permanent complete or partial loss of a heritage asset as a result of ground excavation, including piling;
- Permanent or temporary loss of the physical and/or visual integrity of a feature, monument, building or group of monuments;
- Permanent or temporary damage to the setting and therefore significance of heritage assets;
- Damage to heritage assets due to compaction, desiccation or waterlogging; and
- Damage to heritage assets as a result of ground vibration caused by construction.

9.3.21 Factors for consideration when evaluating magnitude of impact upon heritage assets include:

- The percentage destruction of a heritage asset or group of heritage assets;
- Analysis of the extent to which partial destruction affects the integrity and understanding of a heritage asset or group of heritage assets;
- The extent to which the Scheme and its associated traffic impinge upon factors that contribute to the significance of heritage assets including their setting, i.e. views, topography, vegetation, sound environment, approaches and context, as experienced within the landscape or townscape; and
- The extent to which the Scheme and predicted changes in traffic flows throughout the study area impinge upon the form and understanding of the time depth of historic landscapes.

9.3.22 Five ratings for magnitude of impact have been adopted for heritage assets, major, moderate, minor, negligible, no change based on these considerations and criteria for attribution of magnitude of impact are described in Table 9-4.

Table 9-4 – The magnitude of impacts upon heritage assets

Magnitude of Impact	Criteria
Major	Change to most or all key archaeological elements, such that the resource is totally altered. Change to most or all key built heritage elements, such that the resource is totally altered. Change to most or all key historic landscape elements, parcels or components: extreme visual effects: gross change of noise or change to sound quality: fundamental changes to use or access: resulting in total change to historic landscape character. Comprehensive changes to setting.
Moderate	Changes to many key archaeological elements, such that the resource is clearly modified. Change to most or all key built heritage elements, such that the resource is clearly modified. Change to many key historic landscape elements, parcels or components: visual change to many key aspects of the historic landscape: noticeable differences in noise or sound quality: considerable changes to use or access: resulting in moderate changes to historic landscape character. Considerable changes to setting that affect the character of the asset.
Minor	Changes to key archaeological elements, such that the resource is slightly altered. Change to most or all key built heritage elements, such that the resource is slightly altered. Change to few key historic landscape elements, parcels or components: slight visual change to few key aspects of the historic landscape: limited differences in noise or sound quality: slight changes to use or access: resulting in limited changes to historic landscape character. Slight change to setting.
Negligible	Very minor changes to archaeological elements, built heritage elements, or setting. Very minor changes to key historic landscape elements, parcels or components: virtually unchanged visual effects: very slight changes in noise levels or sound quality: very slight changes to use or access: resulting in very small changes to historic landscape character.
No Change	No change to archaeological elements, built heritage fabric or settings.

Magnitude of Impact	Criteria
	No change to elements, parcels or components: no visual or audible changes: no changes arising from in amenity or community factors.

Methodology for Stage 5 - Mitigation

9.3.23 Embedded mitigation for the Scheme has been included through the form, aesthetics and landmark nature of the proposed bridge structure. The design has followed a 'marine tech' theme, refer to Design Report (document reference 7.5) and Section 0 where this embedded mitigation is discussed in greater detail, because of its greater relevance to the assessment upon townscape character and visual impacts.

9.3.24 Where impacts have been identified following an assessment which takes account of embedded measures, consideration is then given to suitable further mitigation measures, which includes consideration of:

- Preservation of archaeological, built heritage and historic landscape assets in-situ;
- Investigations such as trial trenching to determine the significance of known heritage assets and the presence/significance of unproven heritage assets, and subject to the findings, to inform the identification of any further investigations;
- Preservation by record of heritage assets that are to be destroyed involving part or all of the following: topographic survey, excavation and recording, detailed measurement, mapping and photographic recording of heritage assets and their setting; and
- Interpretation and dissemination of information gathered as a result of any of the above to ensure that knowledge of heritage assets of local, regional, national or international significance is preserved or enhanced.

9.3.25 Preservation in situ of significant designated or non-designated heritage assets is the preferred option should they be present. However, where this is not possible then alternative options can be agreed with stakeholders.

Methodology for Stage 6 - Assessment of significant effects

9.3.26 The assessment of the residual significant effects of the Scheme has involved consideration of the significance of the heritage assets and the potential magnitude of impact to the significance of the assets after embedded mitigation is taken into account. The assessment and determination of significance has been completed using professional judgment to a level of thoroughness proportionate to the relative significance of the asset whose fabric or setting is affected.

9.3.27 Five ratings have been adopted for determining significant effects. The ratings are neutral, slight, moderate, large and very large. These significance ratings should not be confused with those in Table 9.1, which rate the significance of the heritage assets. Table 9.5 instead rates the significance of any residual effects. A matrix showing how the significance of the heritage asset and the scale of predicted impact can inform the assessed significant effect rating is shown in Table 9-5.

Table 9-5 – The significance of effects upon heritage assets

Significance	Magnitude of Impact					
		No change	Negligible	Minor	Moderate	Major
	Very high	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Moderate or Slight	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

9.3.28 The identification of a significant effect is based on professional judgement involving comparison of the significance of heritage assets, the magnitude of potential impact and embedded mitigation to determine a significant effect. If an effect is assessed as neutral or slight this will not be considered a significant effect; but moderate, large or very large effects will require mitigation through embedded design or by proportionate programmes of investigation, recording and dissemination.

9.4 Stage 1 - Baseline Environment

Introduction

9.4.1 A total of six designated heritage assets (three conservation areas and three listed buildings), 51 non-designated heritage assets (archaeological remains, find spots and non-designated built heritage) and 10 archaeological events (desk-based studies, trial trenching, watching brief and building recording) were considered by the desk-based assessment (DBA) that was prepared in December 2015 (Appendix 9A).

9.4.2 The majority of the heritage assets considered in this DBA were located within a 500m study area of the red line boundary as it was at that time, although four of the designated heritage assets (two conservation areas and two listed buildings) and a small number of archaeological assets of prehistoric and Roman date were located just out with this initial study area. The DBA scoped out one of the listed buildings (The Beeches) and two of the conservation areas (North Lowestoft and Oulton Broad) from further consideration as information available when this document was prepared suggested that the existing built environment would screen these assets from the Scheme. Examination of the ZTV has shown that the Scheme may be visible from the highest point of buildings (rooftops) in the vicinity of The Beeches and within the North Lowestoft Conservation Area, but due to the negligible impact at ground level where the heritage asset is best appreciated, this does not warrant reintroduction of these heritage assets into this assessment. As discussed in Paragraph 9.1.9 and 9.4.4, the Oulton Broad Conservation Area has now been brought back into this assessment.

- 9.4.3 The Order limits of the Scheme have altered slightly since the preparation of the desk-based assessment (Appendix 9A) which accompanied the Preliminary Environmental Information Report. The extent of the 500m study area used in this chapter has consequently altered to reflect this. The revised study area has scoped out four of the non-designated assets (all Second World War defensive sites) included in previous assessments as these are now out with the study area, and has brought into consideration three additional designated heritage assets, comprising two listed buildings (both Grade II and situated within the South Lowestoft Conservation Area), and the Oulton Broad Conservation Area (as discussed in Paragraphs 9.1.9 and 9.4.4). The additional designated assets have been included in this chapter within the baseline environment and have been appended to the Gazetteer presented in Appendix 9G. The listed buildings are shown and named on Figure 9.1.
- 9.4.4 In addition, following consultation responses, the revised study area and examination of the ZTV (see Figure 9.2) have brought Oulton Broad Conservation Area back into consideration, added three locally listed buildings, three buildings of local architectural or historical interest and a small number of non-designated archaeological assets. The Oulton Broad Conservation Area and all additional non-designated assets are also considered in this chapter in the baseline environment and have been appended to the Gazetteer. The addition of heritage assets resulting from the alteration to the study area and the numbering of heritage assets examined (but not numbered) in the DBA prepared in 2015 (Appendix 9A) brings the total of heritage assets examined for the baseline of this chapter and included in the Gazetteer (Appendix 9G) to 80.
- 9.4.5 Designated and non-designated built heritage assets that have been assessed are named on Figures 9.1, the location of CAs is shown on Figure 9.2, non-designated archaeological heritage assets and archaeological events are shown on Figure 9.3. Descriptions of all of the heritage assets examined for the heritage baseline and then those subsequently selected for assessment in this chapter, are presented in the Gazetteer (Appendix 9G). Where these heritage assets are identified in this chapter they are referenced as a bold number in brackets utilising a Scheme specific numbering system to allow ease of cross referencing to the figures and the Gazetteer (Appendix 9G).

Summary of Designated Heritage Assets

- 9.4.6 There are no World Heritage Sites, Scheduled Monuments, Registered Battlefields or Registered Parks and Gardens within the study area.
- 9.4.7 One Conservation Area (South Lowestoft) and three Listed Buildings (Wellington Esplanade: **65**, Ashurst: **66**, and 9,10 and 11 Waterloo Road and 16-28 Victoria Terrace: **67**) which are all Grade II and all within the South Lowestoft CA (**68**), are situated within the 500m study area. Out with this study area a Conservation Area located c.1km to the west (Oulton Broad: **69**) and two other listed buildings (Royal Norfolk and Suffolk Yacht Club at Grade II*: **61**, and the Port House: **60**, at Grade II), respectively located c.150m and c.80m to the east of the study area, will have partial views of the Scheme and these assets are consequently included in the baseline environment and the assessment.
- 9.4.8 The designated assets referred to in the preceding paragraph, along with a

classification of their significance derived from the assessment presented in section 9.6, are identified in Table 9-6 and are described further in this baseline environment section.

Table 9-6 – Designated Heritage Assets

Site number	National Heritage List for England ref.	Site Name	Designation	Significance
60	1292511	Port House	Listed Building, Grade II	Medium
61	1207043	Royal Norfolk And Suffolk Yacht Club	Listed Building, Grade II*	High
65	1207048	Wellington Esplanade	Listed Building, Grade II	Medium
66	1207035	Ashurst	Listed Building, Grade II	Medium
67	1292405	9, 10 and 11 Waterloo Road and 16-28 Victoria Terrace	Listed Building, Grade II	Medium
68	-	South Lowestoft CA	Conservation Area	High
69	-	Oulton Broad CA	Conservation Area	High

Conservation Areas

South Lowestoft Conservation Area

9.4.9 The South Lowestoft Conservation Area (**68**) was designated in 1978, extended in 1996, 2003 and again after reappraisal in 2007. The reappraisal²³ describes the CA thus:

"It includes a small area at the north side of Lake Lothing, but mostly encompasses the part of the town situated to the south of Lake Lothing, which was constructed during its 19th century expansion as a seaside resort. The area developed following the establishment of a harbour and river access through Lake Lothing in the early 19th century and grew into a pleasure resort from the mid-19th century onwards. The buildings of the conservation area comprise a small number of commercial premises focussed at the north around Lake Lothing, large townhouses, villas and lodging houses to the south along the seafront, with areas of lower status terraced housing inland. The area has a largely linear street plan, laid out parallel to the shore, which reflects the formal planning of the seaside resort, with pleasure gardens and promenades along the seafront, whilst a more curvilinear plan is apparent within the area of villas to the southwest. The dockside areas are of historic significance, continued importance to the local economy and contribute to the local sense of identity".

Oulton Broad Conservation Area

9.4.10 The Oulton Broad Conservation Area (**69**) was designated in 1990, and at the time of writing is undergoing reappraisal. The reappraisal²⁴ recommends the expansion of the

²³ South Lowestoft Conservation Area Character Appraisal

²⁴ Oulton Broad Conservation Area Re-Appraisal

CA to incorporate Nicholas Everitt Park and other areas situated to the west of Mutford Bridge. The 19th-century and early 20th-century residential area on the north shore of the broad, including three listed buildings, but mostly comprising large detached houses of local architectural and historic interest situated in extensive plots, constitutes the existing conservation area.

Built Heritage

Listed Buildings

9.4.11 There are three listed buildings within the study area; all are located within the South Lowestoft Conservation Area close to, or facing the esplanade and seafront. All were built in the later 19th century as part of the expansion of the holiday resort. The listed buildings comprise:

- Wellington Esplanade (Grade II – LB no 120704);
- Ashurst (Grade II – LB no 1207035); and
- 9, 10 and 11 Waterloo Road and 16-28 Victoria Terrace (Grade II – LB no 1292405).

9.4.12 Wellington Esplanade (**65**) consists of a terrace of houses built in 1852 by John Louth Clemence for Sir Samuel Morton Peto. As shown in Plate 9-2, it is built of red brick with gault brick dressings. This terrace was part of the extensive plan for housing originally devised in 1846 by JL Clemence which had the aim of developing Lowestoft as a fashionable holiday resort. This aim was made possible by the building of the railway by Peto in the 1840s.

9.4.13 Ashurst (**66**) consists of a pair of houses which was built in 1864 by W.O. Chambers. The houses are built of brick which is rendered and whitewashed (Plate 9-3). The houses are now in use as flats but, like Wellington Esplanade, were originally part of the extensive plan for housing devised by JL Clemence.

9.4.14 9, 10 and 11 Waterloo and 16-28 Victoria Terrace (**67**) consists of a terrace of houses built specifically as lodging houses for sea-side leisure activities in 1869. The terrace is built of red brick with gault brick dressings and is shown in Plate 9-3.



Plate 9-1 – Wellington Esplanade



Plate 9-2 – Ashurst



Plate 9-3 – 9, 10 and 11 Waterloo and 16-28 Victoria Terrace

9.4.15 There are also two other listed buildings located slightly to the east of the study area, which will have partial views of the Scheme. These are the:

- Port House (Grade II – LB no 1292511); and
- Royal Norfolk & Suffolk Yacht Club (Grade II* - LB no 1207043).

9.4.16 The Port House (**60**) (Plate 9-4) is located on the north side of Lake Lothing, adjacent to Town Quay. It was originally built in 1831 as a Customs House, and was most recently in use as offices although it is currently disused. It is built of gault brick with slate roofs. The long frontage of the building faces south, towards the north quay.

9.4.17 The Royal Norfolk and Suffolk Yacht Club (**61**) (Plate 9-5) is a purpose built Yacht Club, built in 1902-3 by G & F Skipper of Norwich. The building is built of rendered and whitewashed brick and is of a very advanced design for its date. The building is on an L shaped plan with an engaged tower in the inner angle opposing a square observation road at the top of the outer angle.



Plate 9-4 – The Port House



Plate 9-5 – The Royal Norfolk and Suffolk Yacht Club

Locally Listed Buildings

9.4.18 Located slightly to the east of the study area and within the South Lowestoft Conservation Area are a number of locally listed buildings, which have been identified by WDC, as making a positive contribution to the character of Lowestoft. These sites are not nationally designated, however, they are included on a list of local heritage assets, which means that their conservation as a heritage asset is an objective of the NPPF. These locally listed buildings have been included within the scope of this assessment following consultation with WDC.

9.4.19 It is considered that views of the Scheme will be visible from the locally listed buildings, although often only from the side or rear elevations and upper floors. The locally listed buildings comprise:

- **Lowestoft Central Railway Station (70)** – The second station building on this site which was built by the Lucas Brothers (Petos - local building contractors) in 1855. Engravings and photographs of the building in its heyday show a grand building with three Italianate turrets along its principal (north) elevation. It is evident that what survives is a much reduced form of the original building. Built in gault brick the building is principally of one storey with parapet and moulded stone eaves cornice. A stringcourse and sillband run along all elevations of the building. The parapet has recessed rectangular panels along its length (see Plate 9-6);
- **7-11 Station Square (71)** – This building consists of a three storey gault brick building comprising a terrace of three properties each of two bays. The slate roof is pitched with a deep moulded dentil eaves cornice. The ground floor of each property contains a shopfront (Plate 9-7);
- **18-32 Station Square (72)** – This building is situated on the corner of Station Square and Waveney Road and was the premises of Tuttle's Bon Marche Department Store from the late 19th century until its closure in 1981 (Plate 9-8);
- **1-8 Pier Terrace (73)** – This comprises a terrace of late 19th century buildings constructed in gault brick with pitched slate roofs and rusticated pilasters separating the properties. All of these properties have shopfronts to the ground floor. No's 3, 7 & 8 retain early shopfronts of relatively good architectural quality (Plate 9-9); and
- **RNLI Statue, Pier Terrace (74)** – This statue is located between 1 Pier Terrace and the A47 Bascul Bridge; it was installed in 2008 and commemorates Lowestoft's long association with the RNLI (Plate 9-10).



Plate 9-6 – Central Railway Station



Plate 9-7 – 7-11 Station Square



Plate 9-8 – 18-32 Station Square



Plate 9-9 – 1-8 Pier Terrace



Plate 9-10 – RNLI Statue

Other Buildings and Structures

9.4.20 A small number of buildings within the study area and close to the Scheme are not listed, but have limited architectural or historical interest. The buildings are not included on the Suffolk HER and have been identified during the walkover surveys, via cartographic studies and in consultation with WDC and are noted as 'Local Interest Buildings' on Figure 9.1.

- Three storey 19th century terraced houses (**75**) fronting the north side of Commercial Road from its junction with Station Square, they are within the South Lowestoft Conservation Area (Plate 9-11);
- A detached brick built late 19th or early 20th century three storey warehouse building (**76**) survives on the north side of Commercial Road (No. 41). Gabled to the street, double-width goods doors in the street elevation. Windows and a single loading door are placed on the side elevation (Plate 9-12);
- A two storey brick built 20th century industrial building (**77**) located on the north side of Commercial Road. This building is marked as a “Goods Office” on the 1950 Ordnance Survey map and will have been associated with the former railway freight yard located immediately to the north (Plate 9-13);
- A one storey brick built 20th century industrial building (**78**) located on the north side of Commercial Road at the entrance to Associated British Ports land. First shown on the 1950 Ordnance Survey map, this building appears to have been associated with the railway freight yard (Plate 9-14);

- A detached early 20th century two storey house at 42 Waveney Drive (**79**); not shown on the 1906 Ordnance Survey map, it first appears on Ordnance Survey mapping in 1927 (Plate 9-15). It is a heritage asset with limited architectural/historic interest because it is the earliest residential building to survive in this area, and was perhaps associated with since demolished Raglan Works formerly situated on the north side of Waveney Drive This building has been included within the assessment at the request of WDC; and
- Four detached early 20th century two storey houses at 50 - 56 Waveney Drive (**80**), which are first shown on Ordnance Survey mapping in 1905 (Plate 9-15).



Plate 9-11 – Three Storey Terraced Houses, Commercial Road



Plate 9-12 – Warehouse at 41 Commercial Road



Plate 9-13 - Goods Office for Freight Yard, Commercial Road



Plate 9-14 – Freight Yard Building, Commercial Road



Plate 9-15 – 42 Waveney Drive



Plate 9-16 – 50-56 Waveney Drive

Archaeological Remains

9.4.21 Lake Lothing is an artificial channel which connects the River Waveney and Oulton Broad to the North Sea; it is located at the base of a broad, shallow, east-west aligned valley. The navigation channel of the Lake is regularly dredged to maintain sufficient water depth for commercial shipping requirements.

9.4.22 To the north and south of Lake Lothing the land lies broadly level at c.3.6m AOD. However, this height is largely artificial, resulting from levelling completed during the 19th and 20th centuries to reclaim land and form dockside.

9.4.23 The solid geology of the Lowestoft area is Jurassic Chalk. A thick deposit of Tertiary London Clay lies above the chalk, the clay is capped by Pliocene and Early Pleistocene sands of the Crag Group, which is capped in turn by a succession of Pleistocene glacial till comprising the Happisburgh Formation (formerly Corton Formation) and the Lowestoft Formation.

9.4.24 In the immediate environs of Lake Lothing the Pleistocene deposits are overlain by marine deposits, alluvial sands, gravels, silts and peat of Holocene age. A preliminary deposit model (Appendix 9B) has shown that the alluvium and peat is variably truncated, mainly by modern dredging and historic peat cutting.

9.4.25 The following paragraphs describes the known and potential archaeology of the study area, drawing on wider context as necessary, within a chronological framework extending from the prehistoric periods to the present day. The assessment has considered the following time periods:

- Prehistoric:
 - Palaeolithic c.800,000 – 10,000 BC;
 - Mesolithic 10,000 – 4,000 BC;

- Neolithic 4,000 – 2,500 BC;
- Bronze Age 2,500 – 700 BC;
- Iron Age 800 BC – AD 43;
- Roman AD 43 – 410;
- Early Medieval AD 410 – 1066;
- Medieval AD 1066 – 1540;
- Post-Medieval AD 1540 – 1900; and
- Modern AD 1900 – present

Palaeolithic

9.4.26 The Palaeolithic era was a period of cold glaciations interspersed with warm interstadials and long interglacials (Pleistocene geological epoch). The successive glaciations removed the majority of archaeological evidence of this period at many parts of East Anglia, but rare survivals of scatters of flint tools or other evidence are recorded.

9.4.27 The area of Lake Lothing (and Oulton Broad) follows a low lying, infilled Pleistocene river channel. The river was probably active during a warm interglacial period, and was subsequently infilled with gravels and sands during a cold glacial period.

9.4.28 There are no known sites of this period within the study area, but five possible early Palaeolithic flints, including one identified as a handaxe, were recovered in the late 19th century from ‘Cannon-shot’ gravels at Normanston, c.300m to the north east of the Order limits. In the wider area well preserved evidence has been discovered within the Cromer Forest Bed Formation at Pakefield, c.2.5km to the south, comprising Lower Palaeolithic worked flints, associated palaeoenvironmental material and animal bone dated to c.700,000 BP.

9.4.29 Much further afield the Cromer Forest Bed Formation has revealed evidence of the earliest known presence of pre-modern humans in northern Europe, comprising footprints dated to c.800,000 BP, which were discovered in 2013 at Happisburgh Beach, Norfolk. The presence of this geological formation has not been confirmed during ground investigation completed at the study area (see Chapter 12), but it may be present beneath the Scheme. If present it will be deeply buried beneath late Pleistocene glacial, alluvial and marine deposits, and may contain early Palaeolithic palaeoenvironmental and artefactual evidence (**83**).

Mesolithic

9.4.30 With the temperature increase after the end of the last glaciation the environment at the study area will have gradually changed from tundra to temperate grassland, then open woodland and finally mixed deciduous oak forest. Mesolithic people had a hunting, gathering and fishing economy; their former presence is usually evidenced by scatters of flint tools. The remains of the ephemeral types of structure used by Mesolithic hunter-gatherers are very rarely discovered.

9.4.31 The Mesolithic landscape of the study area is poorly understood, but it may have been

fen or marshland, an environment suitable for wildfowling and seasonal gathering of other resources. The study area was subject to two episodes of marine transgression during later periods and evidence of transient Mesolithic activity could be preserved within or under later marine, alluvial and peat deposits (**87**), which lie at c.5m-15m below ground level.

- 9.4.32 No evidence of this period is recorded within the study area and extensive medieval and post medieval peat cutting, which created Lake Lothing, and the impact of modern land reclamation and development may have adversely affected the survival of any Mesolithic evidence.

Neolithic

- 9.4.33 The Neolithic period saw the development of agriculture and a more sedentary society. Areas of woodland were cleared for growing crops, animals were domesticated, pottery began to be used, ceremonial and communal funerary monuments were constructed.
- 9.4.34 Evidence for human activity from the period is relatively sparse in East Anglia, often comprising scatters of flint tools, or evidence of small scale burning and woodland clearance identified during palaeoenvironmental studies. Flint tool scatters of this period are not recorded in the study area although examples have been found c.170m to the south west at Victoria Road, Lowestoft (**2**) and c.25m west at Heath Road, Oulton (**52**). Isolated or small clusters of pits are also occasionally found, and a single Neolithic pit was discovered c.70m east of the study area at Walton Road, Lowestoft (**11**). No Neolithic evidence is recorded within the study area.
- 9.4.35 An episode of marine transgression affected lower lying parts of the study area during the latter part of this period and any early Neolithic evidence situated here may have been buried by deep marine, alluvial and peat deposits (**87**). Neolithic activity during the marine transgression may have been limited to exploitation of marine and wetland resources, which may have involved the construction of wooden trackways, use of dugout canoes and fish traps. However, medieval peat cutting, and the impact of modern land reclamation and development, may have adversely affected the survival of remains of this period at the majority of the study area.

Bronze Age

- 9.4.36 The Bronze Age marks the beginning of metallurgy in Britain. Woodland clearance intensified while pastoral and arable farming became the mainstay of the economy. A hierarchical society developed during this period and this is reflected in the construction of individual funerary monuments such as round barrows and cairns. Many lowland barrows have been ploughed out, but they remain the most visible monument of this period. Isolated finds or flint scatters are the most frequent evidence of Bronze Age human activity with recorded settlements remaining sparse.
- 9.4.37 Undated cropmarks (**38**) at Barnard's Meadow, an area of playing fields situated on higher ground at the north west of the study area, have been tentatively interpreted as identifying Bronze Age settlement, but they have not been further investigated so could originate from later prehistoric periods. Other cropmarks, including a possible ring ditch of a Bronze Age burial mound, and Bronze Age worked flints (**45**) are recorded c.300m

south west of the study area, but this area was developed for housing in the 1960s without further investigation of the cropmarks.

- 9.4.38 A marine transgression continued to affect the lower lying parts of the study area during the earlier part of the Bronze Age. The majority of human activity may have been limited to exploitation of marine, estuarine and subsequent wetland resources, perhaps involving the construction of wooden trackways, use of dugout canoes and fish traps. Trackways of this period sometimes became foci for religious ceremonies which involved the deposition of bronze artefacts (known as votive offerings) into rivers, pools, meres and bogs. However, evidence of votive activity has not been recorded in the vicinity of Lake Lothing.
- 9.4.39 The subsequent late Iron Age and Roman periods saw a marine transgression which may have buried and preserved any Bronze Age evidence (87) located at lower lying parts of the study area. However, medieval peat cutting, and the impact of modern land reclamation and development, may have adversely affected the survival of Bronze Age remains at the majority of the study area.

Iron Age

- 9.4.40 The study area lay within the tribal territory of the Iceni during the Iron Age. Prevalent monument types of this period include small, sometimes enclosed farmsteads and large hillforts. A few small towns or “Oppida” developed in the latter part of the period and East Anglian examples are present at Saham Toney, Thetford and Caistor St Edmund, which are all situated more than 25km from the study area.
- 9.4.41 The lower lying parts of the study area probably remained as wet, marginal land until the end of this period when a second marine transgression began. The use of the majority of the study area was probably little changed from the earlier periods with a continuation of limited exploitation of wetland, estuarine and marine resources.
- 9.4.42 Iron Age heritage assets could be preserved under and within marine and alluvial deposits (87), but medieval peat cutting, combined with the impact of modern land reclamation and development, may have adversely affected the survival of remains of this period at the majority of the study area.
- 9.4.43 No Iron Age heritage assets are recorded within the study area.

Romano-British

- 9.4.44 The Romano-British era began with the invasion of the south east of Britain in AD 43. The following four centuries saw the establishment of roads, forts, villa estates, and towns, all supporting a central administration which cemented the Roman occupation of Britain.
- 9.4.45 A marine transgression affected the lower lying parts of the study area throughout this period and activity here may have been limited to exploitation of marine and estuarine resources, with perhaps some agricultural use of slightly higher ground situated at the north and south.
- 9.4.46 The River Waveney is located c.3.4km west of the study area and is known to have been used as a communication and trade route during this period. Lake Lothing, Oulton Broad and a canal now connect Lowestoft to the River Waveney, but all of these

waterways were created during the medieval and post medieval periods and it is unlikely that a navigable route existed during the Roman period.

- 9.4.47 A possible Roman road from Colchester to Burgh Castle is said to have passed through Lowestoft and archaeological remains tentatively interpreted as part of this road, or an associated bridge, were found during 19th century excavation in the vicinity of the existing A47 Bascule Bridge, c.200m east of the study area. The evidence comprised several large tree trunks, 10-12 feet in length, laid out parallel and approximately two feet apart.
- 9.4.48 The only recorded heritage assets of this period situated within the study area are two dispersed find spots of coins (**1, 53**) located on the north side of Lake Lothing. A find spot of Roman coins (**4**) is also recorded c.90m north east of the study area at Roman Road in close proximity to the nearest potential settlement evidence, which comprised a coin hoard, a possible cremation urn and the skeletons of a number of horses found during the 19th century at a part of Lowestoft now known as “Roman Hill”, c.150m north east of the study area.

Early Medieval

- 9.4.49 The early medieval period began as the Romans left Britain in AD 410. Heritage assets of the early part of the period are often difficult to detect as the prevailing settlement pattern was dispersed, short-lived, unenclosed farmsteads, which often focussed on river valleys.
- 9.4.50 The middle part of the period saw the establishment of longer lived settlements and the latter part saw the foundation of many historic English villages. The majority of the villages surrounding the study area, including Lowestoft and Kirkley, are recorded in the Domesday survey of 1086 and will have been founded by the latter part of this period.
- 9.4.51 The location of the early medieval settlement at Lowestoft is unclear although it has been suggested that it was located some distance away from the present town centre, perhaps situated c.600m north of the study area with a focus around St Margaret’s church²⁵.
- 9.4.52 An alternative location for the early medieval settlement (and the potential site of a prehistoric burial mound) has been proposed during a recent study of topography and historic field names²⁶. The interpretation of this evidence has resulted in the suggestion that the settlement may have been located c.1km to the south of St Margaret’s church, perhaps in the vicinity of the Scheme’s northern roundabout (see Figure 5.1).
- 9.4.53 The majority of slightly higher ground situated at the north and south of the study area is likely to have seen limited agricultural activity during the majority of this period, with lower lying ground seeing continuity of use from earlier periods, i.e. continued exploitation of marginal land for estuarine and wetland resources.
- 9.4.54 No early medieval heritage assets are recorded in the HER within the study area.

²⁵ Malster, R. 1982. Lowestoft East Coast Port.

²⁶ SCC Archaeological Service 28th November 2017

Medieval

- 9.4.55** During the early part of this period the core of Lowestoft may have retained its earlier focus around, or to the south of St Margaret's church. The Domesday Survey of 1086 records rent for land being partly paid in herrings, which suggests that fishing formed a significant part of the village economy.
- 9.4.56** Kirkley may have been the most important port at this part of the coast for a brief part of the 14th century²⁷. It has been suggested that Lake Lothing was open to the sea for some of the medieval period and that the area surrounding Kirkley Ham inlet may have seen activity associated with the medieval port of Kirkley²⁸, but this interpretation is not supported by results of archaeological investigations completed around the inlet (**12, 15, 16, 58, 59**), which have not discovered any evidence of medieval activity. An alternative interpretation is that during the medieval period Lake Lothing may have been a small freshwater mere separated from the sea by a sand bar.
- 9.4.57** Lowestoft was granted markets in 1308 and 1445 and by the end of the medieval period it had become a significant fishing port and the most important settlement in the area²⁹. The core of the town had by this time moved to the area of the modern High Street and Denes, with the southern limit of the medieval town located c.600m to the north east of the study area.
- 9.4.58** The extent of Lake Lothing is believed to have expanded during the medieval period due to exploitation of this area as a turbarry (**13**), an extensive area of peat cuttings. The speed of this peat cutting and the concomitant development of Lake Lothing is currently uncertain.
- 9.4.59** No medieval heritage assets are recorded in the study area.

Post Medieval

- 9.4.60** In the post medieval period the port and town of Lowestoft continued to expand and in 1679 the town was granted port status with certain specified rights of export and import. By the beginning of the 18th century up to 25% of men were involved in the fishing industry. The main catch of the fishing fleet comprised herring.
- 9.4.61** At the end of the 18th century Lowestoft was a moderately sized market town and fishing port with a population of about 2,300. Lowestoft had doubled in size by 1841 and by 1871 the population was over 13,000. Until the mid-19th century the majority of the study area was situated to the west and south of the town and port; it comprised a landscape of dispersed farms, enclosed fields and marginal land located along the shores of Lake Lothing.
- 9.4.62** The focus of the port was the north shore until the 19th century, with Lake Lothing separated from the sea by a sand bar until harbour works, including construction of lock gates and a customs office known as The Port House (**60**), established alongside

²⁷ Morley, C. 1928. Medieval Suffolk, Unpublished

²⁸ Great Yarmouth and Lowestoft Urban Regeneration Company (URC) 2005. Lowestoft URC Area, Suffolk: Cultural Heritage Assessment.

²⁹ Butcher, B. 1995. Ocean's Gift: Fishing in Lowestoft During the Pre-industrial Era 1550-1750. Studies in East Anglian History Series, University of East Anglia Centre of East Anglian Studies (Norwich)

the Inner Harbour in 1832.

- 9.4.63** This first phase of harbour works included land reclamation at both north and south sides of the eastern end of Lake Lothing. This work involved the importation of large amounts of material to raise the ground level behind quay walls in order to establish the Inner Harbour. Historic cartographic evidence shows that much of the land behind the current quaysides was low-lying and prone to flooding prior to this first episode of reclamation.
- 9.4.64** Work also included construction of the lock at Mutford Bridge, which linked the western end of Lake Lothing to Oulton Broad, and construction of a canal to link the west of Oulton Broad to the River Waveney. This and the first phase harbour works resulted from the passing of the Norwich and Lowestoft Navigation Act (1827), which was designed to allow commercial traffic to and from Norwich to avoid the high fees and congested harbour at Great Yarmouth.
- 9.4.65** However, the first phase harbour works failed to keep the Inner Harbour open to the sea, a loan could not be repaid and the government forced the sale of the harbour in 1842. The harbour was eventually sold to Sir Samuel Morton Peto, and in 1844 mooring for 1,000 boats was provided through construction of the Outer Harbour and permanent access to the Inner Harbour was established. The subsequent success of the port led to further episodes of reclamation along Lake Lothing during the 19th century, which gradually extended quays, wharfs and other port related infrastructure further to the west.
- 9.4.66** From the middle of the 19th century Sir Samuel Morton Peto played a leading role in the expansion and success of Lowestoft. He opened a rail link between Lowestoft and Norwich in 1847, now the East Suffolk Line, with the station located outside the study area slightly to the north of the existing A47 Bascule Bridge. He subsequently built several other railways which linked Lowestoft to Ipswich and towns further afield.
- 9.4.67** The establishment of the London – Great Yarmouth toll road (now London Road) led to limited development of the area to the south of Lake Lothing as a seaside resort from the mid-18th century, but it was the improvement in access provided by the 19th century railway links which enabled Lowestoft to truly establish its position as a popular holiday resort. The focus of the resort was situated toward the south east of the study area; the esplanade, hotels, large townhouses and lodging houses were built from the late 1840s along the seafront and less substantial lodging houses were constructed inland. The Victorian seaside resort now forms the core of the South Lowestoft Conservation Area (**68**).
- 9.4.68** The character of the study area became increasingly urban and industrial during the second half of the 19th century when the town, port, maritime and other industries began to expand to the west. Ordnance Survey mapping shows that the bulk of 19th century industrial development spread along the northern side of Lake Lothing with many timber yards, iron foundries, mills, a dry dock and a ship yard present. Industrial development on a somewhat smaller scale also occurred at the southern side of Lake Lothing, but it generally maintained an earlier focus around Kirkley Ham inlet and mainly comprised two boat yards and the East Anglia Ice Company works. Very few of the 19th century industrial buildings are now extant, some were destroyed by wartime

bombing, but the majority have been demolished since 1945 to make way for redevelopment.

- 9.4.69 The HER records a single post-medieval site within the Order limits: possible earthworks, potential low foundations and structural remains (49) are visible on mid-20th century aerial photographs of an area situated to the north of Lake Lothing. During the late 19th century a small number of structures are depicted here on the 1st Edition Ordnance Survey map and a timber yard is marked on the subsequent 2nd Edition Ordnance Survey map. The area was developed in the late 20th century and the majority of this site is located where an existing roundabout forms a junction between Denmark Road, Peto Way and the North Quay Retail Park.
- 9.4.70 A large detached house, with a formal garden and a lawn to the south (54), was built c.50m to the north west of the study area during this period. The house and garden are first shown on late 18th century mapping, and is named “Normanston Court” on 19th century Ordnance Survey maps. The house, garden and lawn appear to have survived intact during the first half of the 20th century, but the area of the estate fronting Normanston Drive saw piecemeal development for housing after the Second World War, and the lawn was converted and remains in use as playing fields. The main house appears to have survived until the late 1960s or early 1970s when it was demolished to make way for construction of detached houses.
- 9.4.71 Another large house set in a formal garden was present at the south of the study area. Colville House was built during the first half of the 19th century and was situated c.750m to the west of Kirkley Ham inlet; in 1855 it became an “*institution for the imbecile children of the middle and upper classes*”. The institution was in the supervision of various superintendents until 1873 when it was converted back to a private house. The house was used as a youth club from 1952, but it had been demolished by the late 1960s and the area was then developed for industrial use.

Modern

- 9.4.72 Lowestoft continued to grow into the early part of the 20th century with the fishing fleet, boat building, port and associated industries being the mainstay of its economy. By 1911 the population had reached 37,886, which reflects the peak in production for the British fishing industry. The Inner Harbour saw significant development during the early part of this period with many existing industries expanding and others, such as two large cannery and preserve works located near Kirkley Ham inlet, established.
- 9.4.73 The seaside resort remained successful during the early part of the 20th century and grand buildings, such as the Grade II* listed Royal Norfolk and Suffolk Yacht Club (61) continued to be built.
- 9.4.74 The First World War saw some of the more capable local boats requisitioned by the Admiralty for patrolling and minesweeping. The town was bombed on a number of occasions, and on 25th April 1916, the German High Sea Fleet shelled the town and harbour leaving forty houses destroyed, two hundred damaged and four people killed.
- 9.4.75 During the inter war period the port, holiday resort and fishing industry suffered a decline in fortunes, but the start of the Second World War saw Lowestoft transformed into an important naval base with an all-round defensive perimeter of trenches,

pillboxes and dense belts of barbed wire (**6-10, 18-29, 31-35, 37, 42**). None of the defences survive, but many of their locations have been recorded by the HER and the Defence of Britain project

- 9.4.76** Three demolished Second World War defensive sites are recorded by the HER within the Order limits: to the north of Lake Lothing a bunker or air raid shelter (**50**) straddles the southern end of Rotterdam Road; to the south of Lake Lothing the site of a defended fuel store (**27**) is recorded where an existing disused industrial facility will be partially demolished and the new Riverside Road access subsequently constructed; and the site of a type 22 pillbox and a small civil defence building (**43**) is recorded at the junction of Waveney Drive and Riverside Road where the southern roundabout will be constructed. However, it is probable that most, if not all sub-surface evidence of these sites will have been removed during late 20th century demolition and redevelopment.
- 9.4.77** Lowestoft was extensively bombed during the Second World War and significant redevelopment was necessary during the post war period. During the latter part of the 20th century the Inner Harbour remained a focus of shipbuilding and developed as a focal point for operations of the oil and gas industries in the southern North Sea. The Inner Harbour and Entrance Channel and the Inner Harbour – North retain coherent evidence of their late 19th and early 20th century character, with port related activities, road layout, some surviving buildings, including the Port House (see Paragraph 9.4.16), contributing to the understanding of Lowestoft as a port and its development as a safe harbour during the 19th century. The early character of the part of the Inner Harbour – South situated within the study area is poorly preserved as it has been extensively redeveloped for modern retail purposes, or is awaiting redevelopment after demolition of earlier structures, but the quays flanking both sides of the Inner Harbour, in particular the North Quay, with its surviving dry dock, provide a link to understanding the expansion of 19th century port.

Areas of Archaeological Potential

- 9.4.78** Evidence of Lower Palaeolithic pre-modern human activity could be preserved within the Cromer Forest Bed Formation. This formation may be present beneath the study area, but will be deeply buried (c.20m bgl) beneath glacial, alluvial, peat and marine deposits.
- 9.4.79** The preliminary deposit model (Appendix 9B) identified that areas of truncated peat deposits survive at either side of Lake Lothing. The peat will have accumulated during, or before the Bronze Age and is located beneath alluvial sediments and recent levelling deposits at depths of between 3m and 15m below ground level. The peat is likely to preserve evidence of the environment, and could preserve heritage assets of the Mesolithic and later prehistoric periods.
- 9.4.80** A recent study of field names and topography has suggested that an Anglo-Saxon / Anglo-Scandinavian settlement may have been located in the vicinity of the Scheme's northern roundabout junction with Denmark Road. Archaeological watching brief was undertaken during ground investigation for the Scheme where the northern roundabout will be constructed and results of two trial pits (TPC01 & TPC101 as described in Appendix 9E) suggest that the natural deposits descend sharply, or have been

significantly truncated at the west, with over 3m of made ground observed. A further nine trial pits were excavated, one (TPC08 as shown on Figure 9.4) located at the eastern margin of the investigated area contained a potential reworked subsoil, but the remainder suggest that soils were removed and underlying sediments were truncated prior to introduction of levelling deposits. The available evidence suggests that the potential for presence and survival of early medieval settlement remains at this area is low.

- 9.4.81 Evidence of historic exploitation of the area flanking Lake Lothing may be preserved beneath the levelling deposits making up the modern quays and wharfs. Any such evidence is likely to be restricted to heritage assets consistent with exploitation of marine, estuarine and marginal drier environments e.g. fish traps, salterns, mooring posts and perhaps the medieval peat cutting which led to the formation of Lake Lothing.

Maritime Archaeology

- 9.4.82 The baseline suggests that Lake Lothing was not used for maritime activity until 1832, and regular maritime activity was not established until 1844. The limited time depth of recorded maritime activity, combined with maintenance of access for vessels to moor at quaysides and regular dredging of the navigation channel illustrates that the potential for the presence of significant maritime archaeological features is negligible.
- 9.4.83 The 19th and 20th century growth of the port may be evidenced by artefacts or the remains of foundations of buildings present within the levelling deposits forming the modern quaysides.
- 9.4.84 The remains of three Second World War defensive sites (**27, 43, 50**) could provide evidence of wartime activity. However, all three sites are located at areas which were developed during the late 20th century and it is probable that any surviving evidence is very poorly preserved.

Historic Landscape

- 9.4.85 Historic Landscape Characterisation (HLC) has been completed for Suffolk (Suffolk County Council, 2008 V3). The HLC shows that, excepting survival of some road alignments and partial preservation of the lawn boundary of Normanston Court, very little of the pre-19th century landscape character survives in the study area. The HLC defines the broad character of the area straddling Lake Lothing as current industrial; areas of modern leisure are identified at the north west of the study area and a small parcel of unimproved land at the south west; the remaining character comprising the urban area of the late post medieval and modern town.
- 9.4.86 Lake Lothing may have existed as a freshwater mere separated from the sea by a sandbank until the construction of the Inner Harbour in the 19th century. The extent of the mere is believed to have expanded during the medieval period due to use of the area as a turbary (**13**). The existing form of Lake Lothing is largely a consequence of 19th and 20th century development of the Inner Harbour although Leathes Ham, a body of water located at the west of the study area and now separated from Lake Lothing by dockside, may preserve a remnant of the form of the turbary.
- 9.4.87 Early mapping of the Lowestoft area, such as Hodskinson's Map of 1783 and Robert Barnes Map of 1830 (included in the DBA in Appendix 9A), show the extent of Lake

Lothing, the urban focus of the town located c.900m to the north east of the study area and provide some detail of road layout and the location of isolated farmsteads. The early maps show little further detail, with the exception of the presence of the house and formal gardens at Normanston Court (54). A manorial survey of 1618 illustrates that the landscape of the study area had been enclosed by the early 17th century and the Lowestoft (1841), Carlton Colville (1842) and Kirkley Ham (1841) tithe maps show the enclosed agricultural fields bisected by two east-west aligned railway lines.

9.4.88 Ordnance Survey maps show that by the end of the 19th century a north-south aligned railway line had been constructed to the west of Lowestoft and the part of the town located to the north of Lake Lothing and the Inner Harbour had expanded slightly to the west toward the railway, although much of the study area remained in agricultural use. The study area saw gradual housing and industrial development during the first half of the 20th century, but it was almost completely developed for housing, industrial and commercial use during the second half of the 20th century. Lowestoft had reached its current size by the mid-1970s although limited infill development and regeneration has subsequently occurred.

9.5 Stage 2 – Heritage Assets and Settings Affected by the Scheme

9.5.1 The Stage 2 assessment has focused upon terrestrial and not marine archaeology for the reasons given in Stage 1 (section 9.4.82).

9.5.2 Heritage assets examined in the baseline environment have been selected for assessment using professional judgement, if it is considered that they may be indirectly or directly affected by the construction, operation and maintenance of the Scheme and where examination of the ZTV and photomontages (Figures 10.6 to 10.20), and the results of visual, traffic and noise assessments, suggests that their setting may be affected.

9.5.3 The heritage assets and settings selected for assessment from this baseline are described in Section 9.6 and are presented in Table 9-10 to Table 9-13, with reasons given for their inclusion in the assessment pursuant to this Stage 2.

9.6 Stage 3 – Value and Significance of Heritage Assets

9.6.1 This section identifies the value and significance of assessed heritage assets, and where appropriate examines the contribution of setting to their significance, with reference to HE guidance and through the application of professional judgement.

Conservation Areas

South Lowestoft Conservation Area

Description

9.6.2 The South Lowestoft Conservation Area (68) forms the core of the 19th century expansion of the town of Lowestoft, resulting from the establishment of the Inner and Outer Harbours during the early part of the century, and subsequent development to the south of Lake Lothing to establish the town as a seaside leisure resort from the mid-19th century. South Lowestoft Conservation Area has been included within Stage 3 because there is the potential, in parts, for intervisibility with the Scheme that could constitute a significant effect.

9.6.3 The Conservation Area includes all of the designated buildings and structures, all of the locally listed buildings and one of a total of six buildings of local architectural or historic interest selected for assessment. The conservation area appraisal^[24Error! Bookmark not defined.] separates the Conservation Area into four discrete character areas:

- The Harbour;
- The Seafront;
- London Road South; and
- St Peter's Church.

9.6.4 The Conservation Area appraisal describes the character area thus,

“the buildings of the conservation area reflect this history and consist principally of townhouses and villas along the seafront, with areas of lower status terraced housing to the west, commercial premises along London Road North and South, and around the harbour and train station. Larger scale detached villas are present to the southwest of the designated area. A linear street plan, laid out parallel to the shore, is retained throughout much of the conservation area and reflects the formal planning of the seaside resort, with pleasure gardens and promenades along the seafront, whilst a more curvilinear plan is apparent within the area of villas to the southwest”.

9.6.5 The Conservation Area appraisal identifies key views and vistas into and out of the Conservation Area, but none will be impacted by the Scheme. The identified views and vistas comprise:

- London Road North looking north towards the High Street;
- Northwest from South Pier across the Outer Harbour;
- Southwest from South Pier across the South Beach;
- Marine Parade looking south towards Kirkley Cliff;
- North and south along London Road South;
- East along Claremont Road towards Claremont Pier;
- Upper Esplanade eastwards to the sea
- Esplanade west towards Wellington Esplanade and Kirkley Cliff;
- Kensington Road eastwards to the sea; and
- Pakefield Road southeast to the sea.

Value

9.6.6 The aesthetic value of the South Lowestoft Conservation Area largely lies in the planned linear design of the seaside resort, the presence of a number of public open spaces and open views across south beach then out to sea.

9.6.7 The communal value of the Conservation Area lies in the sense of entry to the town, industrial and commercial activity evident at the north and as a focus of seaside leisure activity at the south.

-
- 9.6.8 The historic value of the Conservation Area lies in its association with the development of Lowestoft as a port, and its establishment as a seaside resort during the late 19th and early 20th century.
- 9.6.9 The evidential value of the Conservation Area lies in the survival of many historic buildings, both designated and non-designated, and the strong sense of place provided by the combination of commercial, port and leisure development.

Significance

- 9.6.10 The significance of the Conservation Area is heavily influenced by its setting; the importance of this setting is defined by the values described in Paragraphs 9.6.6 to 9.6.9 9.6.6 to 9.6.9, such as the sense of entry to the town, industry and commercial activity located at the north of the A47 bascule bridge, the formally designed leisure resort to the south with its largely linear designed plan, including coherent rows of vernacular terraced buildings with grander terraces facing the seafront, well designed public spaces, such as the Royal Plain, linear views along aesthetically appealing streetscapes and public spaces, and open views to the sea. All of these factors make a positive contribution to the significance of this asset which is assessed as high.

Oulton Broad Conservation Area.

Description

- 9.6.11 The Oulton Broad Conservation Area (**69**) is currently being reappraised²⁴ and in the future may extend eastward to encompass land west of Mutford Bridge, including the Wherry Hotel and Nicholas Everitt Park. At the time of assessment the Conservation Area encompasses a 19th century and early 20th century residential area situated on the north shore of the broad; the residential area includes a number of large detached Edwardian houses of local architectural and historic interest situated in extensive mature gardens, a number of the houses are locally listed and two structures are Grade II listed. Many of the residential properties have boathouses and moorings and the Conservation Area includes these waterside structures and the northern side of the broad. The character of the land to the east of the Conservation Area is more industrial and to the east of Mutford Bridge it starts to transition to the port related activity of the Inner Harbour at Lowestoft.
- 9.6.12 The ZTV and photomontages show that distant and partial views of the tips of the Scheme bascule bridge's counterbalances may be possible from very localised parts of the Conservation Area, comprising limited waterside locations and a few areas at the northern side of the broad. Therefore, Oulton Broad Conservation Area has been included within Stage 3 because there is the potential, in parts, for intervisibility with the Scheme that could constitute a significant effect. None of the designated or locally listed buildings will have intervisibility with the Scheme.

Value

- 9.6.13 The aesthetic value of Oulton Broad Conservation Area lies in its low density mixed scale housing and well vegetated gardens, containing mature woodland and ornamental trees.
- 9.6.14 The communal value of the Conservation Area lies in its preservation of a soft landscape at the northern side of the broad, with mature trees providing a visual foil,

filtering views of higher density built development situated to the north in views from Conservation Area and the broad.

9.6.15 The historic value of the Conservation Area lies in its association with the development of Oulton Broad as an area to engage in water focussed leisure activities and appreciation of the natural environment during the late 19th and early 20th century.

9.6.16 The evidential value of the Conservation Area lies in the survival of a number of buildings of local architectural and historic interest.

Significance

9.6.17 The significance of the Conservation Area is heavily influenced by its setting; the importance of this setting is defined by the values described in sections 9.6.13 to 9.6.16, such as the low density mixed scale housing surrounded by mature gardens and trees which present a soft landscape at the north side of Oulton Broad, the historic association with development of Oulton Broad as an area of water focussed leisure activity and survival of a number of buildings of local interest. All of these factors make a positive contribution to the significance of this asset which is assessed as high.

Built Heritage.

Designated Built Heritage

9.6.18 The five designated built heritage assets selected for assessment are all situated within the South Lowestoft Conservation Area, and they have been included within proportionate Stage 3 assessment because there is the potential for intervisibility with the Scheme that could constitute a significant effect:

9.6.19 Three Grade II listed buildings (Wellington Esplanade (**65**); Ashurst (**66**); and 9, 10 and 11 Waterloo and 16-28 Victoria Terrace (**67**)) face the Esplanade and seafront at the south east of the study area and interpretation of the ZTV suggests that they could have distant partial views of the Scheme from their rear elevations and upper floors, although the character of the surrounding built environment observed during the walkover surveys suggests that it is probable that the Scheme would only be visible from their rooftops. A proportionate description of value, setting and significance of the locally listed buildings and structures is presented in Table 9-7.

Table 9-7 – Designated Built Heritage Value, Setting and Significance Appraisal (1 of 2)

Listed Building	Description of value	Setting	Significance
65: Wellington Esplanade	The value of this building lies in its relatively plain, but well-proportioned façade and its historical and evidential connection to the 19 th century success of Lowestoft as a seaside resort.	The building forms part of an aesthetically pleasing row of grand lodging houses which face the seafront. It positively enhances the South Lowestoft Conservation Area, and its setting contributes greatly to its significance	The significance of this building is assessed as medium.
66: Ashurst	The value of this building lies in its symmetrical, well-proportioned façade and its historical and evidential connection to	The building faces the seafront and forms part of a formally designed linear streetscape constructed as part of	The significance of this building is assessed as medium.

	the 19 th century success of Lowestoft as a seaside resort	the development of the seaside resort. It positively enhances the South Lowestoft Conservation Area, and its setting contributes greatly to its significance	
67: 9, 10 and 11 Waterloo and 16-28 Victoria Terrace	The value of this building lies in its relatively plain, but well-proportioned façade and its historical and evidential connection to the 19 th century success of Lowestoft as a seaside resort.	The building was purpose built as lodging houses for holidaymakers. It forms part of a linear streetscape constructed as part of the formal development of the seaside resort. It positively enhances the South Lowestoft Conservation Area, and its setting contributes greatly to its significance	The significance of this building is assessed as medium.

9.6.20 Two listed buildings located at the north of the CA, comprising the Grade II listed Port House (**60**) and the Grade II* Royal Norfolk and Suffolk Yacht Club (**61**) will have views of the Scheme. The ZTV (Figure 9.2) shows that the existing built environment limits the view from the Yacht Club although unrestricted views of the centre and southern part of the Scheme will be possible from the Port House (see Figure 10.9). A proportionate description of value, setting and significance of the locally listed buildings and structures is presented in Table 9-8.

Table 9-8 – Designated Built Heritage Value, Setting and Significance Appraisal (2 of 2)

Listed Building	Description of value	Setting	Significance
60: The Port House	The value of this building lies in its strong functional aesthetic, the sense of formal entry it provides to the inner harbour, and in its historic and evidential connection with 19 th century development of, and commercial activity at the port	The Port House is located in a relatively imposing location, immediately west of the A47 Bascule Bridge. However, the area to the north and west contains modern commercial buildings of low architectural quality and much of the area to the south of Lake Lothing is awaiting redevelopment. Setting contributes only moderately to its significance	The significance of this building is assessed as medium.
61: The Royal Norfolk and Suffolk Yacht Club	The value of this building lies in its high architectural quality which derives from its use of an advanced arts and crafts design. Its historical and evidential connection to the 19 th century success of Lowestoft as a seaside leisure resort also contributes.	The Royal Norfolk and Suffolk Yacht Club is situated at the north of the Royal Plain with open views north across the trawl basin and east out to sea. Its setting contributes markedly to its significance ,	The significance of this building is assessed as high.

Locally Listed Built Heritage

9.6.21 The five locally listed buildings and structures (**70-74**) selected for assessment are focussed around the A47 Bascule Bridge, and all are within the South Lowestoft Conservation Area. They have been included within proportionate Stage 3 assessment because there is the potential for intervisibility with the Scheme that could constitute a significant effect. A proportionate description of value, setting and significance of the locally listed buildings and structures is presented in Table 9-9.

Table 9-9 – Non-designated Built Heritage Value, Setting and Significance Appraisal

Locally Listed Building	Description of value	Setting	Significance
70: Central Railway Station	The value of this building lies in its strong functional aesthetic, the sense of formal entry it provides, and in its historic and evidential connection with 19 th century development prompted by Sir Samuel Morton Peto	Station Square to the east and surrounding 19 th century commercial properties provide positive enhancement and a coherent character to the transportation and commercial focus of the northern part of the South Lowestoft Conservation Area.	The station is much altered from its original form; three ornate italianate turrets have been removed, many window openings have been infilled, and a number of functional modern structural elements added. The significance of this building is assessed as low
71: 7-11 Station Square	The value of this terrace lies in its well-proportioned façade, including good classical decoration to upper floor windows and its historical and evidential connection to the 19 th century commercial success of Lowestoft	The terrace is situated in a relatively isolated position, facing the trawl basin and surrounded by busy roads. Its setting contributes little to its significance, which derives mainly from its contribution to the overall transportation and commercial character of the northern part of the South Lowestoft Conservation Area.	The lower floor of the terrace has been modified with poor quality shop fronts although good classical decoration remains on the upper floors. The significance of this building is assessed as low.
72: 18-32 Station Square	The value of this building lies in its well-proportioned façade, its use for nearly 100 years as a locally renowned department store, and its historical and evidential connection to the 19 th century commercial success of Lowestoft	The building is situated opposite Central Station and faces Station Square, this open aspect provides positive enhancement to its significance and contributes to the transportation and commercial focus of the northern part of the South Lowestoft Conservation Area.	The lower floor of the building has been modified with modern shop fronts of variable architectural quality although two oriel windows and various architectural decoration remain on the upper floors. The significance of this building is assessed as low.
73: 1-8 Pier Terrace	The value of this building lies in its historical and evidential connection to the 19 th century commercial success of Lowestoft	The building is surrounded by busy roads, a small number of unremarkable 19 th / early 20 th century / modern buildings and areas awaiting redevelopment. Setting contributes little to its significance, which	The lower floor of the building has mostly been modified with modern shop fronts of variable architectural quality although two early shop fronts of reasonable architectural quality survive. The significance of

Locally Listed Building	Description of value	Setting	Significance
		derives mainly from its contribution to the overall transportation and commercial character of the northern part of the South Lowestoft Conservation Area.	this building is assessed as low.
74: RNLI Statue, Pier Terrace	The value of this structure lies in its commemoration of Lowestoft's longstanding maritime focus and its association with the RNLI and its robust artistic style.	The statue is situated immediately to the southwest of the A47 Bascule Bridge, a car park is located to the west and a busy road to the east. Setting contributes little to its significance.	The significance of this structure is assessed as low.

Local Interest Built Heritage

9.6.22 Six undesignated Local Interest Buildings, which are of restricted architectural quality (see Paragraph 9.4.20), have been selected for proportionate assessment.

9.6.23 A terrace of three storey houses of plain vernacular design (**75**) is located at the north side of Commercial Road, the setting has been much altered by surrounding modern development and it contributes little to their significance which is assessed as low.

9.6.24 Three commercial buildings (**76-78**) are situated further east along Commercial Road; two were associated with a rail freight yard, one of these is the former freight yard goods office, (**77**), both are plain brick and concrete 20th century structures with no architectural adornment. The remaining commercial building is a plain three storey brick built 19th / early 20th century warehouse (**76**). The commercial buildings are surrounded by modern development and their setting contributes little to their significance which is assessed as low.

9.6.25 The remaining local interest buildings (**79-80**) are located at the south side of Lake Lothing and comprise five detached houses situated on Waveney Drive (No's. 42 and 50 – 56). The houses were built during the early part of the 20th century, four (**80**) in similar off plan design, and they originally faced the now demolished Raglan Works; it is currently unclear whether they were associated with the works (perhaps as houses for management). Their potential focus (the Raglan Works) was demolished in 2000 and they are surrounded by later residential and commercial development.

9.6.26 Setting contributes little to the significance of these local interest buildings and overall they are assessed as low.

Archaeological Remains.

Description

9.6.27 Four potential archaeological heritage assets are recorded by the HER within the Order limits and have been included within Stage 3 because they could be significantly impacted upon during the construction phase of the Scheme.

- 9.6.28 The assets comprise possible post medieval earthworks and structural remains (**49**), Second World War evidence interpreted as a defended fuel store (**27**), a bunker or air raid shelter (**50**) and a demolished pillbox and civil defence site (**43**). All of these assets are situated at areas developed during the late 20th century, consequently above ground evidence no longer survives and it is probable that any surviving sub-surface evidence is very poorly preserved. The location of all four archaeological heritage assets is shown in Figure 9.3 and are included within the assessment.
- 9.6.29 Other heritage assets that may be present within the Order limits could comprise survival of sub-surface palaeoenvironmental evidence and archaeological remains of the prehistoric periods (**83**, **87**). The potential presence of Anglo Saxon / Anglo Scandinavian settlement remains (**84**) in the vicinity of the northern roundabout. Evidence of exploitation of the area during historic periods, including remains associated with the 19th century development of the port (**85**), which could be covered by or included within the levelling material forming the quay sides. Due to the considerable uncertainty as to the presence or location of these heritage assets, they have not been included on Figure 9.3 and are included within the assessment.

Value

- 9.6.30 The communal value of archaeological remains lies in their potential demonstration of the time depth to human utilisation of the study area and the enhancement of a strong sense of place possible through the engagement of the local community during investigations. Opportunities for local community engagement will be examined and defined in consultation with SCCAS, as set out in Appendix 9F.
- 9.6.31 The historic and evidential value of archaeological remains lies in their demonstration of the development of the Lowestoft area and the types of human interaction that have occurred and influenced this development.

Significance

- 9.6.32 The significance of any archaeological remains is dependent on the interplay of a number of factors, including their age, character and degree of survival. For example, the survival of earlier prehistoric evidence could be of national, perhaps international importance, and of very high significance, the presence of later prehistoric evidence may be regional importance (high to medium) and evidence of historic activity may be of regional or local importance (medium to low). Refer to Table 9-1 for further information on these criteria.

Historic Landscape.

Description

- 9.6.33 The historic landscape (**86**) of the study area reflects the 19th and 20th century development of Lowestoft, including the growth of the port, the development of the seaside resort and the increasing urbanisation of the 20th century. The historic landscape has been included within Stage 3 because there is the potential that the Scheme that could create a significant effect.
- 9.6.34 Very little appreciable time depth is evident, with only a few surviving road alignments (e.g. Rotterdam Road) and part of the grounds of Normanston Court (now playing fields) reflecting the layout of the pre-19th century landscape. The 19th and 20th century

urban components of the landscape are considered in Chapter 10: Townscape and Visual Impact with only brief further consideration of the Historic Landscape included in this chapter.

Value

- 9.6.35 The value of historic landscapes lies in their demonstration of the time depth to human utilisation of an area, and enhancement of a strong sense of place through survival of a coherent historic context.

Significance

- 9.6.36 The significance of the historic landscape is dependent on the survival of coherent evidence, including landscape types with demonstrable age, character and a good degree of survival. The landscape of the study area has little surviving time depth, it is almost entirely comprised of 19th and 20th century development associated with growth of the port and town of Lowestoft. The significance of the historic landscape is consequently assessed as negligible.

9.7 Stage 4 – Magnitude of Impact

- 9.7.1 The assessment of magnitude of impact has included consideration of the setting of heritage assets, their vulnerability, current state of survival/condition and the nature of the potential impact of the Scheme upon them.
- 9.7.2 Impacts on heritage assets can be indirect or direct, temporary or permanent, and occur during the construction and operational phases of the Scheme, i.e. during groundworks, clearance, landscaping, ground compaction, service installation, stockpiling, storage, visual intrusion (including lighting), alteration to traffic volumes and associated noise and vibration. These activities include the following impacts:

Magnitude of Impact to Conservation Areas

Construction Phase

- 9.7.3 The Scheme does not directly impact the Conservation Areas
- 9.7.4 Indirect impacts on the Conservation Areas will be temporary, are related to their setting, and include visual, noise, vibration and traffic intrusions (see Chapters 10, 13 and 19 respectively) associated with construction activity. With regard to noise, as shown in Figure 13.3, a negligible increase in noise levels³⁰ will occur at the western margins of the South Lowestoft Conservation Area. With regard to vibration Chapter 13 identifies that construction vibration is negligible (see Table 13-20) and hence won't affect the Conservation Areas. The impacts from these factors will be managed in accordance with the requirements and mitigation measures set out within those chapters and secured through their inclusion in the Interim Code of Construction Practice (Appendix 5A) though they are mostly limited in scale and will have a short term effect. The impact of the construction phase of the Scheme at the South Lowestoft Conservation Area is assessed as negligible, and impact at the Oulton Broad Conservation Area is assessed as no change (Table 9-10).

³⁰ See Table 13-10 for a definition of a negligible noise increase

Operational Phase

- 9.7.5 As discussed in Chapter 13 and Chapter 19, the operational phase of the Scheme will result in the re-routing of traffic in Lowestoft with consequential changes in noise, vibration and highway usage.
- 9.7.6 As shown on Figure 19.1, there will be an increase in traffic along the A12 but, as shown on Figure 13.4, this will result in a negligible increase in noise levels at some parts of the western margins of the South Lowestoft Conservation Area. Table 13-25 shows the modelled change at designated sites where all impacts are deemed to be negligible.
- 9.7.7 The introduction of new large scale infrastructure into the setting of the South Lowestoft Conservation Area, combined with planned future residential and commercial development at the southern side of Lake Lothing will alter townscape character and visual amenity at this part of the town in coming decades (see Chapter 10). However, the embedded high quality design (secured through the Design Guidance manual) responds to, and integrates the Scheme with the surrounding townscape, ensuring that it will provide positive reinforcement of the character and visual amenity at this part of Lowestoft, including at night when effective strategic lighting will make the Scheme a feature of the night time views.
- 9.7.8 The ZTV (Figure 9.2) shows that the Scheme will only be visible from a small number of locations within the South Lowestoft Conservation Area. The majority of these views will be partial and distant, except from the area located around the A47 Bascule Bridge (VP4 / Figure 10.9). The embedded mitigation, comprising high quality design, integrates with the existing built environment and the impact of the Scheme at the South Lowestoft Conservation Area is assessed as minor (Table 9-10).
- 9.7.9 The ZTV and photomontages (VP10) suggests that distant views of the upper part of the Scheme's counterbalance fins, and intermittent views of the upper part of the deck when raised, will be possible from some waterfront areas of the Oulton Broad Conservation Area. However, the Scheme is located approximately 2km from the Conservation Area and it will only be partially visible as a distant incidental element of the built environment. The impact of the Scheme at Oulton Broad Conservation Area is assessed as no change (Table 9-10).

Magnitude of Impact to Built Heritage

Construction Phase

- 9.7.10 The Scheme does not directly impact any designated built heritage assets.
- 9.7.11 Temporary indirect impacts on designated built heritage assets are largely related to their setting, and include visual, noise, vibration and traffic intrusions associated with construction activity (see Chapters 10, 13 and 19 respectively). With regard to traffic and noise, as shown in Figure 13.3, a minor increase will occur at 50 – 56 Waveney Drive (80) (Figure 13.3). Table 13-20 of Chapter 13 identifies that construction vibration is negligible. The impacts from these factors will be managed in accordance with the requirements and mitigation measures set out within those chapters and secured through their inclusion in the Interim Code of Construction Practice (Appendix 5A) though they are mostly limited in scale and will have a short term effect. The

impact of the construction phase of the Scheme on all but one of the built heritage assets is assessed as negligible.

- 9.7.12 One building of local historic interest, assigned a low significance rating (**79**: 42 Waveney Drive), will be demolished during construction of the Scheme. Impact to this asset is assessed as major.

Operational Phase

- 9.7.13 During the operational phase of the Scheme, permanent indirect impacts to designated heritage assets relate to their setting, although impacts upon structural integrity from the effects of vibration have also been considered in this assessment.
- 9.7.14 As discussed in Chapter 13 and Chapter 19, the operational phase of the Scheme will result in the re-routing of traffic in Lowestoft with consequential changes in noise, vibration and highway usage.
- 9.7.15 As shown in Figures 13.2 and 13.3, with the exception of 50 – 56 Waveney Drive (**80**) where a minor increase in traffic and noise will occur, there will be a decrease in traffic adjacent to all of the built heritage assets assessed in this chapter, and throughout the historic core of the town of Lowestoft. This will also, as shown in Figure 13.4, result in a decrease in traffic noise and also a decrease in operational vibration at these locations.
- 9.7.16 The introduction of new large scale infrastructure into the setting of one built heritage asset, comprising the Port House, combined with planned future residential and commercial development at the southern side of Lake Lothing will alter townscape character and visual amenity at this part of the town in coming decades (see Chapter 10). However, the embedded high quality design (secured through the Design Guidance manual) responds to, and integrates the Scheme with the surrounding townscape, ensuring that it will provide positive reinforcement of the character and visual amenity at this part of Lowestoft, including at night when effective strategic lighting will make the Scheme a feature of the night time views.
- 9.7.17 Three designated built heritage assets are located within the 500m study area as shown in Figure 9.1. The three designated built heritage assets (**65**: Wellington Esplanade; **66**: Ashurst; 9, 10 and **67**: 11 Waterloo Road and 16-28 Victoria Terrace) are situated c.500m south east of the Order limits and the ZTV shows that the Scheme may be visible from upper floors, but more probably only from their rooftops (see Paragraph 9.1.7 The impact of the Scheme on these designated assets is assessed as no change.
- 9.7.18 The Scheme will introduce a new built structure into the setting of two designated heritage assets situated slightly to the east of the 500m study area, comprising the Port House (**60**) and Royal Norfolk and Suffolk Yacht Club (**61**). However, examination of the ZTV (Figure 9.2), combined with results of the site visit and review of the closest photomontage to these two assets (Figure 10.9) shows that the Scheme will not be visible from the Yacht Club as it is screened from it by the existing built environment. In contrast the centre and south of the Scheme will be visible from the Port House, but surrounding modern industrial and commercial developments mean that setting plays only a limited role in its significance. Impact to the Yacht Club is assessed as no

change and impact to the Port House is assessed as minor.

- 9.7.19 Five locally listed buildings or structures (**70 – 74**) and four buildings of local architectural or historic interest (**75 – 78**) will have partial views of the Scheme, often only from the rear or upper floors. The limited partial views of the Scheme from the designated assets mean that it has negligible impact on their setting and therefore significance, while the settings of the buildings of local architectural and historic interest have seen significant modern redevelopment and consequently have negligible contribution to their significance. Impact to these assets is assessed as negligible.
- 9.7.20 A group of four detached residential buildings of local historic interest (**80**: 50-56 Waveney Drive), assigned a low significance rating, will have views of the Scheme. The four buildings are located at an area which has seen significant modern redevelopment and setting contributes little to their significance. Impact to these assets is assessed as minor.

9.7.21 The predicted impacts to built heritage are summarised in *Table 9-11*

Magnitude of Impact to Archaeological Remains

Construction Phase

- 9.7.22 The Scheme could impact sub-surface archaeological assets and palaeoenvironmental evidence of early prehistoric periods (**83**) if Cromer Forest Bed deposits are present. Assets of this type would be of national (High) or international (Very High) significance, but it is anticipated that any impact to these deeply buried assets, if present, will be spatially constrained and only result from piling. The predicted impact is assessed as negligible.
- 9.7.23 The Scheme could impact sub-surface archaeological assets and palaeoenvironmental evidence of later prehistoric periods (**87**) where deposits of Holocene alluvium and peat survive. Assets of this type would be of regional (Medium) significance, but it is anticipated that the impact to these assets will be spatially constrained and mainly result from piling. The predicted impact is assessed as negligible.
- 9.7.24 The Scheme could impact sub-surface archaeological assets associated with settlement of the Anglo Saxon / Anglo Scandinavian period (**84**) in the vicinity of Denmark Road. Assets of this type would be of local or regional (Low or Medium) significance, but their presence is currently uncertain and they may be poorly preserved, if present, due to past levelling and development of this area. The predicted impact is assessed as minor.
- 9.7.25 The Scheme may impact unknown archaeological assets of the historic periods (either those associated with exploitation of a marginal wetland, estuarine environment, such as salterns, fish traps, peat cutting; or associated with the subsequent development of the port and related industries (**85**)). The significance of any such assets is assessed as local (low) and predicted impact is assessed as minor.
- 9.7.26 The sites of four recorded archaeological assets will be directly impacted by the Scheme: post medieval earthworks and structural remains (**49**), a Second World War defended fuel store (**27**), a bunker or air raid shelter (**50**), and a pillbox and civil defence

site (43). All were demolished post-war and their sites were subsequently developed. It is probable that no, or very little sub-surface evidence will survive, but should any elements of these assets remain they will probably be very poorly preserved; their significance is assessed as low and predicted impact is assessed as negligible.

9.7.27 The predicted impacts to archaeological remains are summarised in Table 9-12.

Operational Phase

9.7.28 No impact to archaeological heritage assets is anticipated during the operational phase.

Magnitude of Impact to the Historic Landscape

9.7.29 The HLC data demonstrates that there is limited time depth to the historic landscape of the study area; it has been subject to significant change over time, most notably during the late 19th and 20th century when the town and port of Lowestoft began to expand and introduce new landscape unit types, including leisure, urban, transport and industrial, into a previously agricultural landscape. Impact to the historic landscape during construction and operation is assessed as negligible (Table 9-10).

9.8 Stage 5 - Mitigation

9.8.1 Embedded mitigation for the Scheme has been included through the form, aesthetics and landmark nature of the proposed bridge structure.

9.8.2 Where impacts have been identified, a range of further mitigation measures are specified with a view to reducing the significant effects of the Scheme. The mitigation measures are set out in a Written Scheme of Investigation for Future Evaluation and Mitigation (Appendix 9F).

9.8.3 In some instances mitigation may involve a progressive sequence of measures which will be dependent on the findings of initial investigations. For example, where trial trenching is to be undertaken there may be no findings of archaeological interest and further investigation may not be appropriate. Should the initial investigations identify features of interest it may be appropriate to progress the investigations further by way of a combination of measures such as partial or full excavation of archaeological remains, measurement, mapping or photographic recording of built heritage and landscapes. The appropriate measures will be agreed with SCCAS as part of the on-going engagement set out in Appendix 9F and the results of the investigations will be disseminated by means of assessment, analysis and reporting

9.8.4 The embedded and further mitigation are summarised in following paragraphs.

Mitigation for Conservation Areas and Historic Buildings

9.8.5 With regard to the Conservation Areas, screening of the Scheme is not possible, although embedded mitigation in the form of a high quality design (see 9.3.23) to complement and enhance the surrounding built environment has been incorporated.

9.8.6 With regard to the listed buildings, screening of the Scheme is not possible, although embedded mitigation in the form of landscape treatment and high quality design (see 9.3.23) to complement and enhance the surrounding built environment has been incorporated.

-
- 9.8.7 With regard to the majority of non-designated buildings, comprising buildings of local interest and locally listed buildings or structures screening of the Scheme is not possible, although embedded mitigation in the form of landscape treatment and high quality design (see 9.3.23) to complement and enhance the surrounding built environment has been incorporated.
- 9.8.8 One non-designated built heritage asset is directly impacted by construction of the Scheme: 42 Waveney Drive (**79**) will be demolished and this asset will be subject to a programme of building recording in advance of commencement of development as set out in the Written Scheme of Investigation for Evaluation and Mitigation presented in Appendix 9F which will be secured as a requirement to the DCO.

Mitigation for Archaeological Remains

- 9.8.9 A programme of geoarchaeological assessment and analysis of continuous borehole samples has been agreed with HE. The geoarchaeological work will be completed in accordance with the WSI for Evaluation and Mitigation (Appendix 9F) and will assess and analyse, as necessary, the character, extent, significance, condition, quality and depth of the surviving sedimentary sequence, the presence or absence of the Cromer Forest Bed Formation and the potential for survival of prehistoric archaeological remains (**83**). The requirement for geoarchaeological assessment and analysis has been agreed with HE following submission of a preliminary deposit model (Appendix 9B), which identified limited potential for survival of deeply buried Quaternary palaeoenvironmental and prehistoric archaeological remains within the Order limits.
- 9.8.10 Preservation in situ of significant designated or non-designated heritage assets is the preferred option should they be present. However, where this is not possible then alternative options will be agreed with SCCAS and HE during completion of the programme of pre-construction evaluation and mitigation set out in Appendix 9F.
- 9.8.11 In order to further understand the survival and nature of sub-surface archaeological remains within the Order limits, a programme of evaluation trenching will be necessary. The evaluation trenching will be restricted to an area situated between the East Suffolk Line and Denmark Road, as the majority of the Scheme follows existing road alignments, or crosses the East Suffolk Line and the Port and it will not be possible to trench these areas in advance of commencement of development.
- 9.8.12 Evaluation trenching may be followed by a programme of archaeological mitigation comprising excavation and recording. The scope of mitigation will be agreed with SCCAS and HE after review of the results of the evaluation.
- 9.8.13 Four archaeological heritage assets are recorded by the HER within the Order limits. Potential post medieval earthworks and structural remains (**49**), a Second World War defended fuel store (**27**), a bunker or air raid shelter (**50**), and a pillbox and civil defence site (**43**), may be directly impacted by the Scheme. However, these assets are assessed as of low significance, all above ground evidence has been removed by late 20th century development and it is probable that any surviving sub-surface remains are very poorly preserved. No further mitigation is therefore proposed.

Mitigation for Historic Landscapes

- 9.8.14 Little time depth survives in the historic landscape (**86**). However, despite significant

recent demolition and redevelopment the integrity of the late 19th and early 20th century industrial, commercial and urban landscape remains legible, especially on the northern side of Lake Lothing. The Scheme will introduce additional large infrastructure to this landscape although its past development will remain legible. The embedded mitigation of the high quality design will complement and enhance the surrounding built environment. No further mitigation is proposed.

9.9 Stage 6 - Significant effects

9.9.1 This section categorises significance of effect after consideration of predicted magnitude of impacts on assessed heritage assets and the proposed embedded and further mitigation.

Significant Effects to Conservation Areas

9.9.2 The embedded mitigation, comprising high quality design, integrates with the existing built environment and the impact of the Scheme at the South Lowestoft Conservation Area is assessed as minor and the significance of effect is assessed as slight (Table 9-10).

9.9.3 The Scheme will be visible from the Oulton Broad Conservation Area as a distant incidental landscape feature. Impact of the Scheme at Oulton Broad Conservation Area is assessed as no change and the significance of effect is assessed as neutral (Table 9-10).

9.9.4 Based upon professional judgement it is concluded that the Scheme will result in less than substantial harm and does not constitute a significant effect upon the Conservation Areas.

Significant Effects to Built Heritage

9.9.5 The Scheme does not directly impact any designated built heritage assets, but three designated (Grade II listed) built heritage assets (**65**: Wellington Esplanade; **66**: Ashurst; 9, 10 and **67**: 11 Waterloo Road and 16-28 Victoria Terrace) are located at the south-east edge of the 500m study area as shown in Figure 9.1. The three designated built heritage assets may have distant views to the Scheme from upper floors, but more probably only from rooftops. After embedded mitigation is taken into account the impact of the Scheme on these designated assets is assessed as no change and the significance of effect is assessed as neutral.

9.9.6 The Scheme will introduce a new built structure into the setting of two designated heritage assets situated slightly to the east of the 500m study area, comprising the Port House (**60**) and Royal Norfolk and Suffolk Yacht Club (**61**). No mitigation is proposed at the Royal Norfolk and Suffolk Yacht Club as the assessment has shown that it is not affected by the Scheme, impact is assessed as no change and the significance of effect is assessed as neutral. After embedded mitigation is taken into account impact to the Port House is assessed as minor and the significance of effect is assessed as slight.

9.9.7 Five locally listed buildings or structures (**70 – 74**) and four buildings of local architectural or historic interest (**75 – 78**) will have partial views of the Scheme, often only from the rear upper floors. The Scheme has negligible impact to these assets and

after embedded mitigation is taken into account the significance of effect is assessed as slight.

- 9.9.8 A group of four detached residential buildings of local historic interest (**80**: 50-56 Waveney Drive), assigned a low significance rating, will have partial views of the Scheme and will be affected by a minor increase in traffic and noise. After embedded mitigation is taken into account impact to these assets is assessed as minor and the significance of effect is assessed as slight.
- 9.9.9 One building of local historic interest, assigned a low significance rating (**79**: 42 Waveney Drive), will be demolished during construction of the Scheme. Impact to this asset is assessed as major and after further mitigation, comprising building recording, is taken into account the significance of effect is assessed as slight.
- 9.9.10 Based upon professional judgement it is concluded that the Scheme will result in no harm to the majority of built heritage assets and less than substantial harm to only one designated asset (The Port House). The impact of the Scheme does not constitute a significant effect upon built heritage.
- 9.9.11 The predicted impacts and significance of effect to built heritage are summarised in Table 9-10 to Table 9-13

Significant Effects to Archaeological Remains

- 9.9.12 The Scheme could impact sub-surface archaeological assets and palaeoenvironmental evidence of early prehistoric periods (**83**) if Cromer Forest Bed deposits are present, impact would be limited to areas of piling. The further mitigation set out in Appendix 9F, will determine the presence of significant deposits, assess, analyse and disseminate results, as appropriate. The predicted impact is assessed as negligible and after mitigation is taken into account the significance of effect is assessed as slight.
- 9.9.13 The Scheme could impact sub-surface archaeological assets and palaeoenvironmental evidence of later prehistoric periods (**87**) where deposits of Holocene alluvium and peat survive, impact to these assets will be spatially constrained and mainly result from piling. The mitigation set out in Appendix 9F, will determine the presence of significant deposits, assess, analyse and disseminate results, as appropriate. The predicted impact is assessed as negligible and after mitigation is taken into account the significance of effect is assessed as slight.
- 9.9.14 The Scheme could impact sub-surface archaeological assets associated with settlement of the Anglo Saxon / Anglo Scandinavian period (**84**) in the vicinity of Denmark Road. The predicted impact is assessed as minor and after evaluation and subsequent mitigation (if necessary), comprising trial trenching and excavation (Appendix 9F), is taken into account the significance of effect is assessed as slight. The final scope of mitigation for any discovered sub-surface heritage assets would be agreed with SCCAS and HE as part of the WSI (Appendix 9F).
- 9.9.15 The Scheme may impact unknown archaeological assets of the historic periods (**85**). However, the baseline environment suggests that the presence of such features is unlikely and further mitigation is not proposed. The predicted impact is assessed as minor and the significance of effect is assessed as slight.

9.9.16 The sites of four recorded archaeological assets will be directly impacted by the Scheme: post medieval earthworks and structural remains (**49**), a Second World War defended fuel store (**27**), a bunker or air raid shelter (**50**), and a pillbox and civil defence site (**43**). No mitigation is proposed as all were demolished post-war and their sites were subsequently developed. The predicted impact is assessed as negligible and the significance of effect is assessed as neutral.

9.9.17 Based upon professional judgement, and with mitigation measures in place, it is concluded that the Scheme will result in less than substantial harm to archaeological heritage assets and does not constitute a significant effect.

Significant Effects to the Historic Landscape

9.9.18 The HLC data demonstrates that there is limited surviving time depth to the historic landscape. After embedded mitigation is taken into account the impact to the historic landscape is assessed as negligible and the significance of effect is assessed as neutral (Table 9-10).

9.9.19 Based upon professional judgement, it is concluded that the Scheme will result in no harm and the impact to the historic landscape does not constitute a significant effect.

9.10 Predicted Impact and significance of effect tables

9.10.1 The significance of assessed heritage assets, as discussed in Section 9.6, and the magnitude of impact and significance of effect, as discussed in Section 9.7, is summarised in Table 9-10, Table 9-11, Table 9-12 and Table 9-13.

Table 9-10 – Impacts to conservation areas and significant effects following further mitigation

Site Number	Name/Asset type	Significance	Type of Impact	Magnitude of Impact	Further Mitigation	Significance of Effect
68	South Lowestoft Conservation Area	High	Visual (construction and operation)	Minor	None	Slight
69	Oulton Broad Conservation Area	High	Visual (construction and operation)	No Change	None	Neutral

Table 9-11 – Impacts to built heritage assets and significant effects following further mitigation

Site Number	Name/Asset type	Significance	Type of Impact	Magnitude of Impact	Further Mitigation	Significance of Effect
60	Port House (Grade II)	Medium	Visual (construction and operation)	Minor	None	Slight
61	Royal Norfolk and Suffolk Yacht Club (Grade II*)	High	Visual (construction and operation)	No Change	None	Neutral
65	Wellington Esplanade (Grade II)	Medium	Visual (construction and operation)	No Change	None	Neutral
66	Ashurst (Grade II)	Medium	Visual (construction and operation)	No Change	None	Neutral
67	9, 10 and 11 Waterloo Road and 16-28 Victoria Terrace (Grade II)	Medium	Visual (construction and operation)	No Change	None	Neutral
70	Central Railway Station	Low	Visual (construction and operation)	Negligible	None	Neutral
71	7-11 Station Square	Low	Visual (construction and operation)	Negligible	None	Neutral
72	18-32 Station Square	Low	Visual (construction and operation)	Negligible	None	Neutral
73	1-8 Pier Terrace	Low	Visual (construction and operation)	Negligible	None	Neutral
74	RNLI Statue, Pier Terrace	Low	Visual (construction and operation)	Negligible	None	Neutral

Site Number	Name/Asset type	Significance	Type of Impact	Magnitude of Impact	Further Mitigation	Significance of Effect
75	Terraced Houses (19th century). Commercial Road	Low	Visual (construction and operation)	Negligible	None	Neutral
76	Brick built 19th century warehouse on Commercial Road	Low	Visual (construction and operation)	Negligible	None	Neutral
77	Goods Office. Commercial Road	Low	Visual (construction and operation)	Negligible	None	Neutral
78	One storey brick built mid - 20th century industrial building. Commercial Road	Low	Visual (construction and operation)	Negligible	None	Neutral
79	Detached two storey early - 20th century residential building. 42 Waveney Drive	Low	Direct (demolition before construction)	Major	Building recording	Slight
80	Four detached two storey early - 20th century residential buildings. No's. 50 - 56 Waveney Drive	Low	Indirect (construction and operation)	Minor	None	Slight

Table 9-12 – Impacts to archaeological heritage assets and significant effects following further mitigation

Site Number	Name/Asset type	Significance	Type of Impact	Magnitude of Impact	Further Mitigation	Significance of Effect
27	Potential remains of WWII defended fuel store	Low	Direct (construction)	Negligible	None	Neutral
43	Potential remains of World War Two pillbox and possible civil defence site	Low	Direct (construction)	Negligible	None	Neutral
49	Possible post medieval remains	Low	Direct (construction)	Negligible	None	Neutral
50	Potential remains of WWII bunker or air raid shelter	Low	Direct (construction)	Negligible	None	Neutral

Site Number	Name/Asset type	Significance	Type of Impact	Magnitude of Impact	Further Mitigation	Significance of Effect
83	Potential Pleistocene palaeoenvironmental and archaeological remains	High or Very High	Direct (piling during construction)	Negligible	Geoarchaeological assessment, analysis, deposit modelling and dissemination of results	Slight
84	Potential sub-surface archaeological remains of Anglo-Saxon / Anglo-Scandinavian settlement	Low or Medium	Direct (construction groundworks)	Minor	Evaluation, excavation, recording and dissemination of results	Slight
85	Potential archaeological remains related to historic exploitation of marginal wetland environment or development of the port	Low	Direct (piling and excavation during construction)	Minor	Evaluation, excavation, recording and dissemination of results	Slight
87	Potential Holocene palaeoenvironmental and prehistoric archaeological remains	Medium	Direct (piling during construction)	Negligible	Geoarchaeological assessment, analysis, deposit modelling and dissemination of results	Slight

Table 9-13 – Impacts to the historic landscape and significant effects following further mitigation

Site Number	Name/Asset type	Significance	Type of Impact	Magnitude of Impact	Further Mitigation	Significance of Effect
86	Historic Landscape	Negligible	Visual (construction and operation)	Negligible	None	Neutral

9.11 Conclusions and Effects

- 9.11.1 In relation to Conservation Areas and the built heritage, following mitigation, the Scheme would have no impact on Oulton Broad Conservation Area, a negligible impact on South Lowestoft Conservation Area, no impact to four listed buildings, including the Royal Norfolk and Suffolk Yacht Club, and a minor impact to one listed building, the Port House. Overall, the significance of effect of the Scheme upon the Conservation Areas and built heritage assets is deemed to be slight, will result in less than substantial harm and does not constitute a significant effect.
- 9.11.2 This assessment has demonstrated that, following mitigation, in relation to archaeological assets the Scheme would have a slight or moderate impact on unknown sub-surface remains. It would have a negligible impact on four known non-designated archaeological assets. Overall, the significance of effect of the Scheme upon archaeological assets is deemed to be slight, the Scheme will result in less than substantial harm and does not constitute a significant effect.
- 9.11.3 In relation to the historic landscape there would be a negligible impact as a result of the introduction of the Scheme. The overall significance of effect of the Scheme on the historic landscape is deemed to be neutral, it will result in no harm and does not constitute a significant effect.

10 Townscape and Visual Impact

10.1 Scope of the Assessments

Introduction

10.1.1 This chapter describes the assessment of the likely significant effects of the Scheme on townscape character and visual amenity during the construction and operational phases of the Scheme. The Scheme has a proposed lifespan of 120 years, during which time the townscape and associated views are likely to undergo some significant change, therefore the assessment does not consider the decommissioning phase. This is further explained in Section 5.8 of this ES.

10.1.2 The assessment of this topic area considers potential impacts of the Scheme within the receiving environment namely; the proposed bridge, control tower, associated approach roads, link roads, including tie-ins with the existing road network, and associated environmental improvements. Chapter 5 of this ES provides a full description of the Scheme and explains how a reasonable or likely worst case scenario has been defined for the purposes of the assessments set out in the ES, including in this chapter. The assessment therefore considers:

- Potential effects on the perception of local townscape character; and
- Potential effects on visual amenity experienced by the surrounding visual receptors.

10.1.3 The assessment has taken account of the comments of the Secretary of State (SoS) in the Scoping Opinion included in Appendix 7B, and has incorporated comments received during the non-statutory and statutory consultation process. This assessment should be read in conjunction with Chapter 9: Cultural Heritage, where an assessment of the setting of the Scheme relative to heritage assets is presented.

10.1.4 For the purposes of the assessment, as the predominant character is one of townscape, references in this chapter to townscape should be taken as covering seascape and landscape. Townscape relates to the landscape within the built up area and the relationship between built form and open spaces, including green space. Seascape primarily incorporates views of coastal waters from adjacent land and vice versa. General views combining the bridge and coastline, which in this location is associated with the Norfolk Coastal Waters and Suffolk Coastal Waters Character Areas are not experienced, therefore for the purpose of this assessment the assessment focuses on Lake Lothing itself as a body of tidal water albeit as a body of inland water.

Study Area

10.1.5 In line with guidance provided in Guidelines for Landscape and Visual Impact Assessment (3rd Edition)(GLVIA), the study area has been defined as the area through which existing townscape character may change or be influenced and in which visual effects may arise, as a direct result of construction and operation of the Scheme. This has been identified through a combination of 3-D modelling and site work within a pre-defined limited study area that was provisionally agreed with Waveney District Council

(WDC) and SCC as a 3km radius around the Scheme (see Figure 10.1), beyond which the potential for significant townscape or visual effects are not anticipated to arise due to the context, scale and nature of the development. Since the agreement of that study area, the tallest component of the bridge, the counterweights, have reduced in height as a result of design development, however the study area has not changed as a result of this.

10.2 Directives, Statutes and Relevant Policy

10.2.1 Table 10-1 provides an outline of the statutes, guidance, policies and plans that have informed the townscape character and visual amenity assessment of the Scheme. Appendix A to the Case for the Scheme (document reference 7.1) identifies how these have been addressed.

Table 10-1 – Townscape/Landscape Regulatory and Policy Framework

Policy	Policy Summary
National Networks: National Policy Statement (NNNPS) (December 2014)	<p>The Government's vision and strategic objectives for national networks includes 'supporting a prosperous and competitive economy and improving overall quality of life' including delivering good design of infrastructure through:</p> <p>Applying "<i>good design</i>" to national network projects to produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction, matched by an appearance that demonstrates good aesthetics as far as possible.</p> <p>Paragraph 3.2 states that "<i>The Government recognises that for development of the national road and rail networks to be sustainable these should be designed to minimise social and environmental impacts and improve quality of life</i>".</p> <p>Paragraph 5.149 states that "<i>projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints, the aim should be to avoid or minimise harm to the landscape (townscape), providing reasonable mitigation where possible and appropriate</i>".</p> <p>Paragraph 5.154 states that the aim for developments outside nationally designated areas but which might affect them there is a duty to have regard to the purposes of these area and should aim to "<i>avoid compromising the purposes of designation and such projects should be designed sensitively given the various siting, operational, and other relevant constraints</i>".</p>
National Policy Statement for Ports (January 2012)	<p>The Ports NPS (PNPS) details the assessments that should be undertaken by applicants for Port development and whilst the Scheme does not constitute Port development, the PNPS does provide useful context for coastal projects in so far that it clarifies that references to landscape should be taken as "<i>covering seascape and townscape, where appropriate</i>."</p>
National Planning Policy Framework (NPPF)	<p>The NPPF was published in March 2012 by the Government. The document streamlines national planning policy into a consolidated set of priorities, replacing most Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) notes. The NPPF sets out 13 core planning principles that should underpin decision taking including: the requirement for good design and conserving and enhancing both the natural and built environments.</p> <p>Paragraph 56 of the NPPF states that "<i>The Government attaches great importance to the design of the built environment. Good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people</i>".</p>

	Paragraph 109 of the NPPF states that “ <i>the planning system should contribute to and enhance the natural and local environment</i> ” including by protecting and enhancing valued landscapes. These principles have been taken into account in the development of the Scheme.
Planning Practice Guidance (2014)	The Planning Practice Guidance provides practical guidance to support the NPPF. The policy document provides guidance to local authorities on consideration of the intrinsic character and beauty of the countryside, including both designated and undesignated landscapes.
East Inshore and East Offshore Marine Plans	Marine Plans are implemented as a requirement of the Marine and Coastal Access Act 2009. The plans provide for the application or clarification of national planning policy in relation to coastal areas. Policy SOC3 sets out, in order of preference, how proposals that may affect terrestrial or marine character should avoid, reduce, mitigate or provide justification for potential impacts.

10.3 Methods of Assessment

10.3.1 The assessment methodology has been undertaken in accordance with the GLVIA and this has been agreed with SCC and WDC as appropriate. Please see Chapters 6 and 7 for further information on how the assessment has been informed through consultation.

10.3.2 As the Scheme comprises a bridge structure and supporting link roads, reference has also been made to:

- Highways England’s Interim Advice Note (IAN) 135/10, that supersedes the relevant section of the Design Manual for Roads and Bridges;
- National Networks National Policy Statement;
- National Policy Statement for Ports ;
- An Approach to Landscape Character Assessment ;
- Suffolk Landscape Character Assessment;
- Landscape Character Assessment, Broads Authority ;
- East Inshore and East Offshore Marine Plans; and
- Waveney District Landscape Character Assessment.

10.3.3 The Waveney District Landscape Character Assessment identifies several landscape character areas that extend beyond the limits of Lowestoft and within the 3km radius study area. The above assessment identifies the built environment as ‘urban’, within which this assessment has refined the urban area into several local townscape character areas.

10.3.4 The GLVIA acknowledges the relationship between the perception of landscape and townscape and the similarities in the approach to be undertaken in the assessment process. It also identifies the perception of townscape, and the experience of viewers (referred to as receptors - defined as residents, people in their workplace, attending school, using recreational facilities and using the countryside, shoppers etc.) and development proposals.

10.3.5 The following assessment of townscape and visual amenity considers the potential effects of the Scheme during:

- Construction, which is assumed to be an approximate two year period, during which time cranes and lifting equipment are anticipated to be present on site for a period of approximately 70 weeks, and will include the presence of associated plant, construction compounds and local traffic management (refer to Chapter 5 for information relating to the construction period);
- At the opening of the Scheme, the analysis will assume that the visual context applicable would be experienced during winter months and with the bridge in the open position (i.e. lifted), when the degree of visual exposure is potentially greatest and represents the worst case scenario, along with changes arising as a result of the tie in with the existing road network. The assessment also includes an assessment of the potential night time effects of the lighting; and
- At ten years into operation (the end of the assessment period), for both summer and winter periods. The analysis at ten years into operation demonstrates the effectiveness of the landscape mitigation proposals associated with the Scheme, allowing for maturation.

Stages in the Assessment Process

10.3.6 There are four key stages in the assessment:

- Recording and analysis of the existing townscape and visual context of the receiving environment (the baseline environment);
- Identification of changes and associated impacts that will be associated with the Scheme including embedded mitigation and the significance of these impacts in the context of the baseline townscape and visual context of the study area;
- Identification of further mitigation where the assessment identifies potentially significant effects appropriate to the Scheme and the views of the receiving local area; and
- Description of the residual effects and their significance associated with the Scheme following the application of such further mitigation.

10.3.7 A methodology for the assessment of townscape character and visual amenity has been prepared and agreed with representatives from WDC and SCC. The key components of the methodology have been set out in sections 10.3.8 to 10.3.49.

Baseline Environment Identification

10.3.8 The identification and evaluation of the existing townscape and visual context of the study area and wider area has involved the following tasks:

- Desk based analysis of OS mapping relating to landform, built form, vegetation, settlement patterns and the drainage regime in the wider area;
- Desk based analysis of aerial photography for the area;
- Review of the townscape units/types and relevant designations e.g. Conservation Areas, Registered Parks and Gardens;

- Site surveys and identification of townscape units/types. Site recording involving annotation of 1:1,250 and 1:25,000 scale OS plans defining the units and the key elements determining character;
- Development and agreement of representative/key viewpoints to be assessed for potential effects on visual amenity;
- Site photography to illustrate character units, notable views / viewpoints and key landscape elements; and
- Identifying and describing local townscape character units within the context of the broader assessment and associated with the Scheme and wider setting including an evaluation of their quality, value and sensitivity to change in the context of the proposed form of development.

Assessment upon Townscape Character

10.3.9 For townscape character, evaluation of the sensitivity to change has been based on the, quality and value of the existing townscape, and the extent to which it is considered as being capable of accepting change in the form of the Scheme. Sensitivity will be rated as being high, moderate or low, as described below.

10.3.10 Magnitude of impact will be based on the extent to which the Scheme will be likely to emerge as a new component in the townscape and change the relationship between components that currently constitute character.

10.3.11 The sensitivity of the receiving townscape and the magnitude of impact will be assessed to determine a significance of effect rating that will result from the construction and operation of the Scheme and the effect that this will have on the perception of townscape character (as further described in paragraph 10.3.20).

Townscape Quality

10.3.12 Townscape quality relates to the intrinsic aesthetic appeal demonstrated by a character unit or feature / composition within the townscape, including the relative condition of the townscape and features therein.

10.3.13 A five point scale has been adopted to assist in describing quality prior to development as shown in Table 10-2.

Table 10-2 – Townscape Quality

Classification	Quality
Highest Quality	Areas comprising a clear composition of distinctive and attractive townscape components in robust form and health, free of disruptive visual detractors and with a strong sense of place. Areas containing a strong, balanced structure with distinct features worthy of conservation. Such areas would generally be internationally or nationally recognised, e.g. World Heritage Sites, Registered Parks and Gardens, and National Parks.
Very Attractive	Areas primarily of attractive townscape components combined in an aesthetically pleasing composition and lacking prominent disruptive visual detractors. Areas containing a strong structure with noteworthy features or elements, exhibiting a sense of place. Such areas would generally be nationally or regionally recognised locations, e.g. Areas of historic townscapes, including Conservation Areas

Classification	Quality
Good	Areas primarily of attractive townscape components combined in an aesthetically pleasing composition with low levels of disruptive visual detractors, exhibiting a recognisable townscape structure. Such areas would generally be regionally and locally recognised areas, e.g. Areas of Local Landscape Importance and areas fringing Conservation Areas
Ordinary	Areas containing some distinctive features of townscape but lacking a coherent and aesthetically pleasing composition with frequent detracting visual elements, exhibiting a distinguishable structure often concealed by mixed land uses or development. Such areas would be commonplace at the local level and would generally be undesignated, offering scope for improvement.
Poor	Areas lacking distinctive townscape components or comprising degraded, disturbed or derelict features, lacking any aesthetically pleasing composition with a dominance of visually detracting elements, exhibiting mixed land uses which conceal the baseline structure. Such areas would generally be restricted to the local level and identified as requiring recovery.

Townscape Value

10.3.14 Townscape value relates to areas of particular scenic merit or those displaying important historic and cultural associations. Townscape value is frequently addressed by reference to international, national, regional and local designations. An absence of a formal designation does not, however, determine that a townscape is necessarily of low value; factors such as accessibility and local scarcity can render areas of unremarkable quality highly valuable as a local resource. For example, an area of relatively insignificant landscape may have increased value associated with it as a result of its proximity to housing or as an informal recreational space.

Table 10-3 – Value criteria for townscape character

Value	Criteria
High	A townscape identified as having characteristics that warrant a high level of protection through designation at a national scale, or as a result of its opportunities for recreational, cultural associations or opportunities to experience a high degree of townscape character at an extensive scale
Medium	A townscape identified as having characteristics that warrant protection through designation at a regional or local scale, or as a result of its opportunities for recreational, cultural associations or opportunities to experience a modest degree of townscape character at a local scale
Low	A townscape identified as having uncharacteristic features that detract from the townscape character and that are undesignated, or that do not contribute positively to opportunities for recreational, cultural associations or that lack a perceptible sense of townscape character at a local scale

Sensitivity to Change

10.3.15 Sensitivity to change relates to the quality and value of the townscape, as outlined above, and the extent to which it is considered capable of accepting the type of development proposed. Three orders of sensitivity have been adopted as shown in Table 10-4.

Table 10-4 – Sensitivity to change criteria for townscape character

Sensitivity	Criteria
High	a townscape displaying particularly distinctive character, of good or greater quality which is highly valued and considered susceptible to relatively small changes
Medium	a townscape of good or ordinary quality which is moderately valued and considered reasonably tolerant of change
Low	a townscape of ordinary or poor quality which is of relatively low value and considered tolerant of substantial levels of change

Capacity to Accommodate Change

10.3.16 Although there is common ground between the aspects of sensitivity and capacity, the relationship between the degree of sensitivity and capacity are not always directly related. An Approach to Landscape Character Assessment³¹ defines landscape capacity as “*The degree to which a particular landscape character type or area is able to accommodate change without unacceptable adverse effects on its character. Capacity is likely to vary according to the type and nature of the change being proposed*”.

10.3.17 A highly sensitive area should not, by definition, infer that it has little or no capacity to accommodate future change. Similarly, an area expressing low sensitivity to change does not automatically have a higher capacity to accommodate development.

Magnitude of Impact

10.3.18 The magnitude of impact has been determined through a description of the changes likely to arise as a result of the Scheme on the existing baseline. This includes changes such as modification to the grain of the built form, loss of vegetation or green space and severance or modification to key townscape components. The evaluation considers the extent to which the Scheme will emerge as a new component in the townscape or change the balance between components that currently constitute baseline character. Five grades of magnitude will be adopted: high; medium; low; negligible; and no change as shown in Table 10-5.

Table 10-5 Magnitude of impact criteria for townscape character

Magnitude of Impact	Criteria
High	Where the development would appear as a significant new adverse or beneficial component in the townscape and result in the total loss/replacement of or major alteration to the existing components in the baseline context.
Medium	Where the development would appear as a distinctly noticeable new adverse or beneficial component in the townscape and result in a partial loss or partial replacement of or alteration to the existing components in the baseline context.
Low	Where the development would appear as a noticeable new adverse or beneficial component in the townscape and result in a minor loss or replacement of or alteration to the existing components in the baseline context.

³¹ An Approach to Landscape Character Assessment, Natural England, March 2018.

Magnitude of Impact	Criteria
Negligible	Where the development would appear as a barely perceptible adverse or beneficial component in the townscape and result in very minor loss or replacement of or alteration to the existing components in the baseline context.
No change	Where the development would have no direct effect on the components in the townscape resulting in no alteration to the existing balance of components in the baseline context

Significance of Effect Assessment

10.3.19 The evaluation of effects for townscape character has involved consideration of the sensitivity and capacity to accommodate change, derived during the baseline assessment, and the predicted magnitude of the impact that will occur in light of the construction and subsequent operation of the Scheme. Effects are considered to be significant where they are identified as being moderate or greater.

Townscape Character Significance of Effect Ratings

10.3.20 The identification of the resulting effects have been established through an evaluation of the sensitivity, as defined in Table 10-4, of the baseline or receptor, the capacity to accommodate change (see paragraph 10.3.16), and the magnitude of the impact, as defined in Table 10-5 which is likely to occur as a result of the Scheme. An indication of the interactions between sensitivity and magnitude of impact and the likely resulting effects that have been used are outlined in Table 10-6.

Table 10-6 – Significance of effect categories for townscape character

	Sensitivity		
	Low	Medium	High
High	Slight/Moderate	Moderate/Large	Large/Very Large
Medium	Slight	Moderate	Moderate/Large
Low	Neutral/Slight	Slight	Slight/Moderate
Negligible	Neutral/Slight	Neutral/Slight	Slight
No change	Neutral	Neutral	Neutral

10.3.21 The significance of effect categories shown in Table 10-6 are only a framework to aid consistency of reporting and provide an initial indication of the likely effect, either beneficial or adverse, arising from the assessment of magnitude of impact and sensitivity of the resource. In considering the sum of the changes, adverse impacts may offset or reduce the magnitude of beneficial impacts and vice versa. Given that the magnitude criteria of 'high/medium/low/negligible/no change' represent levels on a continuum or continuous gradation, application of the framework has also included professional judgement and awareness of the relative balance between sensitivity and magnitude.

10.3.22 The findings of the assessment has been represented using a descriptive, descending scale ranging from large - moderate - slight and adverse through neutral to an ascending scale of slight - moderate - large and beneficial. There is a further effect

rating, very large adverse, used to indicate adverse effects on a very high quality townscape or on important and rare combinations of townscape features and their elements. Such a rating would indicate that the effect is considered highly prejudicial in relation to the specific topic of townscape character. Explanation of the significance of effect ratings that are proposed is provided below in a descending scale of significance.

- Large Beneficial Effect - The proposals:
 - Constitute a major restructuring of a degraded townscape or form an essential part of a townscape strategy to redevelop a major area of dereliction, leading to establishment of a new, attractive environment.
- Moderate Beneficial Effect - The proposals provide an opportunity to enhance the townscape because:
 - They fit very well with the scale, built form and pattern of the townscape;
 - There is potential, through mitigation, to enable the restoration of characteristic features, partially lost or diminished as the result of changes to the baseline context, e.g. from previous inappropriate development;
 - They will enable a sense of place and scale to be restored through careful design and appropriate mitigation measures, that is, characteristic features are perhaps enhanced through the use of local materials and appropriate scale of the development that fits well into the surrounding townscape;
 - They enable some sense of quality to be restored or enhanced through design features; and
 - They further government objectives to regenerate degraded urban areas.
- Slight Beneficial Effect - The proposals:
 - Fit well with the scale, built form and pattern of the townscape;
 - Incorporate measures for mitigation to ensure they will complement the surrounding townscape structure;
 - Will enable some sense of place and scale to be restored through careful design and appropriate use of materials as mitigation measures; and
 - Maintain or enhance existing townscape quality and character.
- Neutral Effect - The proposals are well designed to:
 - Complement the scale, built form and pattern of the townscape;
 - Incorporate measures for mitigation to ensure that the Scheme will blend in well with surrounding features and elements; and
 - Maintain existing townscape quality and character.
- Slight Adverse Effect - The proposals:
 - Do not quite fit the built form and scale of the townscape;

-
- Although not very visually intrusive, will impact on certain views into and across the area;
 - Cannot be completely mitigated for because of the nature of the proposal itself or the character of the townscape in which the development would sit; and
 - May affect an area of recognised townscape quality.
 - Moderate Adverse Effect - The proposals:
 - Are out of scale with, or at odds with, the local townscape pattern and built form;
 - Are not possible to fully mitigate for, that is, mitigation will not prevent the Scheme from scarring or detrimentally affecting the townscape in the longer term as some features of interest will be partly destroyed or their setting reduced or removed; and
 - Will have an adverse effect on a townscape of recognised quality or on vulnerable and important characteristic features or elements.
 - Large Adverse Effect - The proposals are very damaging to the townscape in that they:
 - Are at considerable variance with the built form, scale and pattern;
 - Are visually intrusive and would disrupt fine and valued views of the area;
 - Are likely to degrade, diminish or even destroy the integrity of a range of characteristic features and elements of their setting;
 - Will be substantially damaging to a high quality or highly vulnerable townscape, resulting in fundamental change and be considerably diminished in quality; and
 - Cannot be adequately mitigated for.
 - Very Large Adverse Effect - The proposals would result in exceptionally severe adverse effects on the townscape because they:
 - Are at complete variance with the built form, scale and pattern;
 - Are highly visually and extremely intrusive, destroying fine and valued views both into and across the study area;
 - Would irrevocably damage or degrade, badly diminish or even destroy the integrity of characteristic features and elements and their setting;
 - Would cause a very high quality or highly vulnerable townscape to be irrevocably changed and its quality very considerably diminished; and
 - Cannot be mitigated for, that is, there are no measures that would protect or replace the loss of a nationally important townscape.

Assessment of Visual Effects

10.3.23 The assessment of visual effects has involved the adoption of the four stages of

assessment described in Section 9.3.5.

Baseline Environment

10.3.24 Establishment of the existing visual context for the Scheme has involved consideration of the information relating to existing townscape character established during the townscape character baseline assessment, the definition of a Zone of Theoretical Visibility (ZTV) for the Scheme, and the identification of key visual receptors (represented by key viewpoints) within the visual envelope.

Lowestoft Future Townscape

10.3.25 The future development of the Lowestoft townscape has been informed by the known and relevant planned development as described in the Site Specific Allocations contained within the Lowestoft Lake Lothing and Outer Harbour Area Action Plan. These proposals, outlined from Paragraph 10.4.5, represent the future development around Lake Lothing which have the potential to create a significant change in the existing townscape character of Lowestoft.

Zone of Theoretical Visibility (ZTV)

10.3.26 The ZTV represents the extent of the area within the 3km study area within which there would be potential for views of the Scheme. The analysis considered three scenarios separately:

- HGV Traffic (4.5m vehicle height) – 16 points at 25m intervals along the bridge deck;
- Bridge Lowered - 2 points to represent the high point of each arm of the counterweight of the bridge when lowered; and
- Bridge Raised - 2 points to represent the high point of the deck of the bridge when raised.

10.3.27 The XYZ coordinates that have been used in the ZTV in both the open and closed scenario for the two counterweight blades are shown in Table 10-7. It is noteworthy that the ZTV and the photomontages in Figures 10.6 to 10.20 are based upon the reference design (see Paragraph 5.2.8) although the assessment in this chapter is unaltered should the limits of deviation in Table 5-2 be required. The photomontages are also based upon the Scheme design at the time that they were prepared, although no changes to design since then materially affects the consideration of them for the purposes of this assessment.

Table 10-7 – Coordinates used in the ZTV assessment

	X Coordinate	Y Coordinate	Z Coordinate
Closed blade (east)	653879.44	292739.56	50.36
Closed blade (west)	653901.06	292734.56	50.36
Open blade (east)	653904.06	292750.81	60.07
Open blade (west)	653883.63	292755.56	60.07

10.3.28 The visual analysis was carried out using the Viewshed Analysis tool in ArcMAP 10.5 and was based on:

- 2008-2009 LiDAR Digital Surface Modelling (DSM) at 1m resolution (which includes surface features such as buildings and vegetation) and is accurate to +/-10cm for XY and +/-5cm for Z; and
- Observer points using XYZ co-ordinates to replicate the three scenarios.

10.3.29 The LiDAR information used to develop the ZTV includes all features within the townscape, including landform, vegetation and built form; whilst this is useful in developing the ZTV, it is not always reflected by what is visible on site. Whilst all features of the Scheme, including local road ties in have been assessed, the mapping provided illustrates where there is the potential for the tallest aspect of the Scheme namely the proposed bridge structure to be visible, however this is only theoretical and includes all features with a degree of inter-visibility. The ZTV may therefore suggest that the structure would be visible over much broader extents than would be the reality.

10.3.30 The results of this analysis are shown on Figures 10.2 to 10.4 and have informed the ZTV. Those areas identified in 'green' indicate locations that are predicted to have direct views of all or part of the bridge structure and represent the worst case scenario. In areas where the 'green' is less dense and more sporadically distributed, this indicates that these views may be highly constrained and/or comprise only the very highest sections of the bridge structure, which are likely to limit the degree to which a significant effect is anticipated to arise.

10.3.31 As a result, the top of the structure will not be visible from all locations suggested by the software or are not representative of views experienced by the public. This can be for a number of reasons that may include:

- It may be rooflines of buildings or the tops of trees that are registering as having a view (rather than the eye line of a person at that location);
- Intervening buildings and/or vegetation which were not recorded within the baseline data used (e.g. features built after the LiDAR data was collected); or
- Upper floor windows from private dwellings or glimpses between buildings have been included which in reality may be heavily constrained or orientated away from the structure.

10.3.32 Therefore some interpretation of the results is required. The primary objective was to establish an area within which key receptors or viewpoints, whose views may be influenced by the Scheme, could be identified to inform the assessment.

10.3.33 Further field surveys have been undertaken to verify the actual extent of views and the likelihood that these will be subject to change. Therefore inclusion of an area within the ZTV is not an indicator that all potential receptors within the defined area will experience views of the Scheme.

Key Viewpoints

10.3.34 A total of 15 key viewpoints (see Figures 10.5 and 10.6 to 10.20) have been agreed with SCC, WDC, Historic England and The Broads as suitable for assessment purposes (The Broads National Park is not a national park in law but it has been accepted this is the brand name they are able to use) ("The Broads"). The key viewpoints have been selected on the basis that they provide representative views

from a variety of receptors within the vicinity of Lake Lothing. Site surveys have subsequently been undertaken to establish the nature, location and actual availability of the anticipated view.

Identification of Key Viewpoints

10.3.35 The 15 key viewpoints have been recorded by reviewing the settlement pattern, land use, topography, vegetation, access and transportation patterns contained within the boundaries of the ZTV. Key viewpoints plotted via the desk based review and validated through site survey include the following:

- Residential clusters and individual properties;
- Roads with views of the proposed development site; and
- Recreational and public access areas including footpaths and other rights of way.

10.3.36 The location of the key viewpoints are presented in Figure 10.5, and the verified photography (refer to Appendix 10A for the approach taken) for the preparation of photomontages is presented in Figures 10.6 – 10.20. With the exception of Viewpoint 6 as shown on Figure 10.11, there is an absence of mitigation measures that contribute towards a reduction in potential significance over 10 years, therefore the inclusion of this point in time has been excluded from the remaining viewpoints.

Field Assessment of Key Viewpoints

10.3.37 The 15 key viewpoints were visited and assessed. Factors considered during the visual assessment include:

- Associated receptor types and numbers where appropriate (e.g. dwelling / footpath);
- Existing view;
- Distance of view;
- Percentage and elements of the Scheme visible;
- Viewpoint position (view up / view down / level view);
- Angle of view (acute / perpendicular / oblique);
- Type of view (foreground / mid ground / background) and position of the Scheme in the view; and
- Analysis of potential impact.

Analysis of Visual Effects

10.3.38 Analysis of the likely visual impacts and evaluation of their associated effects involves consideration of the sensitivity to change and magnitude of impact based upon information gathered through site surveys and analysis of the aesthetics of the Scheme.

10.3.39 Evaluation of visual effects relates to the potential impacts during construction, subsequent opening of the facilities and ten years into operation (the end of the assessment period), for both summer and winter periods. The analysis will assume

that the visual context applicable at the year of opening is that which would be experienced during winter months when the degree of visual exposure is potentially greatest. The analysis at ten years into operation demonstrates the effectiveness of the landscape mitigation proposals associated with the Scheme, allowing for its maturation. The analysis relates to each key viewpoint and concludes with an evaluation of the predicted significance of effect.

Sensitivity to Change

10.3.40 Sensitivity to change will consider the nature, location and context of the viewpoint or the associated receptor. Key viewpoints associated with less sensitive receptors are considered, for example, to be people engaged in work whose primary focus would not necessarily be on the surrounding landscape views. Conversely, more emphasis is placed upon receptors whose change in view or visual amenity is either the prime focus, greater in scale or potentially covers a wider area.

10.3.41 The degree and importance of the view gained from a key viewpoint by a receptor also contributes to an understanding of how sensitive a given receptor is towards change. Therefore, value of the view, scenic quality and visual expectations of the receptor are also taken into account in the assessment. In this assessment, sensitivity to change is proposed to be ranked as described in Table 10-8.

Table 10-8 Sensitivity of viewpoints

Sensitivity	Criteria
High	This applies where a key viewpoint is associated with: <ul style="list-style-type: none"> Individual dwellings or dwelling groupings with a view in which the Scheme would become an important focal element from either gardens or room windows, either from upper or lower storey. Roads, footpaths, bridleways, cycleways and publicly accessible open spaces with a view in which the Scheme would be an important focal element in that view.
Medium	This applies where a key viewpoint is associated with: <ul style="list-style-type: none"> Individual dwellings or dwelling groupings with a view from either gardens or room windows, either from upper or lower storey, in which the Scheme would not be a focal element but would be a notable element in the view. Roads, footpaths, bridleways, cycleways and publicly accessible open spaces with a view in which the Scheme would not be a focal element but would be a notable element in the view. Industrial / commercial buildings with a view in which the Scheme would be a focal element in the view.
Low	This applies where a key viewpoint is associated with: <ul style="list-style-type: none"> Dwellings with a view from either gardens or room windows, either from upper or lower storey, in which the Scheme would not be a notable element in the view but would be discernible.

Sensitivity	Criteria
	<ul style="list-style-type: none"> Roads, footpaths, bridleways, cycleways and publicly accessible open spaces with a view in which the Scheme would not be a notable element in the view but would be discernible. Industrial / commercial buildings with a view in which the Scheme would not be a focal element but would be a notable element in the view.

Magnitude of Impact

10.3.42 Magnitude of impact considers the extent of the development that is visible, the percentage of the existing view newly occupied by the Scheme and the viewing distance from the receptor to the development. In this assessment magnitude is proposed to be ranked as follows in Table 10-9.

Table 10-9 Magnitude of visual effect criteria

Sensitivity	Criteria
High	Where the Scheme would cause a substantial change to the existing view
Medium	Where the Scheme would cause a very noticeable change to the existing view
Low	Where the Scheme would cause a noticeable change to the existing view
Negligible	Where the Scheme would cause a barely perceptible change to the existing view
No change	Where the Scheme would cause no discernible change to the existing view

Significance of Visual Effect Criteria

10.3.43 The prime criteria used to evaluate visual effects will relate to the extent to which existing views associated with key viewpoints (such as residents, users of public facilities and visitors to open space and public areas), will change, taking into account embedded mitigation measures. Effects are considered to be significant where they are identified as being moderate or greater.

10.3.44 Other criteria proposed to be used to ascertain visual effect include the size, elevation and proportion of the Scheme in respect of the receiving environment and the degree to which activity within the receiving environment would alter, both during and post construction, and be visible.

10.3.45 Effects can be detrimental where features or key characteristics such as established planting, old buildings or structures will have to be removed, directly affecting the view. Conversely, effects can prove beneficial where derelict buildings or poorly maintained landscape features are proposed to be restored, replaced or maintained, or where there is the introduction of new tree planting and a landscape structure where none currently exists, constituting an improvement in the current view.

Significance of Visual Effect Ratings

10.3.46 The identification of the resulting effects will be established through an evaluation of the sensitivity of the baseline and the magnitude of the impact likely to occur as a result of the Scheme. An indication of the interactions between sensitivity and magnitude of impact and the likely resulting effects are outlined in Table 10-10.

Table 10-10 – Significance of Visual Effect Categories

	Sensitivity			
		Low	Medium	High
Magnitude	High	Slight/Moderate	Moderate/Large	Large/Very Large
	Medium	Slight	Moderate	Moderate/Large
	Low	Neutral/Slight	Slight	Slight/Moderate
	Negligible	Neutral/Slight	Neutral/Slight	Slight
	No change	Neutral	Neutral	Neutral

10.3.47 The ratings presented in Table 10-10 are only a framework to aid consistency of reporting and provide an initial indication of the likely effect, either beneficial or adverse, arising from the assessment of magnitude and sensitivity. Given that the criteria high/ medium/ low/ negligible or no change represent levels on a continuum or continuous gradation, application of the framework will also require professional judgement considering the sum of the changes and awareness of the relative balance between sensitivity and magnitude.

10.3.48 The findings are proposed to be represented using a descriptive scale ranging in a descending scale from large - moderate - slight and adverse through neutral to an ascending scale of slight - moderate - large and beneficial. There is a further effect rating, very large adverse, which is used to indicate effects on a receptor of very high sensitivity, significantly affecting an existing view of very high value and quality. Such a rating would indicate that the effect is considered highly prejudicial in relation to the specific topic of visual effect.

10.3.49 Explanation of the significance of effect ratings proposed is provided in Table 10-11 below along with an example description.

Table 10-11 – Significance of effect ratings

Rating	Example
Large Beneficial Effect	Lead to the removal of a significant eyesore such as a derelict site or buildings and incorporates landscape measures which substantially remodel and enhance the outlook for a large number of people, or where the proposal would cause a significant improvement in the existing view
Moderate Beneficial Effect	Visual intrusion associated with the existing view is noticeably relieved, or where the Scheme would result in a noticeable improvement. It would also apply where the Scheme includes provision for landscape proposals which would largely reduce the visual intrusion of the existing outlook and enhance views for a considerable number of people
Slight Beneficial Effect	Existing visual intrusion associated with the current outlook is slightly relieved, or where the Scheme would cause a barely perceptible improvement in existing receptor view.
Neutral Effect	Implementation of the Scheme not leading to a discernible improvement or deterioration in existing receptor view or outlook.
Slight Adverse Effect	The Scheme is at some distance from the viewpoint, or where the Scheme would not constitute a new point of principal focus. It would also occur where the Scheme is closely located to the viewpoint but is seen at an acute angle and at

Rating	Example
	the extremity of the overall available view, or viewed from rarely occupied upper storey rooms or less sensitive receptor types
Moderate Adverse Effect	The Scheme resulting in a noticeable deterioration to the current outlook, involving removal of existing, visually screening elements in the view, exposing the Scheme. It would also occur where large new structures are introduced as part of the Scheme which may appear at distance but be positioned as a focal point the field of view, or where the Scheme can only be partially mitigated
Large Adverse Effect	The Scheme would cause a significant deterioration in the current receptor view or outlook, be positioned prominently within an existing view of local interest in a valued landscape, or where only selected elements of the Scheme can be effectively mitigated
Very Large Adverse Effect	The Scheme would cause a highly prejudicial deterioration in the current view, be positioned prominently within an existing view of regional or national importance in a valued landscape, or where the Scheme cannot be effectively mitigated.

10.4 Baseline Environment

- 10.4.1** The urban, industrial water space that makes up Lake Lothing provides a link between The Broads via Oulton Broad to the west and the North Sea via the Lowestoft Inner Harbour in the east, refer to Figure 10.1. The linear body of water, which is central to the Port of Lowestoft, is fringed by a variety of land uses that contribute to a varied character, represented primarily by industrial and maritime activity.
- 10.4.2** Maritime (recreational) activity is largely confined to the western end of Lake Lothing where numerous pontoons provide mooring to leisure craft. In contrast, the eastern end of Lake Lothing has a more industrial nature associated with it; in addition to the larger scale sea faring ships that routinely dock along the waterside, industrial, railway and large scale commercial development dominate.
- 10.4.3** Beyond the immediate environments associated with the banks of the Lake, the land use quickly reverts to residential development which extends to the north and south. To the north in particular, the townscape is tight knit, small scale housing that is regular in pattern. This breaks down to the north east where older properties on a more irregular layout interrupt this pattern.
- 10.4.4** To the south of Lake Lothing the townscape is again characterised by a dense housing pattern which becomes more open in nature to the west, with larger gardens and less regular street patterns.
- 10.4.5** Land surrounding Lake Lothing is identified as an area within the Lowestoft Lake Lothing and Outer Harbour Area Action Plan that is identified for regeneration aimed at delivering more diverse mixed use townscapes; improving access to the water's edge, with the frontage onto the Lake being a primary focus.
- 10.4.6** With the exception of the South Lowestoft Conservation Area that encompasses the eastern end of Lake Lothing, Oulton Broad Conservation Area at the western extreme of Lowestoft, and the North Lowestoft Conservation Area (Figure 10.1) that extends northwards from Milton Road East, there are no designations that relate to the topic of townscape within the study area.

10.4.7 A national cycle route skirts Lake Lothing to the east, crossing at the existing A47 Bascule Bridge to the east; this affords transitional but periodic views of the body of water where the route ties into the edges of the lake.

Townscape Character

10.4.8 This section describes the baseline for the identified Local Character Areas (LCA) within the townscape of Lowestoft which are identified in Figure 10.1. The study area has been set at 3km from the Scheme presented in Figures 10.1, within which potential awareness of the bridge structure may exist and potentially influence the perception of the local townscape character.

10.4.9 The townscape of Lowestoft is identified within the Waveney District Landscape Character Assessment as 'Urban', and no further explanation or descriptions of the townscape is provided. The LCAs within the identified urban area have therefore been established by WSP through desk based studies, supported by site surveys undertaken in May 2017, as part of the baseline studies. The identified character areas and baseline descriptions have been discussed and agreed with SCC and WDC as being appropriate for the purpose of this assessment.

10.4.10 Identified within the Waveney District Landscape Character Assessment (April 2008) are several further character areas that lie on the fringes of the 3km study area, refer to Figure 10.1. These are:

- B1: Waveney Valley;
- E2: Great Yarmouth Coastal Strip;
- F1: Pakefield to Benacre Coastal Cliff;
- H1: Blundeston Tributary Valley Farmland; and
- H2: Waveney Tributary Valley Farmland.

10.4.11 On the fringes of the study area, no direct changes would occur within the character areas identified above. The ZTV identified that a single character area, H1: Blundeston Tributary Valley Farmland, would potentially experience some inter-visibility with the Scheme, however the area impacted lies within the area identified within LCA 6. Normanston/Gunston and the likely effects have been outlined below. No further assessment of effects on the above character areas has been undertaken as the potential for a significant effect is considered unlikely to arise.

LCA 1 North Lowestoft and Town Centre

10.4.12 This area covers the town centre of Lowestoft, located between the coastal margin to the north of the harbour and the arterial routes of Jubilee Way and Katwijk Way to the west. It associates with the town's historic core and encompasses the distinctive townscapes of the North Lowestoft Conservation Area, the outer harbour, commercial districts and maritime industry.

10.4.13 The town centre, developed around the road, rail and maritime linkages is a diverse commercial hub of mostly 19th and 20th century development (see Plate 10-1). Its outer harbour area is a focal point of Lowestoft's coastal townscape, with an active and animated character augmented by the East Suffolk railway line. The open aspect of

Lake Lothing, visible from the harbour crossing provides a far reaching inland vista which, though not remarkable in townscape composition, affords a strong sense of place in defining Lowestoft as a gateway point to the inland waters of Norfolk and Suffolk (see Plate 10-2).

10.4.14 The retail spine of London Road runs north from the harbour towards High Street, positioned along the hilltop above the coastal Lowestoft Denes. Road layout and built frontages (see Plate 10-3) reflect the town's historical development as a fishing port with frequent narrow "scores" that run between the escarpment and Whapload Road, affording access to the coast and framed vistas out to the sea. More recent 20th century industrial development occupies much of the low lying Denes, now eroding the character and relationship between the High Street and the early fishing industry/settlement pattern that previously existed on the coastal margins. The retail frontage of High Street ultimately gives way to a residential setting around the grade II listed Belle Vue Park. Here the Denes remains open and retains the link between the town and the open coastal fringe.

10.4.15 This is a diverse townscape, reflective of the formative coastal industry that is central to Lowestoft's development. The area has a good townscape quality of local value, with a medium capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be medium.



Plate 10-1 – Commercial areas on London Road North



Plate 10-2 – View across the marina towards the A47 Bascule Bridge and the entrance to Lake Lothing



Plate 10-3 – View along the High Street in the North Lowestoft Conservation Area

LCA 2 South Lowestoft and Seafront

- 10.4.16** This area covers the linear recreational seafront of south Lowestoft, from the Outer Harbour to Kirkley Cliff and between London Road South and South Beach. This narrow strip of terraced housing, hotels and shops derives from the peak of South Beach as a Victorian coastal resort and falls within the South Lowestoft Conservation Area.
- 10.4.17** The area developed following the establishment of the harbour and river access through Lake Lothing in the early 19th century and grew into a pleasure resort. South of the harbour, the area is formed of a largely continuous townscape frontage to the seafront (see Plate 10-4), where the recreational associations between the linear layout of housing and hotels running parallel with South Beach have been maintained. The buildings of the Conservation Area are comprised of commercial premises focussed at the north around Lake Lothing, and three to four storey terraced townhouses and villas to the south along the seafront. Areas of lower status, typically terraced housing, are located to the west away from the seafront. This area is representative of the coastal resort legacy of Lowestoft and still functions as a holiday or day trip destination.
- 10.4.18** In the north of the area at South Pier a large expanse of public space exists off Royal Terrace in front of the grade II* listed Royal Norfolk and Suffolk Yacht Club and alongside the marina. This open plaza provides a gathering space for seaside visitors with links to entertainment facilities on and around South Pier and along the esplanade and South Beach. This area has maintained a recreational function since the establishment of the early pleasure resort of South Lowestoft in the mid-19th century. South Beach itself is a long stretch of accessible sandy beach extending from the harbour southwards (see Plate 10-5). The beach gradually becomes separated from the esplanade towards the rise of Kirkley Cliffs south of Claremont Pier, where colourful beachside huts line the base of the cliff.
- 10.4.19** This is a distinct area of Lowestoft, derived from the recreational focus that developed along South Beach and important to the town's historical and contemporary identity. The area has a good townscape quality of local value, with a low capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be medium.



Plate 10-4 – The Victorian seaside terraces along Marine Parade



Plate 10-5 – View south along The Esplanade from South Pier towards Claremont Pier

LCA 3 Roman Hill

10.4.20 This area covers a largely residential development around Roman Hill between the arterial routes of Jubilee Road and Katwijk Way and a disused line of the Great Eastern Railway.

- 10.4.21** The area initially developed as an expansion of the older parts of Lowestoft to the east and is mainly formed of compact late 19th century terraced housing in a grid-like pattern of streets. Frontages are typically very close to footways leaving little or no space for gardens which creates a stark and often enclosed townscape (Plate 10-6). As such it is in contrast with the more diverse composition of the town core and seafront areas. This disconnection from the seafront and its influence on areas is apparent in both the street layout and type of buildings, creating a uniform residential character with no visual link to the sea. The uniformity of the townscape extends south to Denmark Road, bordering the East Suffolk railway line and Lake Lothing. Here, areas of extension dating from the late 19th century are evident along Stevens Street, Clemence Street and Selby Street as early examples of the style and layout that has prevailed elsewhere in the district (see Plate 10-7).
- 10.4.22** By the mid-20th century development had extended to the western fringe of the LCA and the former line of the Great Eastern Railway. In this part of the LCA the uniformity of residential scale and layout diversifies to a more fragmented and open townscape form. This includes campuses and open spaces associated with Lowestoft College, some commercial outlets, schools, playing fields, allotments and Lowestoft Cemetery.
- 10.4.23** This is a largely uniform and unremarkable townscape but one that creates a distinct area within the wider Lowestoft townscape. Despite the residential nature of this area there is a relationship, and frequent visual links to the industrial context of Lake Lothing. The area has an ordinary townscape quality of local value, with a low capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be low.



Plate 10-6 – Compact terraced housing along Maidstone Road with Lake Lothing in the background



Plate 10-7 – One of the early areas of residential expansion in this LCA along Clemence Street

LCA 4 Kirkley and Pakefield

10.4.24 This area extends south from the industrial fringes of Lake Lothing, encompassing the shore line beyond south Lowestoft and west to Tom Crisp Way (A12). This largely residential area includes the suburbs of Kirkley and Pakefield. Originally two separate outlying hamlets, they have now become a part of Lowestoft as the town has expanded.

10.4.25 Residential expansion along the older routes of London Road, Kirkley Run, Carlton Road (see *Plate 10-8*) and Stradbroke Road/Pakefield Street has led to gradual infill development, associated with the coastal resort expansion along South Beach and the more recent residential street arrangements in Pakefield. Accordingly there is a diversity of residential townscape character, ranging from the remnants of the early village cores to 19th and 20th century development. The majority of this area is primarily residential in character and formed of a mix of generally two storey semi-detached or terraced properties in a range of condition and styles (see *Plate 10-9*).

10.4.26 The townscape pattern and scale is fragmented by blocks of flats, educational facilities and commercial areas, the most prominent being the CEFAS laboratory building on the sea cliff at the southern edge of South Beach. Open green space forms a regular aspect of the townscape pattern, mostly associated with school grounds and sports fields, small coastal and public parks, cemeteries and a narrow linear recreational park following Kirkley Stream in the west.

10.4.27 Though disparate in nature, the broadly residential spread of development provides a

commonality across the varied urban grain. The geographic constraints of the coast and Kirkley Stream form defined extents. The area has an ordinary townscape quality of local value, with a low capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be medium.



Plate 10-8 – View along one of the traditional routes on Carlton Road



Plate 10-9 – View of the housing and diverse road layouts along Lorne Road and St Leonard's Road

LCA 5 Lake Lothing

- 10.4.28** Lake Lothing is a large urban industrial water space. It represents an important and formative spatial aspect of the town's layout, linking the wider inland waterway network with the coastal townscape (see Plate 10-10). It forms a transitional gateway to The Broads, providing passage and moorings for a range of private and commercial craft travelling between Oulton Broad, the wider inland waterway network and the North Sea.
- 10.4.29** Lake Lothing is linear in form, fringed by a mainly industrial and maritime townscape. Its western length hosts working boatyards and marine related infrastructure, with extensive pontoon moorings that accommodate a mix of vessels. By contrast, the eastern part of the lake through North Quay and the Inner Harbour is more open and regular in form, frequented by larger sea-going craft and flanked by a mix of prominent waterside industry, railway and contemporary retail and commercial development (see Plate 10-11).
- 10.4.30** As a working port, bounded by warehousing, roads and commercial development the levels of associated tranquillity are considered to be relatively low, with visual detractors in the form of portside activity and vehicle movements giving rise to noise and a sense of disturbance.
- 10.4.31** The quality of urban form surrounding Lake Lothing assumes a more disparate and fragmented pattern. Its northern edge is flanked by the East Suffolk railway line, which separates the prominent industrial lake margin from the residential and retail fringes of north Lowestoft. To the south of the lake is a mix of maritime related industry, large tracts of vacant land and areas of new commercial development. It is a townscape in transition, the area having been identified for major regeneration within the Lowestoft Lake Lothing and Outer Harbour Area Action Plan. The distinctive waterfront of Lowestoft and the presence of boat activity are a major part of the town's cultural character. The bascule road bridge crossings at either end of Lake Lothing offer a further sense of townscape animation and a cultural link with boat passage as a part of the town's character.
- 10.4.32** Lake Lothing and the surrounding industrial setting is an important cultural component of Lowestoft, despite being frequently in poor repair and appearance. The area has an ordinary townscape quality of local value, with a medium capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be low.



Plate 10-10 – View towards the Outer Harbour from the waterfront on the south side of Lake Lothing



Plate 10-11 – Industrial areas fringing Lake Lothing

LCA 6 Normanston/Gunton

- 10.4.33** The area is comprised of established medium density residential development to the north of Lake Lothing. This predominantly residential townscape is formed largely of late 20th century suburban development character in the Normanston and Gunton areas. In the north of Lowestoft the topography rises gently from the margins of Lake Lothing, affording occasional views across the lake and its industrial setting.
- 10.4.34** The residential expansion formed around the older areas of settlement at Normanston and Oulton, and the ribbon development along the main routes, particularly on Normanston Drive between Normanston and Oulton Broad. Later the residential development pattern is typically comprised of a series of linked avenues and cul-de-sacs within a broader network of historic through roads. One of the earlier areas of mid-20th century suburban expansion can be found off Foxburrow Hill at Gunton in the north between Spashett Road and Montgomery Avenue, around the highest part of the town.
- 10.4.35** Properties are typically of one and two storeys with large garden spaces. The townscape exhibits a more established character where mature trees and larger areas of open space are more prevalent (see Plate 10-12) than the other residential areas. Normanston Park (see Plate 10-13) and Leathes Ham LNR form large areas of established open green space to the north of Lake Lothing, which have a distinct townscape quality and recreational emphasis. The wooded Bond's Meadow provides a further tract of green space, following a drainage line leading to Oulton Broad. To the west there are numerous recreational links and open space networks providing access to the nearby Oulton Broad, the surrounding farmland and The Broads.
- 10.4.36** The suburban expansion set within a more undulating and treed context creates sense of an established suburban character. The area has an ordinary townscape quality of local value, with a low capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be medium.



Plate 10-12 – View along Higher Drive in Normanston in a more established part of the townscape



Plate 10-13 – Normanston Park to the north of Lake Lothing

LCA 7 Whitton / Carlton Colville

- 10.4.37** The area is comprised of medium density residential development along the lower lying land to the south of Lake Lothing. This residential townscape extends to the southern margins of the town, and westwards from Tom Crisp Way to Beccles Way. Areas of early settlement are evident in the outlying village centres of Carlton Colville and Whitton Green. Early residential expansion was in the form of ribbon development along the network of through roads with later more extensive developments occurring in the east off Kirkley Run and Long Road (see Plate 10-14).
- 10.4.38** As with residential expansion to the north of the town, the pattern of infill development typically comprises a series of linked avenues and cul-de-sacs within the broader network of historic routes, interspersed by local community facilities to create a townscape of domestic scale. Properties are typically of one or two storeys, but with less mature tree cover and smaller garden spaces than those to the north (see Plate 10-15). The townscape pattern has fewer areas, and diversity, of open space. Rosedale Park and a park off Clarkes Lane form the largest areas of formal parkland, with the rest of the open space linked to schools or playing fields. Overall the area presents a less established and diverse townscape character than the comparable areas of residential expansion to the north.
- 10.4.39** The regular pattern of suburban expansion has a broadly similar townscape quality and scale. The area has an ordinary townscape quality of local value with a low capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be medium.



Plate 10-14 – View along Edgerton Road, an early area of 20th century residential expansion



Plate 10-15 – Mixed housing along Planters Grove in Coleville in the south of the LCA

LCA 8 Barnby to The Fleet, Oulton

10.4.40 This character area is situated to the west of the town within The Broads (see Paragraph 10.3.34) and reflects the character area identified within the Landscape Character Assessment, Broads Authority. In contrast with the industrial townscape of Lake Lothing it is a landscape typical of the Norfolk Broads, comprising a large body of water fringed by mature woodland, waterside residential development and yacht/cruiser moorings. It is markedly more domestic in scale and character than the setting of Lake Lothing, with the Mutford Bridge crossing forging a divide between the recreational focus of Oulton Broad to the west and the more industrial maritime townscape of Lake Lothing and Lowestoft to the east.

10.4.41 The northern shore of Oulton Broad, much of which falls within a Conservation Area, maintains a sense of separation and seclusion from wider urban development due to the limited access and privacy created by a combination of mature private gardens and the wooded East Suffolk railway line corridor providing a sense of separation. Large and established residences dating from the late 19th to early 20th century along Borrow Road and Romany Road feature large gardens which often extend to the water's edge (see Plate 10-16). Public access and recreational use is more prevalent along the south side of Oulton Broad, Nicholas Everitt Park forming a focus for recreational activity (see Plate 10-17). The western extent of Oulton Broad, set within low lying marshes and open grazing fields, is characteristic of the inland Broads landscape.

10.4.42 Recreational access between Lowestoft and the Oulton Broad landscape is enabled by several rights of way, the primary link being the “Angles Way” long distance footpath. The accessible natural landscapes and wildlife havens of the Carlton and

Oulton Marshes Nature Reserves on the urban fringe of Lowestoft provide a community and natural resource.

10.4.43 The appealing waterfront setting of Oulton Broad is well established, providing Lowestoft with a direct link to the wider characteristic Broads landscape and a range of recreational activities. The area has a very attractive quality of regional value with a low capacity to accommodate change. Sensitivity to change in relation to the type of development proposed is considered to be high.



Plate 10-16 – View across Oulton Broad towards the housing on the north side and The Broads beyond



Plate 10-17 – View from Nicolas Everitt Park towards the moored leisure craft

Summary

10.4.44 Table 10-12 provides a summary of the identified sensitivity to change for each of the LCAs.

Table 10-12 – Summary of LCA sensitivity to change to the type of development proposed

Local Character Area (LCA)	LCA 1 North Lowestoft and Town Centre	Medium
	LCA 2 South Lowestoft and Seafront	Medium
	LCA 3 Roman Hill	Low
	LCA 4 Kirkley and Pakefield	Medium
	LCA 5 Lake Lothing	Low
	LCA 6 Normanston/Gunton	Medium
	LCA 7 Whitton/Carlton Colville	Medium
	LCA 8 Barnby to The Fleet, Oulton	High
Sensitivity to Change		

The Lowestoft Future Townscape

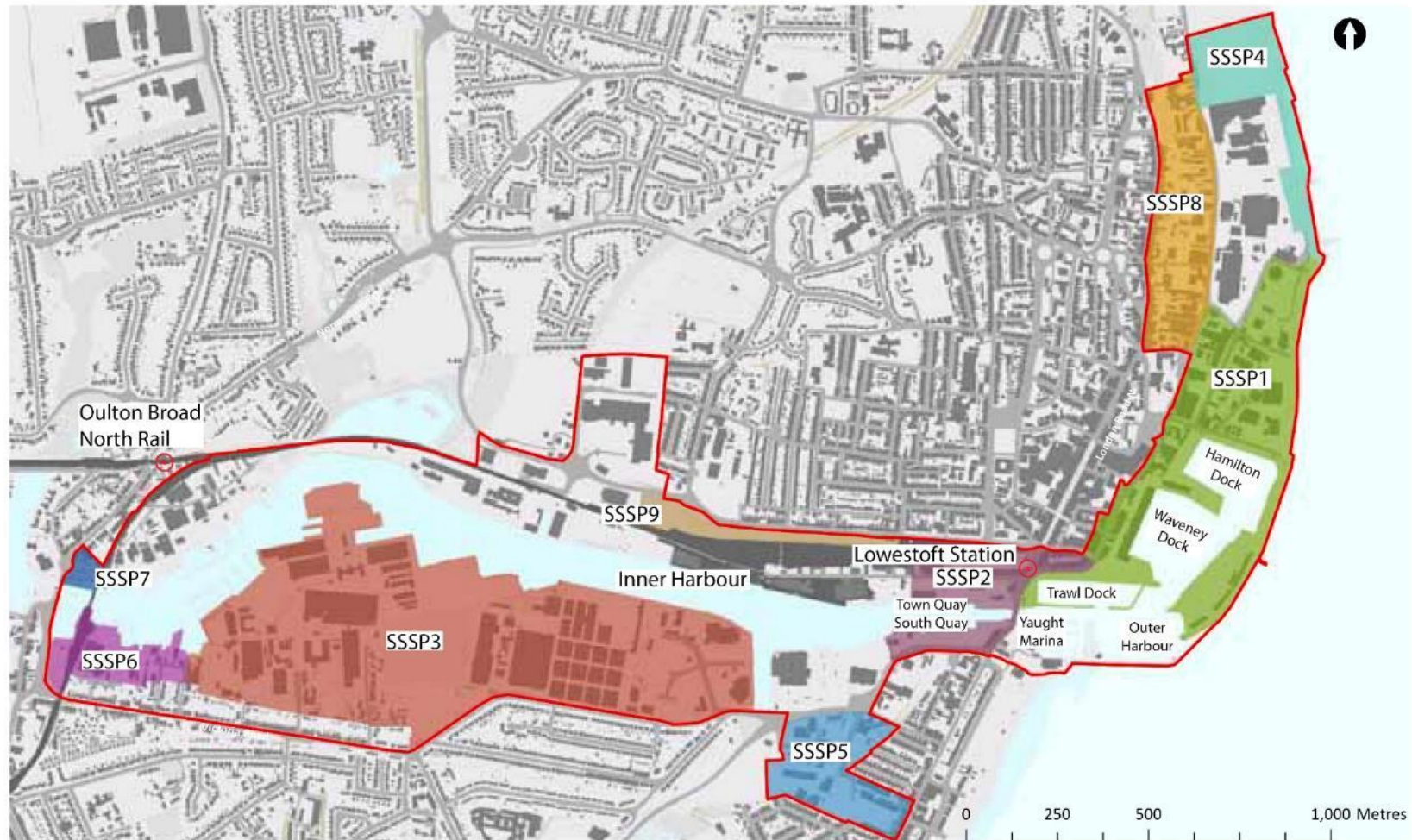
10.4.45 There are varying degrees of certainty around the future townscape surrounding Lake Lothing as a result of the planned proposed developments in the area being at different stages in the planning application process. This assessment has reviewed these areas of potential development in order to understand the likely changes within the identified LCAs that may influence the future setting of the Scheme.

10.4.46 The anticipated development includes several Site Specific Allocations as described in the Lowestoft Lake Lothing and Outer Harbour Area Action Plan, see Plate 10-18. These represent the planned future development around Lake Lothing, and have as a result of the nature, scale and proximity to the Scheme, the potential to contribute to a change in the existing townscape character of Lowestoft. These comprise:

- SSP1 PowerPark (24.7ha) – Proposed energy related employment located within and to the north of the Outer Harbour (LCA1). SPP1 Powerpark would see a phased change within the Outer Harbour and across the industrial estate and seafront to the north. There would be a general shift in employment towards the energy and maritime sectors, assumed to comprise extensive warehouses and office development, as well as site wide improvements to infrastructure, public realm and new developments. These changes, together with those around Lake Lothing itself, would constitute a noticeable shift in the nature and character of the waterfront activities and industry across Lowestoft resulting in increased built form along the fringes of Lake Lothing;
- SSP2 Peto Square (9.04ha) - Proposed Retail, Leisure, Tourism and Port Related Activities located at the eastern end of Lake Lothing (LCA 5). SPP2 Peto Square and South Quay development would surround the Inner Harbour. There would be improvements to the public realm on South Quay and the creation of waterfront employment along the derelict land lining the waterfront. To the north retention of port side activities would keep the maritime character in place around the dry docks, with potential retail and leisure development between Lowestoft Station and the Inner Harbour, revitalising the townscape character and improving access to the waterfront;
- SSP3 Kirkley Waterfront and Sustainable Urban Neighbourhood (59.76ha) - Proposed Housing, Industrial and Community Facilities located on the southern margins of Lake Lothing (LCA 5): SPP3 Waterfront and Sustainable Urban Neighbourhood would dramatically transform the southern and south-western parts of LCA 5. The former industrial and waterfront industries currently between the Inner Harbour and Mutford Bridge give rise to the existing underutilised and vacant character of this LCA. Here the majority of the land from the lake margins towards Victoria Road/Waveney Drive in the south would be re-developed, primarily as a new residential district with mixed commercial and industrial use. Two land parcels (The former Sanyo site and Brooke Yachts and Jeld Wen) have been granted outline planning permission as part of the phased development of the wider SSP3 allocation and are considered further in Chapter 20;
- SSP5 Kirkley Rise (8.31ha) - Proposed Housing, Employment and Community Facilities located south of lake Lothing and the A12 (LCA 4). SSP5 Kirkley Rise development would be set back from the immediate setting of Lake Lothing, beyond Horn Hill (A12) and within LCA 4 where mixed use residential, commercial and employment development would be proposed. These areas would not have an influence on the immediate setting of Lake Lothing but would join and extend the broader regeneration surrounding LCA 5;

-
- SSP6 Western End of Lake Lothing (4.87ha) - Proposed Mixed Use Regeneration located at the south western margins of Lake Lothing (LCA 5): SPP6 Western End of Lake Lothing would dramatically transform the southern and south-western parts of LCA 5. In the southwest the former Sanyo site and Brookes Peninsula would accommodate modern housing, while still maintaining some waterfront industry, particularly in the west where the SSP6 would seek to retain the maritime and waterfront uses. To the east of the retained Brooke Yachts and Jeld Wen County Wildlife Site the Kirkley Waterfront brownfield site would also be redeveloped but with a more distinct waterfront industry and commercial character, reflective of the former nature of the site;
 - SSP7 Oswald's Boatyard (0.82ha) - Proposed Housing and Community Facilities western margins of Lake Lothing (LCA 6/8: SPP7 Oswald's Boatyard would represent a minor development in the west at the fringes of LCA 5 and would not constitute a significant change in the wider setting); and
 - SSP9 Peto Way / Denmark Road Corridor (3.14ha) - Proposed Employment located between Peto Way/Denmark Road and the rail corridor to the north of Lake Lothing (LCA 5): SPP9 Peto Way / Denmark Road Corridor development would add new linear employment development between The East Suffolk Line and Denmark Road which would replace the existing scrubland with built development. This would create a firmer definition between residential LCA 3 Roman Hill and LCA 5 Lake Lothing, where currently the transition of the scrubland of the East Suffolk Line and industry further south creates a somewhat indeterminate boundary. Overall, however, the general setting north of Lake Lothing would fundamentally remain unchanged and largely industrial.

Plate 10-18 – Area Action Plan Site Allocations



(extracted from the Lowestoft Lake Lothing & Outer Harbour Area Action Plan Development Plan Document Adopted January 2012)

10.4.47 The prevailing urban industrial, and in places derelict, character that currently exists within LCA 5 would see a fundamental shift along the southern margins of Lake Lothing and around the Inner Harbour in the east where major regeneration of the waterfront and surrounding area is planned. The northern margins of Lake Lothing, between Mutford Bridge in the west and the Inner Harbour in the east, would however, remain largely unchanged.

10.4.48 Overall in the context of Lake Lothing, where the Scheme would be situated, the future setting has the potential to dramatically change. The primary and most significant shift is predicted to occur along the southern and eastern sides of Lake Lothing where extensive new districts and townscapes may be created. These districts may be likely to result in an increased massing of new and modern built form, contrasting with the existing older and sparse industrial setting retained in the north. This is taken into account in the assessment below.

Visual Amenity

10.4.49 The visual amenity of the townscape within Lowestoft is varied in its quality, composition and perceived tranquillity. The seafront at Lowestoft is a defining feature of the town, where the older built frontages and layouts reflect the town's development as a fishing port. The Outer Harbour and industrial areas add to this a working coastal townscape character, and to the north of the Outer Harbour, separate the town from the coast. South of the Outer Harbour the sandy South Beach, promenade and coastal resort townscape add a further iteration within the seaside character of Lowestoft. The wider townscape consists predominantly of established medium density residential development, surrounding the industrial waterfront of Lake Lothing at the centre of the town. Oulton Broad, to the west of Lake Lothing, is situated within The Broads and represents a tranquil and settled water side character that provides a transition to the landscapes of The Broads.

10.4.50 The immediate visual amenity surrounding the Scheme and Lake Lothing itself is unremarkable, being a mixture of redundant open space, industrial and maritime infrastructure. The waterfront activity and movement of vessels through the connected waterways provides a sense of animation within the waterscape, and a lack of perceptible tranquillity. The western end of the lake hosts working boatyards and marine related infrastructure, with extensive pontoon moorings that accommodate a mix of leisure vessels that contribute to an increasingly small landscape that relates to the Broads. By contrast, the eastern part of the lake through North Quay and the Inner Harbour is more open and regular in form, frequented by larger sea-going craft and flanked by a mix of prominent waterside industry, railway and commercial development. On the south side of Lake Lothing there is a sense of transition where this derelict land is interspersed with the area's modern retail development and indicates the beginnings of the regeneration of the waterfront.

10.4.51 Despite its size and scale the lake and its associated activity are relatively concealed from view within the wider townscape. The crossing points at either end of the lake are generally where this water space is directly appreciated from. However, the taller structures associated with the industrial areas form prominent landmarks and are visual indicators of both the lake's presence and its industrial character.

10.4.52 The following key viewpoints, identified in paragraphs 10.4.53 to 10.4.67 have been selected to provide representative views from the variety of receptors around Lake Lothing and from within the wider townscape. The viewpoints demonstrate the context and likely visibility of the Scheme. Refer to Figure 10.5 for the viewpoint locations and Figure 10.6 to Figure 10.20 for the representative views. The Visual Effects Schedule in Appendix 10B contains more detailed baseline descriptions.

Key Viewpoint 1 – Waveney Drive

10.4.53 This key viewpoint is located on Waveney Drive at the junction of Waveney Crescent looking north towards Lake Lothing and the tie in with the Scheme. It represents the view experienced by users of Waveney Drive and residents of approximately 18 no. properties, two large offices and Riverside Children's and Family Centre. The visual expectations of the view and associated receptors, is that experienced from residential property, ordinarily this would be high, however the presence of the existing road and associated car parks and commercial buildings, results in a view that is considered to be of medium sensitivity

Key Viewpoint 2 – Tom Crisp Way

10.4.54 This key viewpoint is located on Waveney Drive just east of the junction of Durban Road looking north towards Lake Lothing. It represents the view experienced by users of Waveney Drive, including pedestrians, business premises on the northern side of Waveney Drive, two residential semi-detached properties on Waveney Drive immediately east of the junction of Durban Road and three residential properties (one detached, two semi-detached) at the end of Durban Road. The visual expectations of the view and associated receptors, is that experienced from residential property, ordinarily this would be high, however the presence of the existing road, office development and parking in the foreground results in a view that is considered to be of medium sensitivity.

Key Viewpoint 3 – Inner Harbour South

10.4.55 This key viewpoint is located on the waterfront of the south side of the Inner Harbour, at the northern end of the Asda car park looking towards Lake Lothing. It represents users of the public space and footpath on the waterfront and of the Asda car park. A combination of low visual expectation, with some scenic interest in the movement within the channel results in a sensitivity to change of low.

Key Viewpoint 4 – A47 Bascule Bridge

10.4.56 This key viewpoint is located at the crossing on the A47 Bascule Bridge looking west, incorporating views of Lake Lothing. It represents users of the bridge as well as the residents of a row of three and four storey terraces, with commercial units on the ground floor, on the southern side of Lake Lothing on the A12. A combination of medium visual expectation, with some scenic interest in the movement within the channel results in a sensitivity to change of medium. This viewpoint also shows a view from the Lowestoft South Conservation Area (see Chapter 9).

Key Viewpoint 5 – Clemence Street

10.4.57 This key viewpoint is located at the junction of Clemence Street and Denmark Road looking to the south-west. It represents a row of residential receptors along Denmark

Road, numbering approximately 50 receptors. Despite the relative low quality of the views, the medium expectation and value associated with the residential nature of the views would suggest that the view is of medium sensitivity

Key Viewpoint 6 – Denmark Road

10.4.58 This key viewpoint is located on Denmark Road, immediately west of the roundabout junction with Rotterdam Road, looking south-east towards Lake Lothing. It is representative of users of the footpath and cycleway along Denmark Road as well as a row of properties to the south of Essex Road, properties near the roundabout on Rotterdam Road and The Lake Lothing public house. The low quality of the associated views, combined with the medium expectation and value associated with the residential nature of the views would suggest that the view has been identified as of being of medium sensitivity.

Key Viewpoint 7 – Normanston Park

10.4.59 This key viewpoint is located on a footpath within Normanston Park looking south-east across the open parkland and towards Lake Lothing. It represents both users of the park and a row of approximately 10 detached properties on Normanston Road who afford an open outlook into the park from the rear of the properties. The visual expectation associated the open space and residential properties would be high. As a result the sensitivity of the view has been identified as being of high sensitivity.

Key Viewpoint 8 – Brooke Peninsula

10.4.60 This key viewpoint is located on the waterfront within the former Brooke Marina at the edge of Brooke Peninsula looking east. The location of this Key Viewpoint is not publicly accessible, but following agreement with SCC it has been included as representative of views from potential development that is anticipated to form part of the Lowestoft future townscape. The exposed nature of the view, which is of low quality is also of low value (although this may change in the future as a result of further associated development), there is a low expectation associated with the view, the built form resulting in a stark view. The view is considered to be of low sensitivity.

Viewpoint 9 – Kirkley Waterfront

10.4.61 This viewpoint from a proposed development site on the former Jeld Wen site on the edge of Lake Lothing looking east represents the potential future receptors. The exposed nature of the view, which is of low quality is also of low value (although this may change in the future as a result of further associated development), there is a low expectation associated with the view, the lack of significant built form resulting in a stark view. The view is considered to be of low sensitivity.

Viewpoint 10 – Mutford Bridge

10.4.62 This viewpoint is located at the Mutford Bridge crossing in the west of Lake Lothing looking east. It represents views for users of the bridge footpath, cycle path and road users. The view is near the most easterly point of The Broads and the relationship between the bridges, marina and Lake Lothing has some interesting qualities associated with it and is valued as the link with Oulton Broad. As a result the sensitivity of the view is considered to be high, despite its transient nature and restricted views.

Viewpoint 11 – Lake Lothing

10.4.63 This viewpoint is located on a footpath in between Brooke Business and Industrial Park and Jeld Wen on the Jeld Wen County Wildlife Site (CWS) looking east. It represents potential view within the CWS and people working within the outdoor spaces near the waterfront. The exposed nature of the view, which is of low quality is of medium value, representing the view of visitors for whom the outlook is relatively important, although the expectation associated with the view is considered to be low. The view is considered to be of low sensitivity.

Viewpoint 12 – Oulton Broad

10.4.64 This viewpoint is located on a footpath looking to the east from the Carlton Marshes Nature Reserve within The Broads at Oulton Broad, adjacent to White Cast Marshes. It represents recreational users of footpaths within this part of The Broads. The views within The Broads are considered to be of high value, and whilst the quality of the view lacks focus it allows appreciation of the fenland landscape. There is a high expectation associated with the views within The Broads and as a result the view is considered to be highly sensitive to change.

Viewpoint 13 – Camps Heath

10.4.65 This viewpoint looking to the south east is located at the convergence of two public footpaths in the urban fringe landscape at the north west extents of Lowestoft within Camps Heath. It represents users of the two footpaths, however opportunities for views to the south and south east are increasingly constrained as adjacent housing plots are developed. The view from slightly higher ground lacks focus and has low value and quality associated with it. There is a low expectancy associated with it due to the dominance of the expansive housing. The view is considered to be of low sensitivity.

Viewpoint 14 – Britten Road

10.4.66 This viewpoint looking to the north is located within a small local park off Britten Road in the residential area in south of the study area. It represents users of the informal open space as well as rows of terraced residential properties on Britten Road. The view has some local value as an area of open space and the nearby residential property, although it lacks associated quality and has low expectations within the suburban context. The view is considered to be low sensitivity.

Viewpoint 15 – Lowestoft Cemetery

10.4.67 This viewpoint looking to the south is located to the north of Lake Lothing and from within the western extents of Lowestoft Cemetery. It represents visitors to the cemetery and the potential distant views from the north of Lake Lothing. Although lacking in quality the view has local value in its community associations, giving rise to high level of expectation, associated with a place of reflection. As a result the view is considered to be of high sensitivity.

Summary

10.4.68 Table 10-13 provides a summary of the identified sensitivity to change for each of the key viewpoints.

Table 10-13 – Summary of viewpoint sensitivity to change

Key Viewpoints	VP1 Waveney Drive	Medium
	VP2 Tom Crisp Way	Medium
	VP3 Inner Harbour South	Low
	VP4 A47 Bascule Bridge	Medium
	VP5 Clemence Street	Medium
	VP6 Denmark Road	Medium
	VP7 Normanston Park	High
	VP8 Brooke Peninsula	Low
	VP9 Kirkley Waterfront	Low
	VP10 Mutford Bridge	High
	VP11 Lake Lothing	Low
	VP12 Oulton Broad	High
	VP13 Camps Heath	Low
	VP14 Britten Road	Low
	VP15 Lowestoft Cemetery	High
Sensitivity to Change		

10.5 Embedded Mitigation

10.5.1 Given the location, scale and prominence of the Scheme, specific or targeted visual mitigation is generally not possible because the bridge structure and associated infrastructure will be taller and of a scale that would prevent screening in the immediate environment. Alternatives to the Scheme design were considered early on in the design phase see (Chapter 3), the Case for the Scheme (document reference 7.1) and the Design Report (document reference 7.5). However, the mitigation and reduction of potentially adverse effects to townscape character and visual amenity, particularly in the immediate environment, has been embedded within the design, which seeks to respond to, and integrate with the surrounding townscape.

10.5.2 The following design measures form the basis of the embedded mitigation which are identified in the Design Report and secured through the DGM compliance with which is a requirement in the DCO:

- The Scheme has been designed to provide an enhancement of the crossing of Lake Lothing and setting of the surrounding townscape through the form, aesthetics and landmark nature of the proposed bridge structure. The design has followed a ‘marine tech’ theme, refer to Design Report (document reference 7.5);
- Development of the rolling bascule bridge has led to a striking design, as has been recognised by CABE: *“The mechanism and the experience of its opening and closing will constitute a piece of moving sculpture which can go beyond its functional*

requirements to be celebrated by users and onlookers³²;

- Existing townscape character of the study area has been considered as part of the Scheme design and development to ensure appropriate mitigation is in place to avoid or minimise any potential adverse impacts upon existing local character;
- The design for the control tower is aimed at complementing the existing buildings within the townscape, ensuring that this does not detract from the design of the main bridge; and
- Landscape design has encompassed the tie-in for the northern approach with the existing townscape through the proposed formation of public open space associated with links for Non-Motorised Users (NMUs) and Denmark Road, tree planting and areas of seating (as set out on the landscaping plans which are secured through the DCO).

10.6 Predicted Impacts

Townscape Character

10.6.1 This section discusses the effects to townscape character arising as a result of the Scheme during construction, during the winter months in the year of opening and in the summer and winter months in year 10.

LCA 1 North Lowestoft and Town Centre

10.6.2 The Scheme will be located outside of this LCA. The ZTV for the Scheme (refer to Figures 10.2- 10.4) identifies that both the bridge deck and bridge structure (raised or lowered) will however be visible from limited areas within this LCA.

10.6.3 During construction, the activities will occur outside of this LCA, and the limited visibility of the Scheme will keep awareness of the activities contained to around the Outer Harbour. Here such views will not be out of character with the industrial and working waterfront context and will create minor local detractions to the setting of this LCA. The temporary magnitude of impact is anticipated to be low resulting in a slight adverse effect.

10.6.4 In the year of opening views will primarily occur from along the A47 Bascule Bridge where open views towards the Scheme will be possible. Partial views will also exist further east from within the active Outer Harbour area. This awareness of the Scheme will be from within the existing context of the working animated coastal waterfront, which shares a similar character and closely linked relationship with the inland waters of Lake Lothing. As such the Scheme, as a new and distinctive functional component, appropriate to the setting of Lake Lothing, will not be out of character and will provide some vitality to the ageing waterfront industry that is openly visible from these areas.

10.6.5 The Scheme will not alter any physical components within this townscape and will generally not be visible across the wider LCA. From the limited areas in the south of the LCA, where it will be visible it will form an addition, appropriate in the scale, context and the expectations of these views, where it will add to the already strong sense of

³² Design Council CABE- See Appendix 6 of document reference 7.5

place around the waterfront of Lowestoft. Overall the magnitude of impact in the year of opening is anticipated to be in the order of negligible resulting in a neutral effect to this LCA.

- 10.6.6 In year 10 there will be no changes to the level of awareness of the Scheme or its influence on this LCA. The magnitude of impact is anticipated to remain as negligible resulting in a neutral effect.

LCA 2 South Lowestoft and Seafront

- 10.6.7 The Scheme will be located outside of this LCA. The ZTV for the Scheme (refer to Figures 10.2- 10.4) identifies that both the bridge deck and bridge structure (raised or lowered) will however be visible from a very limited area in the north of LCA, however is unlikely to result in changes to the perception of this townscape.
- 10.6.8 During construction the activities will occur outside of this LCA with very limited visibility towards the works. Awareness of construction activities will be limited to a small area around the Outer Harbour and South Pier and will be restricted to partial views. There will be no noticeable detractions or changes to the setting this LCA. The temporary magnitude of impact is anticipated to be negligible resulting in a neutral effect.
- 10.6.9 In the year of opening, potential views will be limited to glimpsed views between the intervening built form. Views will mainly be from within the open plaza on South Pier where the Scheme will form a minor visual element in the background of views and will be an appropriate addition within the awareness of the waterfront in this location. As such the Scheme is not likely to have an influence on the perception of the townscape character within this LCA.
- 10.6.10 Overall the Scheme will not alter any physical components within this townscape and will generally not be visible across this LCA. The magnitude of impact is anticipated to be no change, resulting a neutral effect to this LCA.
- 10.6.11 In year 10 there will be no changes to the level of awareness of the Scheme or its influence on this LCA. The magnitude of impact is anticipated to remain as no change resulting in a neutral effect.

LCA 3 Roman Hill

- 10.6.12 The Scheme will be located outside of this LCA, with some localised changes to the road layout adjacent to the boundary between Roman Hill and Lake Lothing. The ZTV for the Scheme (refer to Figures 10.2- 10.4) also identifies that both the bridge deck and bridge structure will however be visible from within the southern and south-western edges of this LCA.
- 10.6.13 During construction the activity will occur adjacent to the boundary and in close proximity to this LCA and visibility of the Scheme construction will be possible within the south-western extents of this residential area. Awareness of construction activities will extend along the residential streets and will form a noticeable detraction to the setting of the LCA. The temporary magnitude of impact is anticipated to be medium resulting in a slight adverse effect.
- 10.6.14 In the year of opening, the potential views of the Scheme will include open and direct views from the southern residential fringes of this LCA, and oblique views penetrating

along the north/south aligned residential streets in the south-west of the area. These views will be in the context and awareness of the existing industrial character and maritime activity that precede and surround views of Lake Lothing itself. Within this setting the distinctive form of the bridge structure will become a dominant and animated focal point. While not located within this LCA itself the scale and proximity of the bridge structure does have the potential to alter the perception locally. The range of views of the new elevated road crossing, traffic movements, increased lighting and modifications to the nearby street layout will all contribute to an increased sense of urbanisation within the residential scale and nature of this LCA. Offsetting this will be the replacement of views of derelict land in poor condition north of the East Suffolk Railway Line where street improvements and new public realm will create a sense of renewal and vitality to the area. This aspect of the Scheme will have a positive influence on the perception of this part of the LCA which currently has an abrupt interface with the rundown and industrial nature fringing Lake Lothing.

10.6.15 Overall the Scheme will not significantly alter any physical components within this LCA, and will only visually influence a small part of the overall LCA. Where it will be visible, it will form a major new feature that will reinforce the neighbouring industrial character while also altering the immediate setting of this residential area. On balance the magnitude of impact across this LCA is anticipated to be negligible, resulting a neutral effect to this LCA.

10.6.16 In year 10 there will be some maturing of trees, planted as part of the Scheme, leading to a greater sense of integration and tying in of the localised changes at the boundary of this LCA. There will be negligible improvement to the outlook from this location although awareness of the Scheme in year 10 or during the winter and summer months will be broadly similar, particularly the bridge structure and its influence on this LCA. The magnitude of impact is anticipated to reduce to no change resulting in a neutral effect.

LCA 4 Kirkley and Pakefield

10.6.17 The Scheme will be partly located within the northern limits of this LCA. The ZTV for the Scheme (refer to Figures 10.2- 10.4) identifies that both the bridge deck and bridge structure (raised or lowered) will be partially visible from within the northern extents of the LCA, however these elements of the Scheme are unlikely to result in changes to the perception of this townscape.

10.6.18 During construction a limited number of activities, construction of new road layout and local road tie-ins, will occur on the northern fringes of this character area and the transition with LCA 5 Lake Lothing. These would be limited to modifications to the existing roads to form the tie in with Waveney Drive and Tom Crisp Way. There will be no noticeable detractions or changes to the setting of this LCA. The temporary magnitude of impact is anticipated to be negligible resulting in a neutral effect.

10.6.19 In the year of opening, potential views will be restricted to glimpsed partial views above and between the intervening built form surrounding Lake Lothing or filtered through the vegetation surrounding Tom Crisp Way. Minor changes occurring on the fringe of the character area will form a minor component in the context of the urban and industrial setting and is not anticipated to have a material influence on the perception of this

townscape where it may be visible.

10.6.20 Overall the Scheme will not alter any physical components within this townscape and will generally not be visible across this LCA. The magnitude of impact is anticipated to be no change, resulting a neutral effect to this LCA.

10.6.21 In year 10 there will be no changes to the level of awareness of the Scheme or its influence on this LCA. The magnitude of impact is anticipated to remain as no change resulting in a neutral effect.

LCA 5 Lake Lothing

10.6.22 The Scheme will be located almost wholly within this LCA and will comprise a major new and transformative component to the declining urban industrial waterfront character that is central to the identity of Lowestoft as a port. The Scheme will necessitate the removal of derelict storage sheds to accommodate the New Access Road and the creation of a new junction on Waveney Drive to the south of Lake Lothing. To the north the Scheme will provide a new public space and landscaping as set out in the Landscaping Plans secured through the DCO.

10.6.23 During construction the activities will occur within this LCA and will temporarily form a major detraction across the majority of this townscape. Views of the works will be possible in a range of nearby direct views and partial distant views, and will generally have some influence across this LCA. Furthermore there will be disturbances to the regular movement and activity along and around the waterfront and roads within the relatively low levels of existing tranquillity, resulting in temporary changes to the function within this LCA. The temporary magnitude of impact is anticipated to be high, resulting in a moderate adverse effect.

10.6.24 Should the proposed future development associated with Lake Lothing and outlined in Paragraph 10.4.46 not be progressed, the assessment of effects will reflect those outlined in the year of opening assessment.

10.6.25 In the year of opening, the distinctive opening mechanism of the bridge structure will be the most striking and prominent element of the Scheme. It will form a tall structural landmark, visible across most of the LCA and from within the wider townscape, highlighting the portside character that lies at the heart of the town. Furthermore, the bridge, and particularly the operation of the mechanism and the passage of watercraft, will create a sense of drama and interest that will be appropriate within the setting of Lake Lothing and will form a central statement within Lowestoft.

10.6.26 The Scheme will also facilitate the revitalisation of the waterfront character and form a beneficial, prominent addition to the existing layout of the townscape. The bridge, in addition to the introduction of movement and activity, will connect the north and south of the town, provide pedestrian and cycle links over the water, add new areas of public realm and open up access to the waterfront. This access to areas currently relatively inaccessible or unwelcoming will create new vistas and opportunities for the public to observe and appreciate the waterfront activities that have been at the heart of Lowestoft's cultural character. The New Access Road and the new junction upon Waveney Drive will form a relatively discrete feature within the hard landscape within this LCA.

- 10.6.27 Within the future townscape setting the Scheme may be viewed and perceived differently according to the context of that view. When viewed with the anticipated future development to the south, the Scheme will be complementary to the allocated and consented scale of commercial and waterfront development that may surround it, and suited to the proportions and styling of the modern buildings. Whereas, when viewed within the existing industrial context to the north, the Scheme and its modern form will create a juxtaposition within the sparse and ageing portside setting, its operation will be in keeping with the nature of a working waterfront. It is through both its modern form and maritime function that it would likely form a symbolic but contrasting link between the existing industrial heritage north of Lake Lothing and the future sustainable and diverse district to the south.
- 10.6.28 The new highway alignment and connections to the existing road network will also add some potentially detrimental new features and modifications within the townscape. The raised alignment will require large retaining walls, greatly out of scale within the surrounding road network, even while appropriate to the scale of the setting of Lake Lothing. The addition of new roundabouts will also increase the sense of movement and traffic movements within the LCA, the new prominent and elevated traffic and additional lighting within the townscape forming important features.
- 10.6.29 Overall the Scheme will introduce a new local road layout and bridge crossing Lake Lothing, this will become a central and modern component to the setting of this LCA. While initially exposed and contrasting within the largely vacant character of the existing waterfront, it will bring new access, activity and appreciation to the area, in keeping with the existing low levels of tranquillity, and will be symbolic of the planned transformation of Lake Lothing, in combination with modifications to the existing road layout, new link roads and formation of some local open space.
- 10.6.30 These beneficial impacts will be moderated by the introduction of some extensive and substantial built form, increasing the scale and modifying the nature of the local townscape. On balance the magnitude of impact is anticipated to be medium, resulting a slight beneficial effect to this LCA.
- 10.6.31 In year 10 the maturation of localised planting associated with public realm improvements at the northern tie in will help to integrate the proposed changes to the local road layout into the LCA. However overall the bridge will remain a prominent and central component within this LCA and there will be no change to the level of influence of the Scheme during the summer or winter months. The magnitude of impact is anticipated to remain medium resulting in a slight beneficial effect.

LCA 6 Normanston/Gunton

- 10.6.32 The Scheme will be located outside of this LCA. The ZTV for the Scheme (refer to Figures 10.2- 10.4) identifies that both the bridge deck and bridge structure (raised or lowered) will be visible from within limited areas of open space however is unlikely to be visible from across the wider townscape.
- 10.6.33 During construction the activities will be contained outside of this LCA with limited visibility towards the works. Awareness of construction activities will be possible typically from open areas in the south of this LCA. A range of direct and partial views of the works in these areas will form a detraction and intrusion within these areas. The

temporary magnitude of impact is anticipated to be low, resulting in a slight adverse effect.

10.6.34 In the year of opening, the potential views will mainly be restricted to Normanston Park and the playing fields off Barnards Way in the south of the LCA. These large open spaces in close proximity to Lake Lothing allow for broader awareness of the existing industrial components of the neighbouring LCA. Within this context the Scheme will add a prominent new landmark element to the local skyline, and that complements the existing built form and that is not overly influential to the setting of the surrounding open spaces.

10.6.35 Overall the Scheme will not alter any physical components within this townscape, will generally not be conspicuous from within this LCA and therefore will not alter the experience of the LCA. The magnitude of impact is anticipated to be no change, resulting a neutral effect to this LCA.

10.6.36 In year 10 there will be no changes to the level of awareness of the bridge or its influence on this LCA. The magnitude of impact is anticipated to remain as no change resulting in a neutral effect.

LCA 7 Whitton / Carlton Colville

10.6.37 The Scheme will be located outside of this LCA. The ZTV for the Scheme (refer to Figures 10.2- 10.4) identifies that the bridge structure will not be visible from within this area, with the exception of very limited distant views from areas of open space.

10.6.38 During construction the activities will be contained outside of this LCA with very limited visibility towards the works. Awareness of construction activities will be distant and barely perceptible within the context of the intervening built form and urban elements. There will be no noticeable detractions or changes to the setting this LCA. The magnitude of impact is anticipated to be no change resulting in a neutral effect.

10.6.39 In the year of opening, there will be low potential for distant partial views from limited parts of open space or along streets aligned towards the Scheme. Within these potential views the proposed bridge structure will form a very minor distant component in the view and in the context of existing urban elements, and will have no influence on the perception of the townscape character within this LCA. Overall the Scheme will not alter any physical components within this landscape and will generally not be visible across this LCA. The magnitude of impact is anticipated to be no change, resulting in a neutral effect to this LCA.

10.6.40 In year 10 there will be no changes to the level of awareness of the bridge or its influence on this LCA. The magnitude of impact is anticipated to remain as no change resulting in a neutral effect.

LCA 8 Barnby to The Fleet, Oulton

10.6.41 The Scheme will be located outside of this LCA. The ZTV for the Scheme (refer to Figures 10.2- 10.4) suggests that the bridge structure will be visible from within this area. However from surveys undertaken within the area and from specific viewpoints within the character area, a combination of vegetation, built form and landform constrains views towards the Scheme, maintaining the sense of associated tranquillity,

along with the continuing low levels of noise experienced within The Broads and its waterways.

10.6.42 During construction the activities will be contained outside of this LCA with very limited visibility towards the works. Where awareness of construction activities are visible, these will be restricted to views of cranes and other tall elements visible at a distance and immediately above the skyline forming very minor elements. There will be no noticeable detractions or changes to the setting of this LCA. The magnitude of impact is anticipated to be no change resulting in a neutral effect.

10.6.43 In the year of opening, there will be low potential for distant partial and likely winter views only of the tip of bridge structure (raised or lowered) from limited locations. These potential partial views will only be of the tips of the Scheme bridge structure, with no views of the bridge deck or traffic. Within these views the Scheme will appear as a very minor and distant element over 2km away to the east above the residential buildings and other suburban features surrounding Oulton Board. Any new components that will be visible above the skyline will be difficult to discern and will recede within and will not alter or influence the perception of this settled, tranquil part of The Broads.

10.6.44 Overall the Scheme will not alter any physical components within this landscape and will generally not be visible across this LCA. The magnitude of impact is anticipated to be no change, resulting a neutral effect to this LCA.

10.6.45 In year 10 there will be no changes to the level of awareness of the bridge or its influence on this LCA. The magnitude of impact is anticipated to remain as no change resulting in a neutral effect.

Summary

10.6.46 Table 10-14 provides a summary of the effects to townscape character during construction, winter in the year of opening and year 10 (winter and summer). Existing tranquillity within the character areas and specifically associated with those that bound Lake Lothing are influenced by the activity associated with the port, marina, local roads and associated land use developments and is anticipated to be comparable following completion of the Scheme.

Table 10-14 – Summary of LCA and predicted significance of effect

Local Character Area (LCA)		Construction	Year of Opening	Year 10 (winter)	Year 10 (summer)
	LCA 1 North Lowestoft and Town Centre	Slight Adverse	Neutral	Neutral	Neutral
	LCA 2 South Lowestoft and Seafront	Neutral	Neutral	Neutral	Neutral
	LCA 3 Roman Hill	Slight Adverse	Neutral	Neutral	Neutral
	LCA 4 Kirkley and Pakefield	Neutral	Neutral	Neutral	Neutral
	LCA 5 Lake Lothing	Moderate Adverse	Slight Beneficial	Slight Beneficial	Slight Beneficial
	LCA 6 Normanston/Gunton	Slight Adverse	Neutral	Neutral	Neutral

LCA 7 Whitton/Carlton Colville	Neutral	Neutral	Neutral	Neutral
LCA 8 Barnby to The Fleet, Oulton	Neutral	Neutral	Neutral	Neutral
Significance of Effect				

Visual Amenity

10.6.47 This section discusses the findings of the ZTV analysis and presents the Scheme’s anticipated level of visibility throughout the study. The ZTV analysis of three scenarios of the Scheme bridge and highway design, has been carried out to confirm the extent of theoretical views within the study area (see section 10.3.26 to 10.3.33 for details). The three scenarios are presented in Figures 10.2 to 10.4 and include:

- HGV traffic on the bridge deck;
- Bridge lowered; and
- Bridge raised.

10.6.48 The results of this study have demonstrated that the bridge deck, HGV traffic, associated lighting infrastructure and highway link roads and tie into Denmark Road and Waveney Drive will be visible in the immediate open setting around Lake Lothing with views extending to the east to the outer harbour crossing and to Harbour Road in the west. Existing built form around Lake Lothing largely contains views and prevents wider visibility of the changes to the local road network and bridge structure from within the surrounding areas. The existing low levels of tranquillity are anticipated to remain unchanged during and following construction of the Scheme. However where a combination of higher topography and street layouts allow there are potential views towards the elevated components of the bridge that penetrate within the immediate surrounding urban context. This is particularly evident around the north/south street layout to the north of the Scheme between Essex Street and Stevens Street. To the south the residential housing along Waveney Drive limits the extent of views in this direction, while to the south east potential views extend beyond the A12 largely due to the broader scale of intervening development which allows for indivisibility within the townscape. In addition there are potential views from locations around the western and northern extents of Normanston Park where the topography rises.

10.6.49 The analysis of the raised scenario, representing the highest point of the bridge structure during operation (see Table 10-7), suggests the bridge structure will become a highly visible new element within both the immediate setting of Lake Lothing and the surrounding urban areas. From the open margins of Lake Lothing to the surrounding built development the structure will be a dominant feature in un-obstructed open views. As such it will be frequently viewed in relative isolation above the open body of water and drawing the eye.

10.6.50 Beyond these immediate direct views from the margins there will be a range of potential views from the edges of the surrounding built development and further within the urban grain. Here the bridge structure is likely to be visible above the intervening development in partial views only. The bridge structure, comparable in height to the tallest building on the north of Lake Lothing, will form a perceptible feature in views –

indicating the location of the otherwise discreet Lake Lothing within the urban context of views.

- 10.6.51** The analysis shows that these mid-range partial views in the north are likely to be present mostly from the areas around and contained by Normanston Drive and Denmark Road, and extending through to the outer harbour in the east. In the south the potential mid-range partial views will be possible from upper storeys of properties lining South Beach in the south east, and from the numerous isolated pockets of open space in a broad arc between Beaconsfield Road in the south east and Kirkley Run to the south. To the west and south west the potential for mid-range views reduces due to larger scale buildings and the more level elevation. However there will be views possible from Harbour Road Industrial Estate on the North West margins of Lake Lothing to the west as far as the rail corridor.
- 10.6.52** The analysis has shown that there will be potential for long range views of the bridge structure from areas of open space across the study area. Views will typically be very minor partial views of the tops of the structure in the skyline, or in distant contextual views from elevated areas of the town. The desk based ZTV analysis suggested that views should be achieved from the northern fringes of Oulton Broad, Oulton Broad itself, and from the Carlton Marshes Nature Reserve all within The Broads. However as Viewpoint 12 Oulton Broad demonstrates, such views are highly constrained by intervening layers of vegetation and built form and are therefore highly constrained and, where they may occur, they will be almost indiscernible at a distance of over 2km.
- 10.6.53** Potential views of the inshore coastal waters (that includes Lake Lothing) will be possible from the Outer Harbour area, from where views west are likely to be constrained to views towards the entrance of Lake Lothing. Within this context the bridge structure will be partially visible within the skyline towards the background of the view and will not form the focus of the view. Within the visual context of Lake Lothing the potential effects have been identified and described in Key Viewpoints 3, 4, 8, 9 and 11. Views from the coastline of the inshore waters, and beyond the context of Lake Lothing are considered unlikely to be able to combine views of the open water and the Scheme.
- 10.6.54** Other notable potential distant views include the urban fringe landscape to the north west as far as Hall Lane and from the open spaces typically associated with playing fields and school grounds that exist throughout Lowestoft.
- 10.6.55** Progression of the proposed development sites, outlined in Paragraph 10.4.46, within the context of Lake Lothing will result in further built form that will limit broader awareness of the local road improvements, bridge deck and may also include some modification to views of the cantilever structure of the bridge. Whilst the likelihood of development occurring is high, the details of the built form are currently unknown therefore the level of certainty relating to the degree to which views are likely to change as a result of the anticipated Lowestoft future townscape is currently low.

Viewpoint Assessment

- 10.6.56** The detail of the key viewpoint assessment is contained within Appendix 10B.
- 10.6.57** The viewpoint assessment identified that effects no greater than moderate adverse are anticipated to arise during the construction of the Scheme. Moderate adverse effects are anticipated to arise upon VP1, 2, 3, 6 and 9, as a result of a combination of open and direct views of construction activity, associated clutter and plant (including lifting equipment) and occurring in relatively close proximity and within views of Lake Lothing. With the exception of two viewpoints (VP12 and VP13) which are subject to no material change in view during construction and therefore subject to a neutral effect, effects on the remaining viewpoints are anticipated to be in the order of slight adverse.
- 10.6.58** During operation the bridge structure will represent a new prominent and noteworthy feature. Several views (VP3, 4, 5, 6, 8, 9 and 11) that had been identified as being adversely impacted (moderate or slight adverse) during the construction phase will, as a result of the similar direct, open and near distance views, be able to appreciate and interpret the design of the bridge and associated counterweights. The gentle profile associated with the approaches and bridge deck, contrasting with the upward sweep of the counterweights, form new and prominent features within the immediate and wider townscape. As a result the adverse effects identified during the construction phase would be time limited, and instead slight beneficial effects on these viewpoints are anticipated to arise during the operational phase of the Scheme.
- 10.6.59** Four viewpoints (VP1, 2, 7 and 15) will, in the year of opening, be subject to adverse effects. VP1 and 2 would have some perceptible changes to road layouts as part of the bridge approaches in the foreground of the view, whilst lacking the beneficial aspect that includes broader views of the bridge structure itself. In contrast, VP7 and 15 are more distant views, the bridge structure itself being screened by landscape features in the foreground such that only the upper section of the counterweights will be visible. There would be an absence of broader views of the bridge and lower sections of the counterweights such that the overall design will not be appreciated. The viewpoint would therefore be impacted by isolated elements and the effect would be slight adverse.
- 10.6.60** Effects on visual amenity at these Key Viewpoints are not anticipated to substantially change in Year 10, or during winter or summer months. The Scheme does not include extensive planting, with the exception of the proposed tie in with Denmark Road (VP6). As a result views will not be modified by the maturation of trees or shrubs and the significance of effect will remain similar to those identified in the Year of Opening. Viewpoint 6 would however benefit from the proposed tree planting adjacent to the northern roundabout tie in and would experience an improving outlook as this planting matures, such that in Year 10 the anticipated effect would be moderate beneficial.
- 10.6.61** Table 10-15 provides the summary of the effects to the key viewpoint during construction, year of opening and year 10 in both summer and winter.

Table 10-15 – Summary of viewpoint and predicted significance of effect

		Construction	Year of Opening	Summer Year 10	Winter Year 10
Key Viewpoints	VP1 Waveney Drive	Moderate adverse	Slight adverse	Slight adverse	Slight adverse
	VP2 Tom Crisp Way	Moderate adverse	Slight adverse	Slight adverse	Slight adverse
	VP3 Inner Harbour South	Moderate adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP4 A47 Bascule Bridge	Slight adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP5 Clemence Street	Slight adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP6 Denmark Road	Moderate adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP7 Normanston Park	Slight adverse	Slight adverse	Slight adverse	Slight adverse
	VP8 Brooke Peninsula	Slight adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP9 Kirkley Waterfront	Moderate adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP10 Mutford Bridge	Slight adverse	Neutral	Neutral	Neutral
	VP11 Lake Lothing	Slight adverse	Slight beneficial	Slight beneficial	Slight beneficial
	VP12 Oulton Broad	Neutral	Neutral	Neutral	Neutral
	VP13 Camps Heath	Neutral	Neutral	Neutral	Neutral
	VP14 Britten Road	Slight adverse	Neutral	Neutral	Neutral
	VP15 Lowestoft Cemetery	Slight adverse	Slight adverse	Slight adverse	Slight adverse
Significance of Effect					

Lighting Assessment

10.6.62 The approaches to the Scheme bascule bridge deck itself, including the carriageway, will be lit with roadside lighting in line with current highway standards using columns and modern lights with cowls fitted to reduce light spill, as standard. Whilst this lighting will represent a new light source within the context of Lake Lothing, the lights themselves will not significantly intrude into the night sky; lighting appearing as cones of light, illuminating the carriageway and traffic. This will extend to the tie in with Denmark Road and Waveney Drive, both of which have existing street lighting associated with them, as such new lighting is unlikely to significantly increase the perception of lighting.

10.6.63 The bridge structure and counterweights will also be subject to lighting as noted in the Design Guidance Manual (document reference 7.6) and will require approval by the county planning authority in detailed design pursuant to the DCO. This will include strategically located lights within the structure aimed at complementing, and emphasising particular angles and shapes within the design. Where these extend

along the bridge deck and vertically along the counterweights the associated lighting will result in the design being perceptible from a distance at night. This will occur to a similar extent to that experienced by receptors with a view of the structure, and particularly the counterweights, during daylight hours as identified within the ZTV and assessment of visual effects.

10.6.64 The impact of lighting will be to provide identity to the structure, and as a feature of the night time views in and around Lowestoft. As such, the effects on visual receptors of the Scheme at night will be similar to those identified during day light hours, i.e. where the design of the bridge is appreciated, the effect is anticipated to be beneficial - within night time views this will occur as a result of effective strategic lighting.

10.7 Conclusions and Effects

10.7.1 The assessment of predicted effects on townscape character, has concluded that:

- During the construction phase, activity would result in a significant effect of moderate adverse on LCA 5 – Lake Lothing, the remaining character areas being subject to effects no greater than slight adverse; and
- Post construction, the identified effects are not anticipated to be significant, the majority being neutral with the rejuvenation associated with the newly constructed public realm and influence of the Scheme resulting in a slight beneficial effect on LCA 5 – Lake Lothing. The effects are anticipated to remain beyond the period post construction, continuing into the design year at year 10. The remaining character areas, with limited awareness of the Scheme, are not anticipated to be subject to a perceptible change in the perception of character and will be subject to a neutral effect.

10.7.2 The assessment of predicted effects on visual amenity, has concluded that:

- During the construction phase, the influence of activity, plant, cranes and the interruption to the existing outlook would give rise to adverse effects on thirteen of the fifteen viewpoints, five of these would be significant, giving rise to moderate adverse effects;
- The significant effects identified during construction are anticipated to substantially reduce upon completion of the Scheme. As a result four viewpoints will remain subject to effects in the order of slight adverse, arising as a result of changes in the foreground (VP1, VP2) associated with the tie in with the existing road network or where as a result of more distant views, the upper sections of the counter weights that are visible will result in a slight deterioration to the existing outlook (VP7, VP15).
- Post construction identified viewpoints are not anticipated to be subject to significant adverse effects, four viewpoints (VP1, VP2, VP7 and VP15) will be subject to a slight adverse effect. The remaining viewpoints are anticipated to be subject to neutral or slight beneficial effects.
- Significant effects are not anticipated to arise on views from within The Broads to the west.

10.7.3 The assessment of townscape and visual effects has concluded that overall there will not be significant effects on the perception of townscape character associated with Lowestoft. Temporary significant effects will arise during the construction phase on a number of viewpoints associated with direct views towards Lake Lothing, however upon completion of the Scheme the significance of these effects are anticipated to have reduced, and as a result no significant adverse effects on visual amenity have been identified as likely to arise.

11 Nature Conservation

11.1 Scope of the Assessments

Introduction

11.1.1 This chapter describes the assessment of the likely significant effects of the Scheme on biodiversity and nature conservation during the construction and operational. It is supported by Figures 11.1 to 11.7 and Appendices 11A to 11G.

11.1.2 The assessment of this topic area considers potential impacts relating to the following aspects:

- Statutory and non-statutory designated sites;
- Important or protected habitats; and
- Legally protected species and/or species of conservation importance.

11.1.3 The assessment has incorporated the comments of the Secretary of State (SoS) presented in the Scoping Opinion included in Appendix 6B, as well as those received during the S42 consultation. The assessment should be read in conjunction with Chapter 8: Air Quality; Chapter 12: Geology and Soils, Chapter 13: Noise and Vibration, Chapter 17: Road Drainage and the Water Environment and Chapter 19: Traffic and Transport.

Study area

11.1.4 The study area for the assessment has been defined at the following three different levels to capture information that is pertinent to different aspects of the assessment. They have been informed by legislation and guidance (see Section 0 below);

- Main Study Area– 500m from the Order limits. This study area has been used for assessing habitats and suitability for protected species that could be significantly impacted by the Scheme. The extent of this study area has been defined following surveys of the Order limits and surrounding land carried out as part of the PEA and following the recommendations of that PEA (Figure 11.1);
- Broad Study Area– 2km from the Order limits. This study area has been used for biological records from data searches. A larger study area than the Main Study Area is appropriate to capture further baseline data to determine if further assessment on species is appropriate (Figure 11.1); and
- Extended Study Area– 30km from the Order limits, in order to take into account internationally important sites of interest. The extent of this study area is informed by guidance within the DMRB for what is an appropriate distance to consider the effects upon internationally important sites (Figure 11.2).

11.1.5 The survey areas that have been used, along with sampling sites for surveys targeting particular species are shown in Figures 11.3 to 11.7. It should be noted that survey areas for particular species are specific to that species and is limited to the suitable habitat that is present further to the findings of the PEA.

11.2 Directives, Statutes and Relevant Policy

11.2.1 Ecological features receive protection through legislation and planning policy. Legislation and planning policy relevant to the Scheme have been identified following a determination of ecological receptors relevant to the Scheme following completion of the surveys that have been carried out.

11.2.2 The assessment has been compiled with reference to the following relevant nature conservation legislation, planning policy and the UK Biodiversity Framework from which the protection of sites, habitats and species is derived in England.

The Conservation of Habitats and Species Regulations (Habitats Regulations) 2010 (as amended)

11.2.3 The EC Habitats Directive and EC Birds Directive are transposed into UK law via the Conservation of Habitats and Species Regulations 2010 (as amended), referred to as the Habitats Regulations. All species listed under Annex IV of the Habitats Directive require strict protection and are known as European Protected Species (EPS). Certain EPS are also listed under Annex II of the Habitats Directive and are afforded protection by the establishment of core areas of habitat known as Special Areas of Conservation (SAC). This means these species are a relevant consideration in a Habitats Regulations Assessment (HRA).

11.2.4 The Birds Directive seeks to maintain populations of all wild bird species across their natural range (Article 2). All bird species listed under Annex I of the Birds Directive are rare or vulnerable and afforded protection by the classification of Special Protection Areas (SPAs), these are also designated under all regularly occurring migratory species, with regard to the protection of wetlands of international importance (Article 4). This means these bird species and communities are a relevant consideration in HRA. Impacts on these sites are considered separately in the HRA Report (document reference 6.5).

The Wildlife and Countryside Act (WCA) 1981 (as amended)

11.2.5 Under the WCA (England and Wales) all birds, their nests and eggs (with exception of species listed under Schedule 2) are protected by the WCA. It is an offence to intentionally kill, injure, or take any wild bird, their eggs or to damage or destroy the nest of any wild bird (whilst being built, or in use).

11.2.6 Species listed on Schedule 5 of the WCA, which includes species of reptile native to the UK, gives either full or partial protection against the killing, injuring or taking, the possession or control of individuals (live or dead) and the damage, destruction, disturbance or obstruction of places of shelter or protection.

11.2.7 Schedule 9 of the WCA also makes provision for the control of invasive species and makes it illegal to cause such plants to grow in the wild.

11.2.8 In addition the WCA makes it an offence (subject to exceptions) to pick, uproot, trade in, or possess (for the purposes of trade) any wild plant listed in Schedule 8, and prohibits the unauthorised intentional uprooting of such plants.

Countryside Rights of Way (CRoW) Act 2000

11.2.9 The CRoW Act has amended the WCA in England and Wales strengthening the

protection afforded to Sites of Special Scientific Interest (SSSI) and the legal protection for threatened species. It adds the word 'reckless' to the wording of the offences listed under Section 9(4) of the WCA. This alteration makes it an offence to recklessly commit an offence, where previously an offence had to be intentional to result in a breach of legislation.

The Natural Environment and Rural Communities (NERC) Act 2006

11.2.10 Species and Habitats of Principal Importance in England and Wales are listed under Section 41 and Section 42 respectively of the NERC Act. The Section 41 and 42 lists detail species that are of principal importance for the conservation of biodiversity in England and Wales, and should be used to guide decision-makers such as local and regional authorities when implementing their duty to have regard for the conservation of biodiversity in the exercise of their functions.

The Wild Mammals (Protection) Act 1996

11.2.11 The Wild Mammals Act is an anti-cruelty legislation which makes it an offence to intent to inflict unnecessary suffering on a wild mammal through such acts as mutilation, beating or drowning.

The UK Post-2010 Biodiversity Framework (2011-2020) (JNCC and DEFRA, 2012)

11.2.12 This Framework lists the UK's most threatened species and habitats and sets out targets and objectives for their management and recovery. The UK Biodiversity Action Plan (BAP) process is delivered nationally, regionally and locally and should be used as a guide for decision-makers to have regard for the targets set by the framework and the goals they aim to achieve. The UK BAP has now been replaced by the UK Post-2010 Biodiversity Framework, however, it contains useful information on how to characterise important species assemblages and habitats which is still relevant (UK Post-2010 Biodiversity Framework, 2012).

Biodiversity 2020: A strategy for England's wildlife and ecosystem services (DEFRA, 2011)

11.2.13 This document provides a strategy on the implementation of international legislation and provides a strategic plan for biodiversity policy for terrestrial, aquatic and marine habitats.

The National Policy Statement for National Networks

11.2.14 The National Policy Statement for National Networks (NNNPS) sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides the basis for the examination by the Examining Authority and for the primary decision making process by the Secretary of State.

11.2.15 The NNNPS requires an ES to clearly set out likely significant effects on ecological receptors and to show how a project has taken advantages of opportunities to conserve and enhance biodiversity, referring to the measures set out in the Biodiversity 2020 Strategy (see Paragraph 11.2.13).

11.2.16 Paragraph 5.23 of the NNNPS also states that an applicant should demonstrate how an application has taken the opportunity to conserve and enhance biodiversity. Paragraph 5.25 of the NNNPS also requires applicants for development consent to, as

a general principle, avoid significant harm to biodiversity in the construction and operation of a Nationally Significant Infrastructure Project.

National Policy Statement for Ports

11.2.17 The National Policy Statement for Ports (PNPS) sets out the Government's strategy for new port infrastructure to meet current and future needs. It determines the approach planning decision-makers should take with respect to ports and port infrastructure proposals.

11.2.18 The PNPS requires an ES to investigate the effects of the project on marine ecology, biodiversity and protected sites, and to take into account discharges to water and physical modifications of the water environment that may affect ecological resources. Consideration should be made of the effects of noise on sensitive marine resources and the Environment Agency, Natural England and the Marine Management Organisation should be consulted as necessary.

11.2.19 In Paragraph 5.1.22 the PNPS states that capital dredging requirements will need to be subject to assessment within the ES.

East Inshore and East Offshore Marine Plan

11.2.20 This Marine Plan includes policies that are relevant to the consideration of the effects of a project upon the marine environment.

11.2.21 Policy BIO1 states that "Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole..."

The National Planning Policy Framework (NPPF) 2012 (DCLG, 2012)

11.2.22 National planning policy on the protection of biodiversity is set out in the NPPF. The NPPF requires that impacts on biodiversity are minimised and projects provide net gains in biodiversity where possible and opportunities to incorporate biodiversity in and around developments should be encouraged.

UK Biodiversity Action Plan (UKBAP)³³

11.2.23 The UKBAP detailed the important species and habitats of the UK and provided implementable plans for the conservation of those resources which aimed to conserve and where necessary, aid in their recovery.

Suffolk Biodiversity Action Plan (2012)

11.2.24 The Suffolk Biodiversity Action Plan identifies objectives and targets to promote and protect biodiversity within the county during the development planning process.

11.3 Methods of Assessment

11.3.1 The assessments have been based on the methods outlined in the following guidance:

- The DMRB Volume 11, Section 3, Part 4 Ecology and Nature Conservation;
- IAN 130/10 – Ecology and Nature Conservation: Criteria for Impact Assessment,

³³ The UK BAP has now been replaced by the UK Post-2010 Biodiversity Framework, however, it contains useful information on how to characterise important species assemblages and habitats which is still relevant.

Highways Agency (2010);

- Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2016); and
- Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal published by Chartered Institute of Ecology and Environmental Management (CIEEM) (2010).

11.3.2 Establishment of the baseline environment for nature conservation has involved a review of the existing information relating to designated and non-designated sites, habitats and fauna and consultation with Suffolk County Council (SCC) and Natural England including discussion of which ecologically important sites are to be included within the assessment.

11.3.3 During the course of the Preliminary Ecological Appraisal (PEA) (see Appendix 11A) which included a repeat Phase 1 Survey that was carried out for the Scoping Report (Appendix 6A), assessments were made of the suitability of habitats within the Main Study Area for species that are protected by law or otherwise of particular nature conservation importance. Following the findings of these surveys further surveys have been carried out as shown in Table 11-4 to further inform the assessment. These are:

- Bat surveys;
- Reptile surveys;
- Breeding bird surveys;
- Black redstart breeding surveys;
- Wintering bird surveys;
- Terrestrial invertebrate survey;
- Benthic ecology survey; and
- Fish trawl survey.

11.3.4 The above surveys were discussed with Natural England and SCC on the 14th September 2016 and additional representation was made in the Scoping Opinion (Appendix 6B). Phase 2 National Vegetation Classification (NVC) surveys were recommended through the scoping process, but following the PEA and further liaison with Natural England, it was agreed that the information obtained from the original Phase 1 Habitat survey was sufficient due to the lack of priority habitats within the survey area. Impacts from the Scheme can be adequately addressed with the information presently gathered. Habitats that have greater importance due to supporting protected species will be assessed in terms of those species present.

11.3.5 A further meeting and site visit to discuss scope and progress with an SCC Ecologist from the Natural Environment Team occurred on the 19 June 2017. The purpose of this meeting was to discuss the Scheme and the surveys to date with a different SCC Ecologist to that who prepared the response to the Scoping Report (Appendix 6A). Additional bat and reptile surveys to those proposed in the Scoping Report were

recommended as a result of this meeting. It was considered that all other ecological surveys that had already been undertaken, or were scheduled, was sufficient for the ES.

- 11.3.6** With regard to the marine surveys (benthic ecology survey and fish trawl survey) the scope and design of these were shared with the MMO and the EA prior to the survey taking place. Feedback and comments were incorporated into an amended methodology that was undertaken and is presented in Appendix 11G.
- 11.3.7** Assessment of the significance of impacts on sites, habitats and species is based on the guidance provided in the Guidelines for Ecological Impact Assessment. This defines the ecological value of identified assets based on their geographic influence, which ranges in definition from sites of international importance down to those within the local and immediate zone of influence of the Scheme. Only those assets with a geographic value at the local level or above have been subject to detailed assessment other than where receptors of lesser value are subject to some form of legal protection or can act in combination to lead to a cumulative impact. To that end, the determination of whether a significant effect is likely is a matter of professional judgement having considered a number of factors as to how the Scheme will interact with the baseline ecological environment.
- 11.3.8** Criteria relating to confidence, magnitude, extent, duration, reversibility and timing have been considered in combination with value to define impact significance. The Guidelines for Ecological Impact Assessment define a significant effect as '*an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'*'. The assessments have accordingly using professional judgement and taken into account the composition and status of sites, habitats and species under consideration, including their importance relative to the geographical context and nature of the predicted impact to enable an evaluation of significance to be made.

Value

- 11.3.9** The value of ecological resources has been determined in accordance with guidance within IAN 130/10. This approach, with additions relevant to the Scheme is summarised in Table 11-1. In line with the advice provided by IAN 130/10, assigning value to an ecological resource relies on professional judgement by individuals with sufficient relevant experience.

Table 11-1 - Value of ecological resources

Value	Description
International or European Value	<p>Natura 2000 sites including: Sites of Community Importance (SCIs); SPAs; potential SPAs (pSPAs); SACs; candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites). Biogenetic Reserves, World Heritage Sites and Biosphere Reserves.</p> <p>Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.</p> <p>Resident, or regularly occurring, populations of species which may be considered at an International or European level where:</p> <ul style="list-style-type: none"> • The loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • The population forms a critical part⁴ of a wider population at this scale; or

Value	Description
	<ul style="list-style-type: none"> The species is at a critical phase of its life cycle at this scale.
UK or National Value	<p>Designated sites including: SSSIs; Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs).</p> <p>Areas which meet the published selection criteria eg JNCC (1998) for those sites listed above but which are not themselves designated as such.</p> <p>Areas of key/priority habitats identified in the UK BAP, including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity.</p> <p>Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory.</p> <p>Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:</p> <ul style="list-style-type: none"> The loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or The population forms a critical part of a wider population at this scale; or The species is at a critical phase of its life cycle at this scale.
Regional Value	<p>Areas of key/priority habitats identified in the Regional BAP (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats (for example, South West Nature Map); and areas of key/priority habitat listed within the Highways Agency's BAP.</p> <p>Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within the HABAP where:</p> <ul style="list-style-type: none"> The loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or The population forms a critical part of a wider population; or The species is at a critical phase of its life cycle.
County or Unitary Authority Area Value	<p>Designated sites including: Sites of Nature Conservation Importance (SNCIs); County Wildlife Sites (CWSs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context.</p> <p>Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent). Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:</p> <ul style="list-style-type: none"> The loss of these populations would adversely affect the conservation status or distribution of the species across the County or Unitary Authority Area; or The population forms a critical part of a wider population; or The species is at a critical phase of its life cycle.
Local Value	<p>Designated sites including: LNRs designated in the local context.</p> <p>Trees that are protected by Tree Preservation Orders (TPOs).</p> <p>Areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.</p>
Negligible	Features or habitats that do not have an appreciable ecological value.

11.3.10 Table 11-2 shows the magnitude ratings that have been used in the assessment which

is derived from IAN 130/10.

Table 11-2 – Magnitude of ecological impacts

Magnitude Category	Typical Descriptors of Impact (Nature conservation)
Very Large	A permanent and irreversible impact that will adversely impact on one or more receptor(s) of International, European, UK or National Value
Large	A permanent adverse or beneficial impact on one or more receptor(s) of Regional Value.
Moderate	A temporary or permanent adverse or beneficial impact on one or more receptor(s) of County or Unitary Authority Area Value.
Slight	A temporary or permanent adverse or beneficial impact on one or more receptor(s) of Local Value.
Neutral	No significant impacts on key nature conservation receptors.

11.3.11 Whether a potential impact or effect is ‘significant’ or not at the given geographical level that the receptor is valued at, is determined by quantifying the magnitude of effect on each of the receptors identified.

11.3.12 Thus for receptors of national or international value and high sensitivity, negative effects measured at high or very high magnitude are likely to represent a significant impact at that geographical scale. In development control terms, such impacts are very likely to conflict with planning policy. At the other end of the scale, minor magnitude effects on receptors of low sensitivity and only immediate local value are likely to be below significance thresholds, and to merit relatively low weight in planning decisions. Substantial effects on high value receptors that are of low sensitivity may fall either side of the significance threshold - in such cases further avoidance or mitigation may be able to be employed to ameliorate effects.

11.3.13 A key consideration is whether the ‘integrity’ of a site or ecosystem (e.g. the coherence of its structure and function) and/or the ‘conservation status’ of a species or habitat (e.g. the ability of a population/habitat to maintain itself at pre-development levels/quality) will be compromised.

11.3.14 Based on the findings of the assessments further mitigation relating to avoidance, reduction or compensation of impact have been identified prior to an evaluation of the consequent significant effects. For the purposes of the 2009 Regulations, a significant effect is deemed to be a moderate effect or greater.

11.4 Baseline Environment

11.4.1 A desk study, a Phase 1 Habitat survey, a PEA and surveys of particular species have been undertaken to identify changes to known biodiversity resources and include both designated and non-designated sites. Reports describing surveys of particular species are included in the following appendices:

-
- Desk study and Phase 1 Habitat survey; included in Appendix 6A as an annex to the scoping report;
 - PEA; included in Appendix 11A;
 - Bats; Appendix 11B;
 - Wintering birds; Appendix 11D;
 - Reptiles; Appendix 11E;
 - Terrestrial invertebrates; Appendix 11F; and
 - Benthic ecology; Appendix 11G.

11.4.2 The surveys have been undertaken with reference to the following guidance:

- TAG Unit A3 Chapters 5 and 9 (which also references DMRB Volume 11 Section 3 Part 4);
- 'Guidelines for Ecological Impact Assessment in the UK' (Chartered Institute for Ecological and Environmental Management (CIEEM), 2016);
- DMRB Volume 11 Section 4 Assessment of the Implications (of Highways and/or Road Projects) on European Sites (including Appropriate Assessment); and
- Bibby C., N. Burgess, D. Hill & S. Mustoe (2000). *Bird Census Techniques: 2nd edition*. Academic Press.

Desk-Based Studies

Nationally and Locally Designated Sites

11.4.3 The suite of desk-based studies undertaken to inform this assessment identified that there is one nationally designated site within the Broad Study Area of the Scheme. This is the Leathes Ham Local Nature Reserve (LNR) (Figure 4.2 and 11.1).

11.4.4 In the Scoping report (Appendix 6A) the following designated sites were identified as requiring consideration:

- The Broads SAC;
- Broadland SPA;
- Broadland Ramsar;
- Southern North Sea cSAC; and
- Outer Thames Estuary SPA and pSPA Extension.

11.4.5 In the Scoping Opinion (Appendix 6B) the following were also identified as worthy of consideration and this has informed the area of the Extended Study Area. These are shown on Figure 11.2 alongside other internationally designated sites that are in closer proximity to the Scheme but have been agreed with Natural England as being out with the scope of the assessment.

- Alde-Ore Estuary SPA;
- Benacre to Easton Barents SPA;

- Barnby Broad and Marshes SSSI;
- Sprat's Water and Marshes SSSI; and
- Carlton Colville SSSI.

11.4.6 LNRs are sites of local or district-wide importance, designated for the enjoyment, study or conservation of wildlife, geological features and landforms. Leathes Ham LNR is a freshwater lake with a mix of wooded and grassland habitat that is home to many bird species.

11.4.7 Gunton Warren LNR (shown on Figure 4.2) is a site displaying a range of coastal habitats from mobile shingle, to sand dunes and vegetated cliff slope, to lowland heath. Gunton Warren was originally excluded from the scope of the ecological assessment, due to the distance between it and the Scheme. However, the Air Quality assessment in Chapter 8 has identified likely significant effects upon this LNR and hence it has been included within this assessment.

11.4.8 Three County Wildlife Sites (CWS) exist within the Broad Study Area, namely:

- Brooke Yachts and Jeld Wen Mosaic County Wildlife Site;
- Kirkley Ham County Wildlife Site; and
- Outer Harbour County Wildlife Site.

11.4.9 Gunton Warren LNR Leathes Ham LNR and the three CWSs are identified on Figure 11.1.

Species Records

11.4.10 The review of existing records of species within the Broad Study Area of the Scheme has established records of brown long-eared bat *Plecotus auritus*, pipistrelle *Pipistrellus* sp., water vole *Arvicola amphibius*, grey seal *Halichoerus grypus* and common lizard *Zootoca vivipara* exist in the Broad Study Area.

11.4.11 Approximately 150 species of birds have been recorded within the Broad Study Area, including notable species such as barn owl *Tyto alba*, black redstart *Phoenicurus ochruros*, green sandpiper *Tringa ochropus*, hen harrier *Circus cyaneus*, kingfisher *Alcedo atthis*, little tern *Sternula albifrons*, peregrine *Falco peregrinus* and red throated diver *Gavia stellata*.

11.4.12 Biological records show several priority species (S41 NERC Act as amended) that have been recorded within the Broad Study Area. Species recorded include hedgehog *Erinaceus europaeus*, common toad *Bufo bufo*, common frog *Rana temporaria* and smooth newt *Lissotriton vulgaris*. These species are afforded no formal protection within the UK but preservation of their biodiversity value is a relevant consideration in the planning phase.

The Suffolk County Biodiversity Action Plan

11.4.13 Appendix 11C contains a list of the Biodiversity Action Plan (BAP) species that have been considered and informed the surveys of particular species that have been undertaken.

Field Studies

Habitats

11.4.14 The types and extent of habitats identified within the Main Study Area are described in Table 11-3 and shown in the Lake Lothing Third Crossing PEA report (Appendix 11A) and Figure 11.2.

Table 11-3 – Habitats present in the Main Study Area

Habitat	Description
Amenity Grassland	There is an area of amenity grassland on the corner of Rotterdam Road and Denmark Road comprising a playing field and recreational area. This habitat is of Negligible ecological value.
Hard Standing	Several areas of old hard standing are present, containing numerous cracks within which vegetation has become established. Species present include buddleia <i>Buddleja davidii</i> , gorse, willow herb and several species of grasses. This habitat is of Negligible ecological value,
Tall Ruderal	Small isolated areas of this habitat were present to the north of the railway line adjacent to Denmark Road. These areas were dominated by bramble, with willow herb, common nettle, ragwort <i>Senecio jacobaea</i> , common hogweed <i>Heracleum sphondylium</i> , ivy, bindweed <i>Convolvulus arvensis</i> , broom <i>Cytisus scoparius</i> and dog rose <i>Rosa canina</i> . This habitat is of low ecological value.
Unimproved Neutral Grassland	Small areas of grasses were interspersed within the tall ruderal, and these consisted of perennial rye grass <i>Lolium perenne</i> , timothy-grass <i>Phleum pratense</i> , false oat grass <i>Arrhenatherum elatius</i> and willow herb. There were also some woody species within the tall ruderal, including elm, hawthorn and sycamore. This habitat is found throughout the UK and is of low ecological value.
Standing / Tidal Water	Lake Lothing is a saltwater lake, which at the western extent is connected to Oulton Broad and the River Waveney. The lake is tidal and exposes mudflats at some locations at low water. There is no emergent vegetation and the lake is subject to considerable disturbance through its use as a port. Mudflats and saline lagoons are both priority habitats, however Lake Lothing is a poor example of these habitats and hence is of low ecological value.
Benthic	Water in Lake Lothing is of poor ecological quality (see Water Framework Directive Assessment, Appendix 17A). Lake Lothing contains silty sediments with highly turbid water. These habitats support an impoverished invertebrate community and low numbers of typical fish species. Other than eel <i>Anguilla anguilla</i> no migratory fish species were shown to be present.

11.4.15 No groundwater dependent terrestrial ecosystems have been identified within the Main Study Area which is the area of groundwater that is reasonably likely to be impacted by any change as a result of the Scheme, and as identified in Chapter 17, impacts upon these habitats are scoped out of the assessment.

Species

11.4.16 A summary of the results of surveys undertaken for the species identified in Paragraph 11.4.1 is provided in Table 11-4.

Table 11-4 – Survey Findings for Species

Species	Description
Bats	<p>Assessment of the suitability of structures to support roosting bats were carried out and locations for walked transect surveys determined in August 2016.</p> <p>Five structures (labelled B1 to B5 on Figure 11.3) and no trees within the Main Study Area were confirmed as suitable for use as bat roosts. Bat roost surveys were undertaken at each of these structures. Sites B1, B3 and B4 were surveyed in summer 2016, B2 in early summer 2017 and B5 in early autumn 2017. No evidence of roosting bats was found during any survey. Surveys undertaken at structure B1 recorded a single Nathusius' pipistrelle <i>Pipistrellus nathusii</i>, a species which is widespread but rare within the UK.</p> <p>A hibernation survey was undertaken at structure B1 during winter 2016/2017 (it being the only structure suitable for hibernation). No bat hibernation behaviour was recorded.</p> <p>Walked transect surveys were undertaken during late summer 2016 and late summer 2017. Bat activity was consistently low, typically with just a single bat pass recorded. Nathusius' pipistrelle was not recorded during these surveys.</p> <p>Detailed findings of the bat survey are included in Appendix 11B.</p>
Badgers	<p>During the PEA, no field signs of badger <i>Meles meles</i> were found. Suitable habitat is available for this species adjacent to the railway line, however, there is little connectivity to the wider area and it is unlikely that this species is present. A suspected badger sett was identified by the Applicant at grid reference TM54384 92899, although an assessment of this during the PEA subsequently showed it to be a fox den.</p>
Otters and Water Voles	<p>The PEA found that Lake Lothing provides poor quality habitat for otters and water voles. No evidence of these species was found during any of the surveys, and it is therefore concluded that these species are absent and no further survey is appropriate.</p>
Birds	<p>Trees and woody vegetation within the Main Study Area provide suitable habitat for breeding birds. The former industrial sites on the south side of Lake Lothing are suitable foraging and nesting habitat for black redstart.</p> <p>Surveys for this species undertaken in 2017 showed that black redstart was not breeding within the survey area shown in Figure 11.5.</p> <p>Peregrine falcons are known to have nested on the grain silo building to the north of Lake Lothing and sightings of this species were confirmed during surveys in 2017.</p> <p>25 species of birds in low numbers, predominately comprising gulls and waders, were recorded within Lake Lothing during winter. The majority of Lake Lothing is open water, large proportions of the banks of which have wooden or concrete-clad vertical faces. A small area (Jeld Wen) contains areas of sand, gravel and mud at the edge of the water. Lake Lothing is of local value to wintering birds.</p> <p>The findings of the wintering bird survey are provided in Appendix 11D.</p> <p>The locations of breeding and wintering bird surveys within the Main Study Area are shown in Figure 11.5.</p>

Species	Description
Reptiles	Tall ruderal vegetation, grassland and hard standing within the Main Study Area provide suitable habitat for reptiles. Reptile surveys undertaken in spring and autumn 2017 within areas of suitable habitat adjacent to the East Suffolk Line to the north side of Lake Lothing recorded a small population of common lizard. In addition, a single common lizard was recorded on two occasions in September 2017 during the PEA (Appendix 11A) on the south side of Lake Lothing. These areas are shown on Figure 11.4 and additional information is provided in the reptile survey report (Appendix 11E).
Terrestrial Invertebrates	<p>An area of rough grassland centred on grid reference TM538925 is a dedicated wildlife area for the five-banded weevil wasp <i>Cerceris quinquefasciata</i>, a nationally rare and UK BAP Priority Species of sand-burrowing insect. Habitat suitable for use by this species includes the sandy substrate associated with amenity planting on the south side of Lake Lothing.</p> <p>Invertebrate surveys were undertaken on an area shown in Figure 11.6 on the 26th of May 2017, 22nd of June 2017, and 31st July 2017 using a range of techniques as described in Appendix 11F.</p> <p>A total of 207 species were identified including the five-banded weevil-wasp and the UK BAP Priority Species small heath <i>Coenonympha pamphilus</i>.</p>
Marine invertebrates	Lake Lothing supports an impoverished community of marine invertebrates which is likely to be a result of the existing drainage regime. Further information is included in Appendix 11G.
Fish	Fish trawls have showed low numbers of typical fish species to be present in Lake Lothing. These include eels but no other migratory species. Further information is included in Appendix 11G.
Other Species	Habitats within the Main Study Area were confirmed during the Phase 1 Survey to be suitable to support UK and Suffolk BAP Priority Species including hedgehog <i>Erinaceus europaeus</i> .
Schedule 9: Invasive Species	<p>The data search returned records of species listed on Schedule 9, including wakame <i>Undaria pinnatifida</i>, montbretia <i>Crocossmia pottsii</i> x aurea, three-cornered garlic <i>Allium triquetrum</i>, New Zealand pigweed <i>Crassula helmsii</i>, Virginia-creeper <i>Parthenocissus quinquefolia</i>, wall cotoneaster <i>Cotoneaster horizontalis</i>, Japanese rose <i>Rosa rugosa</i>, yellow archangel <i>Lamiasstrum galeobdolon</i> ssp. <i>argentatum</i>, Indian balsam <i>Impatiens glandulifera</i> and Japanese knotweed <i>Fallopia japonica</i>.</p> <p>Three stands of Japanese knotweed were found within the Order limits during the Phase 1 survey undertaken to inform the PEA (Appendix 11A) at TM53770 93019, TM53976 92398 and TM53906 92409. A single stand of Japanese rose was found at TM538929.</p>

11.5 Predicted Impacts before mitigation

Statutory Designated and Non-Statutory Protected Sites

- 11.5.1** A screening study, or threshold assessment, to inform a Habitats Regulations Assessment of the effects of the Scheme on Internationally Designated sites identified in Section 11.4.4 is presented in the HRA Report (document reference 6.5). This concludes that there are no likely significant adverse effects on any Natura 2000 site or its qualifying features or conservation objectives as a result of the Scheme. The Scheme will therefore not give rise to adverse effects on sites protected at an International level of importance.
- 11.5.2** No land take will take place for the Scheme from any SSSI, LNR or CWS. Effects on other designated sites will therefore be neutral during both the construction and operational phase.
- 11.5.3** It is possible that contaminated material might be present within the sediment of Lake Lothing. Sediment modelling has, however, shown that there is no difference in the movement of sediment around Lake Lothing whether the Scheme is present or absent. As there will be no change in sediment transport, changes in sediment movements will have no significant effect on ecological resources as a result of the Scheme. The movement of sediments is considered further in Chapter 17 and the Sediment Transport Assessment (Appendix 17C).

Air Quality

- 11.5.4** Chapter 8 considers the likely significant effects of the Scheme upon air quality and this includes in Appendix 8G an assessment of the effects of road traffic emissions upon ecologically designated sites due to increased NO_x levels and increased nitrogen deposition (N-deposition).
- 11.5.5** As presented in Appendix 8G, five designated and non-designated sites have been included within the assessment::
- Gunton Warren LNR;
 - Leathes Ham LNR;
 - Brooke Yachts and Jeld Wen CWS;
 - Kirkley Ham CWS; and
 - Barnby Broad and Marshes SSSI.
- 11.5.6** The assessment in Appendix 8G has identified that there are no likely significant effects upon Gunton Warren LNR, Brooke Yachts and Jeld Wen CWS or Barnby Broad and Marshes SSSI and the impacts of air quality upon these sites is not considered further in this assessment.
- 11.5.7** Leathes Ham LNR, as shown on Figure 11.1, lies to the west of Peto Way which will experience an increase in traffic flow during the operational phase of the Scheme (see Figure 19.4 which shows the modelled Annual Average Daily Traffic (AADT) along this route). The air quality modelling has identified that N-deposition as a result of the Scheme will be above 1% of the critical load (see Appendix 8G for a full definition) at

a distance up to 75.5m from the road edge but as the modelled annual deposition in the opening year remains below the total critical load ($15\text{kg N ha}^{-1} \text{y}^{-1}$), there will be no impact upon this designated site and there will be no significant effect.

- 11.5.8** Kirkley Ham CWS is located to the south east of the Order limits and lies either side of the A12 Tom Crisp Way (see Figure 4.1 and Figure 11.1). As shown on Figure 19.4, the AADT on Tom Crisp Way is modelled to increase from 16,409 to 25,044 in the opening year.
- 11.5.9** The air quality modelling has identified that N-deposition will be above 1% of the critical load for acid grassland across the entire CWS in the opening year (DS scenario) and the critical load for acid grassland of $5\text{kg N ha}^{-1} \text{y}^{-1}$ is exceeded across the CWS in both the DM and DS scenarios.
- 11.5.10** Using the criteria identified in Table 11-2, the increase in N-deposition above the critical load is considered to be a moderate impact due to the permanent impact upon a site of County value. Having applied professional judgement and applying the precautionary principle, this is a significant adverse effect upon this CWS.
- 11.5.11** Mitigation for these significant effects upon Kirkley Ham CWS have been discounted due to their unfeasible and un-proportional nature. Three mitigation measures have been discounted for the following reasons:
- Reducing traffic upon Tom Crisp Way; this would be contrary to the objectives of the Scheme;
 - Realignment of Tom Crisp Way; this would not reduce the significant effect as the effect is experienced across the entire site; and
 - Barriers; barriers are presently being trialled on much busier roads than Tom Crisp way (such as the M25) and their effectiveness is uncertain and may even be counterproductive. It is also not considered that a barrier along Tom Crisp Way, from a visual perspective, would be a suitable mitigation measure.
- 11.5.12** With regard to construction dust emissions, the assessment within Chapter 8, and the results shown in Figure 8.2 identify that the effects of construction dust are likely to be as a worst case restricted to within 50m of the Order limits and therefore will not adversely affect any designated sites.

Noise

- 11.5.13** The assessment within Chapter 13 has considered the effects of noise upon noise sensitive receptors in the operational phase of the Scheme and identified designated ecological sites in Table 13-25. The modelled change in traffic noise at these designated sites is no greater an increase than 4dB and will not adversely or beneficially affect the species and habitats for which the site is designated.
- 11.5.14** The terrestrial species that have been identified through surveys (and presented in Table 11-4) are not considered to be sensitive to the order of increase in noise that is likely to result during the construction or operational phase of the Scheme and no significant adverse effects will therefore result.
- 11.5.15** With regard to underwater noise the marine survey has not identified any fish that are likely to be at risk from marine noise. The Environment Agency has been consulted

upon the scope of the assessment with regard to the effects of noise upon marine ecological resources, and have not raised any issues of concern. However, as stated in the HRA Report (document reference 6.5) the contractor for the construction phase of the Scheme will undertake their works with due regard to good practice measures with regard to harbour porpoise.

Habitats

11.5.16 The site is largely urban, interspersed with areas of improved grassland, scattered trees, scrub and standing water. These habitats are of no greater than low biodiversity value.

11.5.17 Marine habitat within Lake Lothing supports an impoverished invertebrate fauna and low numbers of typical fish species as shown in Appendix 11G. These habitats are of no greater than low biodiversity value.

Species

11.5.18 The effects of the Scheme on particular species are described in Table 11-5.

11.5.19 Sources of impacts upon these species could arise from:

- the loss of suitable habitats during both construction and operation;
- disturbance during construction in the form of light, dust or noise;
- discharge of pollutants into watercourses;
- mobilisation of contaminated materials; and
- permanent or temporary severance of a route travelled by protected species.

Table 11-5 - Effects of the Scheme

Species	Effects of the Scheme	Significance	
		Construction	Operation
Bats (Local value)	<p>The Scheme would not give rise to adverse effects on trees or structures that are known to support roosting bats.</p> <p>Bats have been demonstrated through the surveys to use vegetation along the banks of Lake Lothing and the East Suffolk Line as routes for foraging and commuting. The Scheme may disturb foraging bats during construction through vegetation clearance lighting of the construction compound and lifting of the construction works. During the operational phase, however, the Scheme would not be a barrier to bat movements because of the clearance and permeability of the structures provided by the Scheme Bascule Bridge and the bridge over the East Suffolk Line.</p> <p>Lighting of the completed Scheme (see Paragraph 5.5.1) will be provided for the carriageway (Figure 5.7) as well as feature lighting of the Scheme Bascule Bridge counterweights. As there will be no additional lighting of the bat commuting corridor along the East Suffolk line and as Scheme lighting will be elevated on the Scheme that is out with the existing foraging/commuting area, there will be no effects on bats from lighting of the Scheme.</p>	Slight adverse	Neutral

Species	Effects of the Scheme	Significance	
		Construction	Operation
Breeding Birds (general) (local value)	All trees and hedges that would be removed by the Scheme are likely to be suitable for use by breeding birds.	Slight adverse	Neutral
Black redstart (local value)	Black redstart was not found to be breeding within the survey area (Figure 11.5, but evidence in the form of mimic calls from other species from within the survey area suggests that this species is present within the wider area and could colonise the area of the Scheme prior to construction commencing.	Neutral	Neutral
Peregrine (local value)	Peregrines are known to nest close to the Scheme. Anecdotal evidence indicates that nesting sites are on the opposite side of the grain silo to the Scheme (on the north side of the grain silo). This feature would not be affected by the Scheme.	Neutral	Neutral
Wintering Birds (local value)	<p>Small numbers of birds use Lake Lothing during the winter period (see Appendix 11D).</p> <p>Construction and operation of the Scheme would give rise to increased noise and artificial light which may increase current levels of disturbance of wintering birds. However, current levels of noise and lighting within this area are already elevated.</p> <p>Birds habituate to constant levels of noise and lighting and those currently using Lake Lothing are therefore unlikely to be further affected by such an increase in background levels.</p> <p>Given the low numbers of birds concerned and their habituation to current high levels of disturbance, effects of additional noise and lighting are not considered to be significant.</p>	Neutral	Neutral
Reptiles (local value)	A small population of reptiles has been identified on land to the north of Lake Lothing (Appendix 11E) and a single reptile was recorded in the south. Without mitigation these animals are at risk of being disturbed and displaced by construction works.	Slight adverse	Neutral
Terrestrial invertebrates (local value)	The Scheme will require both temporary and permanent land take (see Figure 1.3) from an area of supporting habitat for the five-banded weevil-wasp <i>Cerceris quinquefasciata</i> (see Appendix 11F) although burrowing habitat for this species will not be disturbed as a result of the Scheme.	Slight adverse	Slight adverse

Species	Effects of the Scheme	Significance	
		Construction	Operation
Marine invertebrates (negligible value)	<p>Lake Lothing supports an impoverished community of marine macroinvertebrates (see Appendix 11F for further information), which is likely to be a result of its existing drainage regime. No species of particular nature conservation value were identified during surveys, although the non-native brackish water mollusc <i>Theora</i> was present and this species could be spread during the construction phase.</p> <p>Dredging of Lake Lothing will therefore not have an effect upon any species of conservation value.</p>	Slight adverse	Neutral
Fish (general) (negligible value)	<p>Fish trawl surveys (see Appendix 11G) indicate that the habitat in Lake Lothing is of limited value to fish. Eel <i>Anguilla</i> was confirmed to be present in low numbers, but no other species of particular nature conservation interest were present. Although temporary disturbance may occur during the construction period, any effects on fish would be negligible (see 11.5.15). During the operational phase the Scheme would have no effects on fish.</p>	Neutral	Neutral
Migratory fish (negligible value)	<p>No migratory fish species other than eel were found during surveys and the Scheme will have no effect upon migratory fish.</p>	Neutral	Neutral
Eels (local value)	<p>The habitats within Lake Lothing provide suitable habitat for eels, of which a solitary specimen was found during the fish trawl surveys (Appendix 11G). Although temporary disturbance may occur during the construction period, any effects on eels would be negligible (see 11.5.15). During the operational phase the Scheme would have no effects on eels as it will not impede their passage through Lake Lothing.</p>	Neutral	Neutral
Marine mammals including harbour porpoise (local value)	<p>Open water within Lake Lothing could be used by marine mammals, including harbour porpoise, which are present within the North Sea. However, no marine mammals were identified within biological records or during the PEA (Appendix 11A), and no anecdotal evidence of sightings within Lake Lothing were identified. It is therefore highly unlikely that marine mammals would be affected by the Scheme.</p> <p>Effects of the noise from piling activities during construction on Harbour Porpoise within the Southern North Sea cSAC are discussed in greater detail in the HRA Report (document reference 6.5).</p>	Neutral	Neutral
Hedgehogs (negligible value)	<p>The habitats within the site, and the surrounding residential gardens, are suitable to support hedgehogs.</p>	Neutral	Neutral

Species	Effects of the Scheme	Significance	
		Construction	Operation
Schedule 9 Invasive Species (negligible)	<p>It is an offence to carry out activities that would cause the growth of a Schedule 9 Wildlife and Countryside Act 1981 species in the wild.</p> <p>The Schedule 9 species Japanese knotweed and wakame are present within the vicinity of the works. Measures are required by law to control the spread of these species.</p>	Moderate adverse	Neutral

11.5.20 Table 11-6 describes mitigation measures that are included to mitigate the effects identified in Table 11-5 above as well as identifying further pre-construction surveys to be undertaken to ensure that the status of particular species has not changed between application and construction (for example, pre-construction checks of structures and trees that are suitable for use by roosting bats).

11.5.21 Mitigation measures described in Table 11-6 are included within the interim CoCP (Appendix 5A) and will be developed in detailed design by the contract through the full CoCP which will be approved by the county planning authority.

11.5.22 To facilitate these measures, an Ecological Clerk of Works, specialist ecologist, or similarly competent person (referred to as ECoW in table 11-8) must be appointed to be responsible for overseeing on-site ecological mitigation.

Table 11-6 – Mitigation measures and pre-construction surveys

Species	Mitigation measures	Significance after mitigation	
		Construction	Operation
Bats	<p>There is a risk that bats may colonise structures suitable for roosting prior to construction and therefore pre-construction checks of structures B1 to B5 (see Figure 11.3) will be required.</p> <p>Pre-construction surveys will be undertaken on any building that is suitable to support roosting bats and which would be likely to be disturbed during construction. Surveys would seek to confirm that bats have not taken occupation in these structures since the surveys that have informed this ES then the Ecological Clerk of Works (ECoW) will advise as to the most appropriate course of action to ensure legislative compliance.</p> <p>To minimise the risk of effects on foraging and commuting bats, the use of artificial lighting during construction will be kept to a minimum. Where temporary artificial lighting is used, only the immediate area of works shall be illuminated by using as sharp an angle of lighting as possible and avoid light being directed at, or close to adjacent vegetation. Shields or hoods shall be used to control or restrict the area to be lit. The ECoW shall advise on all temporary lighting proposals prior to installation.</p>	Neutral	Neutral
Breeding birds	In order to minimise the risk of disturbing breeding birds, the removal of trees and hedges should be undertaken outside of the typical bird breeding season (March to July inclusive). If	Neutral	Neutral

Species	Mitigation measures	Significance after mitigation	
		Construction	Operation
	tree and vegetation removal has to take place during this period, the vegetation shall be checked prior to removal for the presence of nests by the ECoW. If nests that are in use are present, it may be necessary to delay work in immediate proximity the nest until the young have fledged.		
Black redstart	A watching brief for the presence of this species will be maintained as appropriate during the construction period by the ECoW. Should black redstart be present and being disturbed by the construction of the Scheme, the ECoW will advise appropriate action in the interests of its protection.	Neutral	Neutral
Peregrine	<p>Peregrines are known to alter their nest locations and it is possible that at the time of construction peregrines may be nesting closer to the Scheme.</p> <p>The extent to which peregrines are sensitive to noise disturbance, however, is unlikely to be a concern given their nesting location adjacent to the port operations which are inherently noisy themselves. Impacts upon peregrines are therefore more likely should there be a disruption to their food source (predominantly pigeons, but also other birds including kittiwake, of which there is a population at Outer Lowestoft Harbour). The Scheme is unlikely to affect the population of these prey species due to the very small amount of land take of the Scheme relative to the wider suitable habitat that is present.</p> <p>Peregrine are a day-flying species that readily acclimatise to, and are to an extent dependent on, human activities in urban areas. Lighting of the Scheme would not give rise to adverse effects on this species.</p> <p>Although the risks of causing disturbance of this species are minimal, the ECoW will maintain a watching brief as appropriate to ensure that no adverse effects occur to peregrine.</p>	Neutral	Neutral
Reptiles	<p>During the construction phase, vegetation clearance of all habitat suitable for reptiles will be undertaken as follows:</p> <ul style="list-style-type: none"> • Reptiles shall be excluded from the proposed works area through habitat manipulation and natural refugia removal; • Habitat manipulation shall involve strimming the vegetation within the works area prior to commencement of works to reduce the vegetation to a sward height that would encourage reptiles to move offsite and into adjacent areas. This shall be undertaken when reptiles are active, i.e. between mid-April to mid-October when the temperature is at least 12°C; • The strimming shall cut vegetation to a height of approximately 150mm to avoid affecting reptiles that may be present. Strimming shall be completed in 	Neutral	Slight beneficial

Species	Mitigation measures	Significance after mitigation	
		Construction	Operation
	<p>phases. All clearance works shall be carried out using hand tools; and</p> <ul style="list-style-type: none"> • These works shall all be supervised by the ECoW. <p>Areas of habitat creation for reptiles will be provided within land as shown on the Landscaping Plans (document reference 2.8) This will include artificial hibernation sites (hibernacula) created using site won materials, such as felled timber, brash, tree roots and inert rubble. These materials may be covered in soil and grass so as not conflict with the aesthetics of landscaping proposals. Hibernacula will be located away from the footpath/cycle lane so as to minimise risk of disturbance.</p> <p>Areas of exposed substrate shall be included within the landscape design of the Scheme for the benefit of reptiles. In combination with provision of a structurally varied vegetation, this will help to provide a mosaic of habitats suitable for use by reptiles. Given the small area of land suitable for reptiles that would be lost, this would be a slight beneficial effect of the Scheme.</p>		
Terrestrial invertebrates	Approximately half of the land take required from supporting habitat for the five-banded weevil-wasp will be reinstated post-construction to be suitable for use by this species.	Slight adverse	Slight Adverse
Marine invertebrates	Control measures shall be implemented through an Invasive Species Management Plan to prevent the spread of the non-native mollusc <i>Theora</i> .	Neutral	Neutral
Marine mammals including harbour porpoise	The contractor will follow the Statutory Nature Conservation Agency protocol (a document produced by Natural England, The Countryside Council for Wales and the JNCC) for minimising the risk of injury to marine mammals from piling noise to prevent adverse effects ³⁴ , secured through the CoCP.	Neutral	Neutral
Hedgehogs	The ECoW will maintain a watching brief during vegetation clearance to protect individual hedgehogs should they be present.	Neutral	Neutral
Schedule 9: Invasive Species	<p>The interim CoCP includes measures to control Japanese knotweed within the Order limits and measures to minimise the risk of its spread, in line with the guidance recommended by the Environment Agency. Details of the specific measures to be implemented would be specified in an Invasive Species Management Plan as required by the interim CoCP.</p> <p>Measures to restrict the spread of wakame during the construction of the Scheme will be included within the full CoCP.</p>	Moderate beneficial	Moderate beneficial

³⁴ http://jncc.defra.gov.uk/pdf/jncc_guidelines_piling%20protocol_august%202010.pdf (accessed 8th January 2018)

11.6 Conclusions and Residual Effects

- 11.6.1 The effects of the Scheme on ecological resources has been informed by desk studies collating available information and original surveys undertaken in connection with the Scheme.
- 11.6.2 With respect to the consideration of sites of international ecological importance, a screening, or threshold assessment, informing Habitats Regulation Assessment has been undertaken (document reference 6.5) and this has concluded that no significant effects would occur as a result of the Scheme. This was confirmed by Natural England in their S42 consultation response.
- 11.6.3 No sites statutorily designated for their ecological value are present within the Main Study Area and no ecologically designated sites outside the Main Study Area would be adversely affected by the proposals.
- 11.6.4 Habitats present within the Main Study Area are common and widespread throughout the UK. None of these receive specific protection by law or are of particular nature conservation value. However, some are suitable to support species that are protected by law or otherwise of particular nature conservation importance.
- 11.6.5 The assessment has identified that there is a significant effect upon Kirkley Ham CWS that cannot be mitigated.
- 11.6.6 The Main Study Area contains five structures that are suitable for use by roosting bats. Surveys undertaken in 2016 and 2017 found no evidence of roosting or hibernating bats at any of these locations. Walked transect surveys showed low numbers of bats foraging and commuting within the Main Study Area. The Scheme will not sever existing commuting routes or foraging habitats and will not adversely affect roosting bats. To avoid possible effects during construction, mitigation measures have been included within the interim CoCP. Pre-construction checks for roosting bats will also be undertaken to confirm that bats have not occupied suitable roosting sites since the production of this ES. With these measures in place the Scheme will not give rise to significant effects upon bats.
- 11.6.7 Breeding bird surveys showed that the bird assemblage identified is typical of an urban-industrial location. Vegetation present in the Main Study Area is likely to be used by common breeding birds and accordingly the ECoW will undertake checks of vegetation prior to its removal to ensure that breeding birds are not affected and with these mitigation measures in place, there would be no residual adverse effects on breeding birds. No effects on the protected species black redstart or peregrine are anticipated.
- 11.6.8 Wintering bird surveys showed that small numbers of birds use Lake Lothing in winter and that these would not be significantly affected by the Scheme.
- 11.6.9 Surveys confirmed that a small population of reptiles is present in habitat along the East Suffolk line to the north of Lake Lothing, and a single common lizard was recorded on the south side. Measures to minimise the risk of adverse effects occurring on reptiles during construction are proposed. During the operational phase the creation of suitable habitat will result in a slight beneficial effect upon reptiles, although this

does not constitute a significant effect.

- 11.6.10** The Scheme will affect supporting habitat used by the five-banded weevil-wasp as a result of temporary and permanent land take. Areas of temporary land take will be reinstated to be suitable for use by this species, but a small part of the supporting habitat will be permanently lost. This will result in a slight adverse but not significant residual effect.
- 11.6.11** The Scheme would have no adverse effects on marine invertebrates or fish. Changes in sediment movements occurring as a result of construction of the Scheme will also have no effect on ecological resources (see Chapter 17 and Appendix 17C).
- 11.6.12** Measures would be implemented within the full CoCP for the Scheme to ensure that appropriate attention is given to ecological resources during the construction period. These measures include pre-construction surveys for bats to ensure that suitable sites have not become colonised as bat roosts since submission of the ES, advance measures to minimise the risk of affecting individual reptiles, and watching briefs for other ecological resources including breeding birds and hedgehogs to ensure that adverse effects on individual animals that may be present are avoided. These measures would be implemented under the supervision of the Scheme's ECoW.
- 11.6.13** Measures would also be implemented within the full CoCP to control and prevent the spread of Schedule 9 invasive plant species in accordance with best practice and the recommendations of the Environment Agency, as well as further control measures to prevent the spread of the non-native marine mollusc *Theora*. It is concluded that the control and removal of Japanese knotweed from within the Order limits would constitute a significant beneficial effect.

12 Geology, Soils and Contamination

12.1 Scope of the Assessments

Introduction

12.1.1 This chapter describes the assessment of the likely significant effects of the Scheme on geology, soils and contamination during the construction and operational phases. It is supported by Appendices 12A, 12B and 12C and Figures 12.1 to 12.2.

12.1.2 The assessment of this topic area considers potential impacts relating to the following receptors:

- Effects on geology and soils;
- Effects on human health (site users and adjacent site users including construction workers);
- Effects on infrastructure in the operational phase (including new buildings, buried services and foundations); and
- Effects on controlled waters (from the mobilisation of contaminants) is discussed but is specifically dealt with in Chapter 17.

12.1.3 The effects on ecological receptors is specifically dealt with in Chapter 11.

12.1.4 The potential for disturbance of existing contaminated land (including lake-bed sediments) and the potential for construction to establish pathways between contaminants and receptors are also discussed.

Study Area

12.1.5 An initial study area, for which the Desk Study Report (Scoping Report Appendix 6A Annex G) was originally prepared, comprised in most locations a larger area than the Order limits due to the uncertainty at the time (September 2016) as to the amount of land that would be necessary to construct, operate and maintain the Scheme. The decision was taken at that time to assess a wider area in order to all possible constraints and issues in relation to geology, soils and contamination to be identified and assessed.

12.1.6 The initial study area covered an area of approximately 21ha, centred at National Grid Reference 653884, 292755 and this is shown in Appendix 6A (Appendix G).

12.1.7 Following comments from the Environment Agency that were provided along with the Scoping Report (Appendix 6A), the Desk Study Report has been updated and is presented in Appendix 12A.

12.1.8 The study area for the assessment is the Order limits, although a 500m search area for sites of geological interest is used together with a 250m search area for sites such as gasworks, landfills, dye works and bleach works which can be particularly contaminated and from which contamination could have migrated into the Order limits.

Limitations

12.1.9 The ground investigation (see 12.3.4) and the earlier work to support the Desk Study

Report could not access the former timber yard (also known as Jeld Wen) where the New Access Road is to be constructed. No piling is required in this area and highway construction will not extend beyond approximately 1.5m depth in this area therefore it is considered that shallow ground conditions can be assessed at detailed design stage.

12.2 Directives, Regulations, and Relevant Policy

12.2.1 The assessment has been undertaken in accordance with and in reference to legislation specific to geology, hydrogeology and human health as follows.

National Legislation

The Environmental Protection Act 1990

12.2.2 The Environmental Protection Act 1990 defines, within England, Wales and Scotland, the fundamental structure and authority for waste management and control of emissions into the environment. The Act was intended to strengthen pollution controls and support enforcement with heavier penalties.

12.2.3 Part 2A of the Environmental Protection Act 1990 was inserted into that Act by section 57 of the Environment Act 1995 and contains a regulatory regime for the identification and remediation of contaminated land. In addition to the requirements contained in the primary legislation, operation of the regime is subject to regulations and statutory guidance.

12.2.4 The main objective underlying the introduction of the Part 2A contaminated land regime was to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment, assessed in the context of the current use and circumstances of the land.

12.2.5 It provides a means of identifying and remediating land that poses a significant risk to health or environment, where there is no alternative solution. It also works alongside planning rules to help ensure that this land is made suitable for use following development.

12.2.6 Development of land will have to take into account Part 2A because a change in the use of the land may bring the development inside the statutory definition of contaminated land by creating a pollutant linkage.

Water Resources Act 2003

12.2.7 The Water Resources Act 1991 replaced the corresponding sections of the Water Act 1989. The Act sets out the responsibilities of the Environment Agency in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The Act regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwaters. To prevent pollution of controlled waters, planning policies and decisions should ensure that new development is appropriate for its location. It requires risks at a construction site to be adequately characterised.

Water Act 2003.

12.2.8 Under the Water Act it is an offence to cause or knowingly permit a discharge of poisonous, noxious or polluting matter into any Controlled Waters without the proper authority.

CDM Regulations

12.2.9 The Construction (Design & Management) Regulations (CDM 2015) are the main set of regulations for managing the health, safety and welfare of construction projects (this includes the risks posed by contamination to construction workers and others who may be affected by the construction activities such as the general public and adjacent site users). CDM applies to all building and construction work and includes new build, demolition, refurbishment, extensions, conversions, repair and maintenance.

National Policy

National Policy Statement for National Networks (January 2015)

12.2.10 The National Policy Statement for National Networks (NNNPS) provides some guidance on assessing geology, soils and contamination in relation to biodiversity and ecological conservation, coastal change, noise and vibration, water quality and resources, land use and sets out how the impacts should be considered.

12.2.11 Paragraph 5.168 of the NNNPS states “For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this.”

National Policy Statement for Ports (2012)

12.2.12 NPS for Ports (PNPS), in Paragraph 5.13.8, likewise advises that developments on “previously developed land.....should ensure that they have considered the risk posed by land contamination”.

National Planning Policy Framework 201

12.2.13 NPPF (paragraphs 120-122) provides guidance on land contamination issues. These include local policies and decisions that ensure development sites are suitable for use, taking account of ground conditions and pollution arising from previous uses, as well as any proposals for land remediation.

12.2.14 Paragraph 120 of the NPPF states that

“To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.”

12.3 Methods of Assessment

12.3.1 An Environmental Desk Based Study (Appendix 12A) has been prepared, using information from historical Ordnance Survey maps, environmental data reports, previous GI and publicly available remediation reports together with published and internet based information sources.

12.3.2 An understanding of the likely existing environmental setting in terms of geology, soils and contamination has been established with reference to the following sources of information:

-
- British Geological Survey, www.bgs.ac.uk;
 - Environment Agency;
<https://www.gov.uk/government/organisations/environment-agency>;
 - Historical Ordnance Survey maps and environmental data reports obtained from GroundSure;
 - Environmental Review and Desk Study Report, reference 13578DS prepared by RSA Geotechnics Ltd dated June 2013;
 - Interpretative Report, Ground Investigation Report Number 13578GI prepared by RSA Geotechnical Ltd dated July 2013;
 - Phase III Remediation Method Statement, reference NG13/015/RMC prepared by JPC Environmental Services dated October 2013; and
 - Phase IV Environmental Remediation and Validation Report, reference NG13/015/RMC/v1.1, prepared by JPC Environmental Services dated April 2015.

12.3.3 The assessment has been based upon the guidance presented in DMRB Volume 11 Section 3 Part 11 Geology and Soils³⁵ and be supplemented by the assessment procedures contained within BS10175:2011³⁶ and CLR11³⁷.

Ground Investigation and Interpretative Reporting

12.3.4 A Ground Investigation (GI) commenced in late July 2017 completing in April 2018 and comprised:

- 28 onshore cable percussion / rotary boreholes;
- 16 machine excavated trial pits;
- 14 window samples;
- Sediment sampling within Lake Lothing for contamination testing;
- Surface water sampling within Lake Lothing for contamination testing (see Appendix 12B);
- Soil and groundwater sampling and chemical testing;
- Gas and groundwater monitoring wells constructed in selected boreholes; and
- Gas and groundwater monitoring.

12.3.5 An Interim Interpretative Environmental Ground Investigation Report has been prepared using the information gathered from the ground investigation and is included in Appendix 12B. This includes human health, controlled waters and ground gas risk

³⁵ The Highways Agency et al, (1993), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 11, Geology and Soils.

³⁶ British Standards Institution (2011). BS 10175:2011 Code of Practice for the Investigation of Contaminated Land.

³⁷ The Environment Agency (2004). Model Procedures for the Management of Land Contamination. Contaminated Land Report 11.

assessments undertaken in accordance with:

- CLR and SR (SC050021 series) (DEFRA) guidance as well as CL:AIRE guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008,
- Environment Agency Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination, 2006; and
- Assessing Risk Posed By Hazardous Ground Gases to Buildings (CIRIA) C665, dated 2007.

12.3.6 These human health, controlled waters and ground gas risk assessments have assessed the potential contaminant linkages identified in the Desk Study Report (Appendix 12A) and have allowed the development of an updated conceptual site (CSM) model in Appendix 12B to clarify potential source-pathway-receptor linkages, and assist with the assessment of potential impacts on human health and controlled waters.

12.3.7 A Piling Works Risk Assessment (presented as Appendix 12C) has been prepared to assess the likely impact on controlled waters and underlying geology from the piling works.

Significance criteria

12.3.8 In terms of geological and geomorphological resources as well as contaminated land, DMRB does not provide any specific methods of assessment or scales of measurement for either the value / sensitivity of the receptor or the magnitude of the impact. Assessment has therefore been based on professional judgement, using a phased approach, taking into account the assessment procedures detailed in CLR11 to inform a quantitative risk assessment using the source-pathway-receptor protocol. Determination of significance will be carried out using the criteria detailed in CIRIA C552 and professional judgement.

Consultation

12.3.9 Specific consultation with the Waveney District Council facilities management team and the Environment Protection Officer at Suffolk Coastal and Waveney District Councils was undertaken to ascertain if they were aware of any potentially contaminated sites within the Order limits.

12.3.10 Information from the discussion with Waveney District Council is included within the Desk Study Report (Appendix 12A) and information from the discussion with the Environmental Protection Officer at Suffolk Coastal and Waveney District Councils is detailed in the Interpretative Environmental Ground Investigation Report.

12.4 Baseline Environment

Designated Sites

12.4.1 No geological designated sites exist within 500m of the Order limits although Corton Cliffs SSSI which is a site designated because of its Pleistocene era geological interest, has been identified during scoping as a site that should be considered for possible inclusion within the assessment. As Corton Cliffs SSSI is approximately

3.5km from the Order limits there is not considered to be a pathway to Corton Cliffs from the Scheme at that distance and it is very unlikely to be impacted upon. Therefore it has not been included within the scope of the assessment in this chapter.

Desk based studies

Bedrock Geology

12.4.2 As indicated on the British Geological Survey (BGS) website the bedrock geology across the study area comprises the Crag Group. This is a sedimentary green to orange sandstone containing haematite. In the lower deposits, the material predominantly comprises flint gravel.

Superficial Geology

12.4.3 The BGS website indicates that the northern and southern ends of the Order limits are underlain by sand of the Happisburgh Glacigenic Formation while the central parts of the Order limits immediately adjacent to Lake Lothing are underlain by alluvium deposits comprising clay, silt, sand and gravel.

Soils and Sediment

12.4.4 The nature of soils and sediments within the Order limits is undetermined. The Soilscales website³⁸ indicates the soils comprise the following: fen peat soils, freely draining slightly acidic sandy soils and freely draining slightly acidic loamy soils. However, due to previous development within the Order limits, naturally occurring soils were only occasionally encountered at the surface during the ground investigation and made ground is more prevalent at the surface.

Potentially Contaminated Sites

12.4.5 The Desk Study presented in Appendix 12A includes a review of information from a GroundSure report. This records that no locations within the study area are determined as contaminated land under Part 2A legislation, but does record a number of historical ground workings, as well as industrial uses; all of which may have introduced contaminated material into the Order limits, including ponds, unspecified pits, lake, unspecified wharf, quay and a refuse heap, rail, ship building and an ice works.

12.4.6 There are records relating to an historic Environment Agency landfill within the south east corner of the study area as shown on Figure 12.1. GroundSure does not provide any further information on the waste types accepted or licence numbers. The Environmental Protection Officer at Suffolk Coastal and Waveney District Councils provided a brief ground investigation report on this landfill area and this is summarised in the Interpretative Environmental Ground Investigation Report (Appendix 12B).

12.4.7 In addition, two refuse tips (marked on 1963 historic mapping and recorded by GroundSure Local Authority Landfills) are also recorded at this location within the study area but not marked on Figure 12.1 as we cannot delineate the boundaries with any certainty.

³⁸ Soilscales. Available from: <http://landis.org.uk>

Previous Ground Investigation / Remediation Information

- 12.4.8** Ground investigation and remediation verification has been undertaken at the Council Offices (see Figure 4.1) by RSA Geotechnics Ltd and JPC Environmental Services. Details are presented in the Desk Study (Appendix 12A). The ground investigation undertaken by RSA Geotechnics Ltd identified the presence of elevated polyaromatic hydrocarbons, total petroleum hydrocarbons (TPH), asbestos and lead within soils which posed a potential risk to human health. It was concluded that there was negligible risk to controlled waters and to the Council office site from ground gas.
- 12.4.9** Remedial works comprising clean cover capping of landscaping areas, removal of all underground fuel storage tanks, and removal of asbestos containing material (ACM) were undertaken.
- 12.4.10** The site currently occupied by the Registry Office on Canning Road (see Figure 4.1), was part of the same site as the Council Offices but was not included in previous ground investigation or remediation works. It is likely that similar contamination will exist within the Order limits in proximity to the Registry Office as was found on the site of the Council offices pre-remediation.
- 12.4.11** A Ground Investigation Report was provided by Suffolk Coastal and Waveney District Council for the small landfill in the south east corner of the Order limits (see Figure 12.1). No other ground investigation reports have been made available for elsewhere within the Order limits.

2017/2018 Scheme Specific Land Based Ground Investigation

- 12.4.12** A land based GI was undertaken by Geosphere Ltd (contracted to the Applicant) from July 2017 to April 2018 with the dual purpose of informing the design of the Scheme and identifying the extent of any contamination that is present. The scope of works are detailed in the Interim Interpretative Environmental Ground Investigation Report presented as Appendix 12B but broadly comprised:-
- Cable percussion boreholes;
 - Machine excavated trial pits;
 - Window Samples;
 - Hand dug trial pits / inspection pits;
 - Installation of gas and groundwater monitoring wells in selected boreholes;
 - Soil sampling from the boreholes, trial pits and window samples for the purpose of chemical testing; and
 - Gas and groundwater monitoring and groundwater sampling and chemical testing following completion of the intrusive works.
- 12.4.13** Figure 12.2 presents the exploratory hole locations. Engineer's logs and chemical test results are presented in Annex C of the Interim Interpretative Environmental Ground Investigation Report (Appendix 12B).
- 12.4.14** Made ground was recorded at all exploratory hole locations and varied in thickness from 0.75m to at least 3.7m (although this same location recorded possible made

ground in excess of 6.0m depth). The made ground was generally granular and heterogeneous in nature and was composed of detritus including concrete, charcoal, clinker, brick, tile, metal (including reinforcing bar), ash, asphalt, glass, wood, soot, pottery and cast iron. Fragments of potential asbestos containing materials were recorded at two locations (TPC02 and BH102) (see Figure 12.2).

12.4.15 Solid concrete up to at least 0.6m thick and asphalt / flexible surfacing up to 0.2m thick was recorded at a number of locations both at and below the surface. One location recorded concrete to 2.0m thick where it varied from crumbling degraded concrete to solid layers.

12.4.16 A small diameter clay pipe (possibly a redundant land drain) was encountered at one location and was infilled with clay with a hydrocarbon odour.

12.4.17 Other than the man-made detritus recorded within the made ground, visual and olfactory evidence of contamination was recorded at a few locations as hydrocarbon odour within both made ground and natural ground deposits.

12.4.18 The underlying natural deposits were predominantly sand, although layers of silt, clay, gravel and sand and gravel were also recorded.

12.4.19 The Interpretative Environmental Ground Investigation Report (Appendix 12B) includes human health and controlled waters risk assessments, gas risk assessments and waste classification / re-use assessments which have informed the need for mitigation measures.

Ground gas monitoring

12.4.20 Geosphere undertook gas and groundwater monitoring of all installed monitoring wells on two occasions 9th to 14th May 2018 and 23rd to 24th May 2018.

12.4.21 This comprised measuring the following parameters from each monitoring well:-

- Methane concentration;
- Carbon dioxide concentration;
- Oxygen concentration;
- Volatile Organic Compounds (VOC);
- Atmospheric pressure; and
- Water level.

12.4.22 Methane was recorded up to 0.1% and carbon dioxide up to 3.6%. Volatile organic compounds were recorded up to 4ppm. Flow rates varied with initial flows up to 50.4 litres per hour but these reduced to less than 1 litre per hour once a steady state had been reached and are considered to be elevated as a result of fluctuating water levels rather than generation of gas.

12.4.23 The ground gas risk assessment undertaken in accordance with CIRIA C665 did not record ground gas at concentrations that would require specific gas protection over and above standard construction techniques.

Human Health Risk Assessment

12.4.24 A human health risk assessment undertaken to identify potential risks to site users and adjacent site users from contamination within the Order limits and has identified the following:-

12.4.25 Asbestos recorded by the chemical testing laboratory in two samples and also recorded by the GI Contractor at one location during the ground investigation.

12.4.26 Exceedances of the public open space screening values have been recorded for pH, lead and benzo-a-pyrene.

12.4.27 Exceedances of the commercial / industrial screening values have been recorded for pH and lead.

Controlled Waters Risk Assessment

12.4.28 Soil leachate chemical testing was undertaken as part of the ground investigation and the results indicate the following minor theoretical risks:-

- Lake Lothing surface water body – metals and speciated polyaromatic hydrocarbons.
- Underlying aquifers - pH, metals and speciated petroleum hydrocarbons.

12.4.29 Groundwater sampling and testing was undertaken and the results indicate the following:-

- Exceedances for copper, lead, nickel, hexavalent chromium and zinc indicating groundwater has the potential to impact the surface waters of Lake Lothing. However, the risk of impact is considered low due to the low magnitude of the exceedances.

12.4.30 Minor exceedances for pH, sulphate, arsenic, chromium and nickel indicating groundwater has been previously impacted although due to the low magnitude of the exceedances, an unacceptable risk is considered unlikely.

12.4.31 Shallow groundwater exceedances have not been replicated in the deeper groundwater samples and surface sampling of Lake Lothing has not recorded the same determinands as those recorded in either the soil leachate or groundwater samples indicating an impact is not considered to be occurring.

12.4.32 There is some olfactory/ visual evidence of the presence of hydrocarbons in the vicinity of the exploratory holes near the southern bank of Lake Lothing (and in a number of other isolated locations). In addition, there are some associated VOC readings (identified using a PID meter during ground investigation) and minor theoretical hydrocarbon exceedances in soil leachate screening values.

12.4.33 Sampling of groundwater from monitoring well installations within adjacent boreholes do not show any exceedances of groundwater screening values for hydrocarbons. It is therefore concluded that although there is some evidence of hydrocarbon presence in a number of locations on site, particularly near the southern bank of Lake Lothing, the analysis of soil, soil leachate and groundwater samples identify that the concentrations are not significant. It is possible that minor spillages have occurred in the past or that any more significant spillages have dispersed with time due to the generally permeable nature of the sub-strata on site.

Waste Classification and Soil Re-Use Assessment

12.4.34A waste classification hazardous properties assessment has been carried out in accordance with the WM3 Technical Guidance. The soil chemical test results have been assessed and identified hazardous properties in seven samples. As a results, this material cannot be reused in the Scheme and will require offsite disposal as hazardous waste at a suitable permitted facility.

12.4.35Waste acceptance criteria (WAC) analysis has been carried out on a number of samples in order to assess the acceptability to landfill should offsite disposal be required. Two samples recording hazardous properties were also subjected to WAC testing and the results indicate these materials are suitable for hazardous waste disposal. The other WAC test results indicate that most of the samples meet the criteria for inert waste disposal but four samples fail the inert criteria and will require disposal as non-hazardous waste.

2018 Scheme Specific Marine Sediment and Water Sampling

12.4.36Marine based sediment and water sampling was carried out by CMS-Geotech Ltd (contracted to WSP) and comprised:

- Surface water sampling at four locations from Lake Lothing waterbody;
- Sampling of sediments from the lake bed at nominal 1m intervals to 4m depth from 12 vibrocore locations; and
- 48 grab samples from the top layer of lake bed sediments.

12.4.37Engineer's logs and chemical test results are presented in Annex D of the Interim Interpretative Environmental Ground Investigation Report (Appendix 12B).

12.4.38Some sediment samples recorded contaminant concentrations above the CEFAS Action Level 1 screening values but no samples recorded concentrations above the CEFAS Action Level 2. The assessment has also confirmed that the sediments are also likely to be suitable for disposal at sea and this has been indicatively agreed with the MMO subject to further sampling prior to disposal.

12.5 Predicted Impacts

Construction Impacts

12.5.1 This section builds upon the information from the Desk Study Report and the Interpretative Ground Investigation Report (Appendix 12A and 12B respectively) to assess the potential impacts on the receptors (identified in Appendix 12B) and the underlying and surrounding geology and soils during the construction phase of the Scheme. Construction work is likely to cause disturbance to the geology and soils and this includes potentially contaminated ground which could then impact upon receptors.

12.5.2 Embedded mitigation and further mitigation are both considered and are identified as such in Section 12.6 below.

Geology and Soils

12.5.3 Some elevated determinands have been identified in both soil, soil leachate and groundwater, as explained in appendix 12B and summarised below:-

-
- 12.5.4 In addition to potential asbestos recorded on the Draft Engineers logs (see Appendix 12A) at one location, it was also recorded in two made ground soil samples. The potential for more asbestos containing materials to be present within made ground materials cannot be discounted.
- 12.5.5 Natural ground within the southern site area recorded exceedances of the human health generic assessment criteria (GAC) screening values for both public open space and commercial / industrial end use for alkaline pH at one location and acid pH at two locations.
- 12.5.6 Natural ground within the northern site area did not record any exceedances of the human health GAC values for either a public open space or commercial / industrial end use.
- 12.5.7 Made ground within the southern site area recorded exceedances of the human health GAC values for both public open space for benzo-a-pyrene (two locations) and for both a public open space and commercial / industrial end use for alkaline pH (five locations) and lead (one location).
- 12.5.8 Made ground within the northern site area recorded exceedances of the human health GAC values for a public open space end use for benzo-a-pyrene (one location) and for both a public open space and commercial / industrial end use for alkaline pH (six locations) and lead (one location).
- 12.5.9 Surface water samples from Lake Lothing have identified minor exceedances of the water quality standard (WQS) screening value for zinc.
- 12.5.10 Groundwater samples have identified generally low exceedances of the WQS screening values for a number of determinants and risks to controlled waters are therefore considered to be relatively low although there is some evidence of impact to groundwater. Whilst a contaminant linkage is possible, an unacceptable risk to controlled waters is considered unlikely.
- 12.5.11 There is some olfactory/ visual evidence of the presence of hydrocarbons in the vicinity of the exploratory holes CPTC13, BHC13, BHC101, BHC102, BHC103 and WSC103 near the southern bank of Lake Lothing (and in a number of other isolated locations). In addition, there are some associated VOC readings (identified using a Photo Ionisation Detector during ground investigation) and minor theoretical hydrocarbon exceedances in soil leachate screening values.
- 12.5.12 Sampling of groundwater from monitoring well installations (adopting best practice of purging) within adjacent boreholes (BHC102, BHC14 and BHC27) do not show any exceedances of groundwater screening values for hydrocarbons.
- 12.5.13 It is therefore concluded that although there is some evidence of hydrocarbon presence in a number of locations on site, particularly near the southern bank of Lake Lothing, the analysis of soil, soil leachate and groundwater samples identify that the concentrations are unlikely to result in an impact to geology and soils as a result of the construction of the Scheme.
- 12.5.14 Landfilled materials were not encountered during the GI and ground gas monitoring to date has not identified any emissions that would require gas protection measures

above standard floor slab construction, and so it is not considered likely that a pathway could be created from such materials. A further four visits of gas monitoring are programmed to capture a wider range of atmospheric conditions and the results of this monitoring will be presented to the Environment Agency to enable them to fully consider the results of this assessment.

Water Environment

12.5.15 Sediment modelling detailed in Chapter 17 and Appendix 17C has concluded that the change in sediment transport post construction will be negligible and the marine sediment sampling described in appendix 12B has not identified any elevated contamination within the marine sediments.

12.5.16 It is therefore considered that the sediments are unlikely to have an adverse impact from a contamination perspective if they are mobilised during and / or after construction.

12.5.17 Land based ground investigations identified a theoretical risk to controlled waters from soil leachate but the exceedances were of a low magnitude and therefore an unacceptable risk is not considered to exist.

Site Users and Adjacent Site Users including Construction Workers

12.5.18 Asbestos has been identified within made ground that could impact site users, adjacent site users, construction workers and maintenance workers during construction through inhalation of asbestos impacted soils.

12.5.19 Exceedances of human health commercial / industrial screening values have been identified for pH and lead which could impact receptors through direct contact, ingestion and inhalation. However, the concentrations are not considered to be sufficiently elevated to pose an unacceptable risk to site users, adjacent site users and construction workers during construction and can be mitigated with standard construction industry good practice, such as the measures set out below.

Operational Impacts

Geology and Soils

12.5.20 During the operational phase of the Scheme, remediation will have been undertaken where required during the construction phase (pursuant to the DCO) and given the urban environment surrounding the Order limits, geology and soils will not be significantly impacted by the operational highway.

Water Environment

12.5.21 Impacts to the water environment from the operational phase of the Scheme are discussed in detail in Chapter 17.

12.5.22 No unacceptable risks to controlled waters have been identified from the results of the ground investigation (please see Paragraphs 12.5.9 to 12.5.13) and no remedial measures are considered necessary. No further mitigation measures are considered necessary from the perspective of impacts to water from the geology and soils present within the Order limits as part of the operational phase of the Scheme.

Site Users and Adjacent Site Users including Construction Workers

12.5.23 In areas, such as landscaping (reference to Landscaping plan) where humans could interact with the geology and soils, it has been identified that impacts will arise through direct contact, ingestion or inhalation of contaminated soils.

12.5.24 Ground gas monitoring has not identified any ground gas at concentrations that would pose a risk to site users. Gas protection measures in any new buildings associated with the Scheme are not required over and above standard floor slab construction methods.

Infrastructure Within the Order Limits

12.5.25 Infrastructure such as piled foundations could also impact geology and soils through the creation of new pathways for migration of contamination. This is assessed in the Piling Works Risk Assessment in Appendix 12C which has identified no risks to controlled waters or the environment are considered likely during the operational phase and no additional mitigation is required assuming the following methods of construction;

- conventional bored piles with temporary casing over the upper 6m to 10m depth (standard practice in the ground conditions identified on site);
- appropriate concrete sulphate classification design; and
- appropriate disposal of arisings in accordance with current waste regulations and protocols.

12.6 Mitigation

Construction Impacts

12.6.1 The following embedded mitigation will be undertaken by the Contractor and is relevant to all aspects of Geology and Soils:-

- The Scheme will adhere to pollution prevention guidance and best practice during the construction phase which will be incorporated into and managed via the full CoCP. An interim CoCP has been prepared for submission with the ES (see Appendix 5A) which sets the framework for the full CoCP which will be prepared by the construction Contractor on the basis of the interim CoCP, as secured as a requirement to the DCO.

12.6.2 The following further mitigation will need to be undertaken by the Contractor as an added safeguard to manage any contamination issues in an efficient and appropriate manner and is relevant to all aspects of geology and soils:-

- The construction Contractor will have a watching brief during the works (excavation and piling in particular) to identify any unforeseen potential contamination. If encountered, works in that area will cease and an appropriate way forward will be agreed with the Environment Agency and / or Local Authority Environment Health Department. This is secured through a DCO requirement.

12.6.3 Table 12-1 summarises mitigation for each of the identified impact receptors, which are also set out in the CoCP.

Table 12-1 – Geology and Soils Construction Mitigation Measures

Impact Receptor	Embedded Mitigation	Further Mitigation
Geology and Soils	Good working practices and housekeeping during construction such as sealing or covering stockpiles of contaminated soils and treating water removed from excavations to the satisfaction of the discharge regulator will be undertaken.	N/A
Water Environment	As indicated in 12.6.1, the Scheme will adhere to pollution prevention guidance and best practice.	N/A
	Water removed from any excavations and discharged directly to controlled waters will be controlled pursuant to the provisions of the DCO. If the Contractor chooses to discharge directly to sewer, this will be controlled by the water company through a consent pursuant to the DCO.	N/A
Site Users and Adjacent Site Users including Construction Workers	<p>Risks to human health from contamination will be managed through the CDM Regulations. The development of method statements and risk assessments for the various construction activities and use of good construction practices are included within the interim CoCP and include;-</p> <ul style="list-style-type: none"> • Use of appropriate PPE for construction workers; • Good hygiene practice including wearing gloves and washing hands before eating, drinking or smoking when working with potentially contaminated soils or water; and • Damping down during periods of dry weather to reduce dust generation. 	N/A
Buried Infrastructure Within the Order Limits	The construction Contractor will assess the ground conditions information at detailed design stage taking into account their chosen design and construction methodology pursuant to the CDM Regulations. The operators of relevant services will have controls over the interaction of the Scheme with their assets through the operation of their protective provisions in the DCO.	N/A

Operational Impacts

12.6.4 This section summarises the mitigation for the above predicted operational impacts.

12.6.5 Hard standing is present across much of the Order limits which will limit the amount of precipitation percolation through the made ground in turn reducing the risk of leachate generation. Chemical test results indicate a few soil leachate exceedances indicating a theoretical risk to controlled waters but the magnitude of the exceedances is low therefore no unacceptable risk to the water environment is considered to exist and no mitigation is necessary.

12.6.6 Table 12-2 details mitigation for each of the identified impact receptors.

Table 12-2 – Geology and Soils Operational Mitigation Measures

Impact Receptor	Embedded Mitigation	Further Mitigation
Water Environment	N/A	A suitable drainage system will be incorporated into the Scheme to mitigate to acceptable levels the risk of contamination that could arise from traffic emissions entering the water environment, as secured through the Drainage Strategy (Appendix 18B).
Site Users and Adjacent Site Users including Maintenance Workers	N/A	<p>Due to the presence of asbestos, pH, lead and polyaromatic hydrocarbons, a contaminant linkage is likely to be present. In presenting its full CoCP for approval, the Contractor should set out if its construction methodology requires (or if it does not, why not):</p> <ul style="list-style-type: none"> • further assessment of the locations where asbestos was recorded and if necessary excavation of those areas if they are to be located in landscaping areas, • placement of an inert subsoil and topsoil capping with a geotextile membrane within landscaping areas to break the pathway between the contaminants and the receptors.
Infrastructure Within the Order Limits	N/A	Mitigation and implemented by the Contractor during construction will mitigate any impacts to infrastructure at operation stage.

12.7 Conclusions and Effects

- 12.7.1 An assessment has been undertaken of the impact of the Scheme on the geology and soils, including potentially contaminated soils and the subsequent impacts on human health, controlled waters and the environment.
- 12.7.2 Potential risks to construction workers during the construction phase will be managed through the CDM Regulations by the Contractor using developed Method Statements, Risk Assessments and the use of good construction practices.
- 12.7.3 Potential risks to human health from contamination during the operational phase can be mitigated through placement of an inert soil capping and geotextile membrane in landscaping areas. The exact specification will be confirmed at detailed design.
- 12.7.4 Potential risks to controlled waters are not considered likely to occur.
- 12.7.5 Ground gas has not been recorded in concentrations that require any special gas protection measures in building floor slabs beyond standard floor slab construction.
- 12.7.6 There will be no significant effects upon geology, soils and contamination arising from the Scheme.

13 Noise and Vibration

13.1 Scope of the Assessment

Introduction

13.1.1 This chapter sets out the findings of the noise and vibration assessment for both the construction and operation of the Scheme. It is supported by Figures 13.1 to 13.5 and Appendix 13A to Appendix 13D and should be read in conjunction with Chapter 9: Cultural Heritage and Chapter 11: Nature Conservation (these two chapters also make reference to the effects of noise and vibration).

13.1.2 The assessment has focused on:

- The identification and appropriate mitigation of likely significant effects at noise sensitive receptors from construction noise;
- The identification and appropriate mitigation of likely significant effects at noise sensitive receptors from construction related vibration; and
- The identification and appropriate mitigation of likely significant effects at noise sensitive receptors from operational noise.

13.1.3 An assessment of the operational noise and vibration nuisance changes at noise sensitive receptors as a result of the Scheme has also been undertaken.

13.1.4 The Scoping Report (Appendix 6A) identified that the most significant noise and vibration effects are likely to occur during the construction phase of the Scheme. However, both construction phase and operational phase effects are considered in this assessment.

13.1.5 This chapter builds on the findings and recommendations of the Scoping Opinion (Appendix 6B) and PEIR report, and incorporates any new information such as operational traffic noise modelling and additional background monitoring data that has become available since these reports were produced³⁹.

13.1.6 The assessment has been informed by relevant policies, legislation, standards and guidelines relating to noise and vibration, the most relevant of which are the Government's *Noise Policy Statement for England* and the *Design Manual for Roads and Bridges*. The content of these and other relevant documents is detailed in this Chapter.

13.1.7 The general approach adopted for the noise and vibration assessment has been to:

- Identify locations where noise or vibration is likely to be generated during the construction and operation of the Scheme. This may include locations such as construction compounds which will not necessarily be in the immediate vicinity of the route corridor, and also existing roads that do not form part of the Scheme but may exhibit a change in noise level as a result of changes in traffic flow;
- Identify noise and/or vibration Sensitive Receptors (NSRs) in the vicinity of those

³⁹ It should be noted that the maintenance and operation of the Scheme Bascule Bridge has been scoped out of the noise and vibration assessment, in line with the commentary in section 5.7.

locations where noise or vibration, or a change in noise or vibration, is likely to be generated as part of the Scheme;

- Calculate the levels of noise or vibration, or the change in noise or vibration levels, that will be experienced at those identified NSRs;
- Evaluate the significance of the calculated levels of noise or vibration, or the change in noise and vibration levels, taking into account the relevant legislation, standards and guidelines; and
- Identify and assess potential mitigation measures where potentially significant noise or vibration effects are predicted to occur and more generally to improve or enhance the noise and vibration climate wherever possible.

13.1.8 The calculation methodologies used to predict the noise and vibration impacts associated with the Scheme and the methods for identifying and assessing significant effects are described in this Chapter.

Study Area

13.1.9 The study area for the operational phase noise and vibration assessment is presented in Figure 13.2. The construction phase noise and vibration assessment has been undertaken at the noise monitoring locations, as shown on Figure 13.1, as representative of the nearest NSRs to the Scheme and likely to be affected by the construction works. Further details on how the operational and construction phase study areas have been defined is presented in Section 13.3.

13.2 Directives, Regulations and Relevant Policy

13.2.1 This section outlines the statutes, guidance and policy relevant to the Scheme with respect to its noise and vibration impact. As well as providing a summary of the legislation and policy guidance relating to noise and vibration, details of specific guidance relating to noise and vibration from construction activities and road traffic is provided.

Legislation

The Control of Pollution Act 1974 (CoPA)

13.2.2 The CoPA enables Local Authorities to implement measures to control the noise from construction sites and prevent the occurrence of disturbance to surrounding residents (section 60 - Control of noise on construction sites).

13.2.3 Furthermore, section 61 (Prior consent for work on construction sites) provides a method by which a contractor can seek consent to undertake construction works in advance of their commencement.

Environmental Protection Act 1990 (as amended) (EPA)

13.2.4 The EPA (Section 79) contains a definition of what constitutes a "*statutory nuisance*" with regard to noise and places a duty on Local Authorities to detect any such nuisances within their area. Section 79 also considers 'best practicable means' with reference to mitigation measures, which is defined as steps "*reasonably practical having regard, among other things, to local conditions and circumstances, to the current state of technical knowledge and to the financial implications*".

13.2.5 Section 80 of the EPA (*Summary proceedings for statutory nuisances*) provides Local Authorities with powers to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence.

Noise Insulation Regulations

13.2.6 The Noise Insulation Regulations (NIR) 1975, as amended in 1988, impose a duty upon the overseeing Highways Authority to make offers of noise insulation for dwellings and other places used for residential purposes near a new road or an additional carriageway. In order to qualify for such an offer, four criteria must all be fulfilled at 1m in front of the most exposed door or window of an eligible room in the façade of a property:-

- Level - The highest total traffic noise level expected within the first fifteen years use of the road (the 'Relevant Noise Level') must be predicted to be not less than the Specified Level of 68 dB(A) LA10,18hr. Predicted noise levels of 67.5 dB LA10,18hr and above are rounded up to 68 dB LA10,18hr;
- Increase - The Relevant Noise Level in the design year, or within any other year between the year before the highway construction works commenced and the design year, must be at least 1 dB(A) greater than that immediately before construction commenced (the 'Prevailing Noise Level');
- Contribution - Noise from traffic on the road for which the Regulations apply must contribute at least 1.0 dB LA10,18hr to the Relevant Noise Level; and
- Locality - The property under consideration must be within 300m of the Scheme.

13.2.7 The Regulations apply only to qualifying eligible rooms, which include living rooms and bedrooms affected by road traffic noise.

Environmental Noise (England) Regulations 2006

13.2.8 Defra has prepared action plans for major roads following strategic noise mapping. The Environmental Noise (England) Regulations (S.I. 2006/2238, Regulation 15(1)(e)) require that action plans should "...*apply in particular to the most important areas as established by [the] strategic noise maps...*", and to this end Defra has identified noise important areas (NIAs or noise "hot-spots") that are where 1% of the population are affected by the highest noise levels from major roads according to the results of the strategic noise mapping. This approach has been taken because those residing in these areas are likely to be at the greatest risk of experiencing a significant adverse effect to health and quality of life as a result of their exposure to road traffic noise.

National Policy

National Policy Statement for National Networks (NNNPS)

13.2.9 Published by the Department for Transport, the NNNPS was designated for use by the Secretary of State in January 2015. It provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks.

13.2.10 Paragraph 5.189 of the NNNPS states where a development is subject to EIA and significant noise impacts are likely to arise from the Scheme, the applicant should include a noise assessment which details the noise and vibration baseline, sensitive

receptors, predictions of changes in baseline with the Scheme and mitigation measures.

13.2.11 For operational noise paragraph 5.191 states that effects on human receptors 'should be assessed using the principles of the relevant British Standards and other guidance' and that 'prediction of road traffic noise should be based on the method described in the Calculation of Road Traffic Noise' (1988). For the prediction and assessment of construction noise, it is stated that 'reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies'.

13.2.12 The NNNPS goes on to state in paragraph 5.193 that developments must be undertaken in accordance with the statutory requirements for noise and that due regard must be given to the relevant sections of the NPSE and the NPPF.

13.2.13 Paragraph 5.195 states that the "Secretary of State should not grant development consent unless satisfied that the proposals will meet, the following aims, within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life from noise as a result of the new development;*
- *mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and*
- *contribute to improvements to health and quality of life through the effective management and control of noise, where possible".*

13.2.14 The NNNPS also confirms that for most national network projects, the relevant Noise Insulation Regulations will apply.

National Policy Statement for Ports (PNPS)

13.2.15 The PNPS requires an applicant to assess the noise generating aspects of a development on the marine and terrestrial environment including noise sensitive areas and noise sensitive species which has been informed by the existing marine and terrestrial noise environment. These assessments should then identify any measures that are included to mitigate the effects of noise.

Noise Policy Statement for England (NPSE)

13.2.16 The NPSE was published in March 2010 by the Department for Environment Food and Rural Affairs (Defra) and is the overarching statement of noise policy for England. It applies to all forms of noise other than occupational noise, with paragraph 1.6 setting out the long term vision of Government noise policy which is to "*promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.*"

13.2.17 The Explanatory Note to the NPSE introduces three concepts for use in the assessment of noise in England:

- **NOEL - No Observed Effect Level** - This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.
- **LOAEL - Lowest Observable Adverse Effect Level** - This is the level above

which adverse effects on health and quality of life can be detected.

- **SOAEL - Significant Observed Adverse Effect Level** - This is the level above which significant adverse effects on health and quality of life occur.

13.2.18 None of these three levels are defined numerically in the NPSE and for the SOAEL the NPSE makes it clear that the noise effect level is likely to vary depending upon the noise source, the receptor and the time of day and day of the week,. The need for more research to investigate what may represent a SOAEL for noise is acknowledged and the NPSE asserts that not stating specific SOAEL values provides policy flexibility in the period until further evidence and guidance is published. This chapter sets out the approach to defining the NOEL, LOAEL and SOAEL for this Scheme in line with current best practice and guidance.

National Planning Policy Framework (NPPF)

13.2.19 The NPPF was published in March 2012 and sets out the following generic guidance relating to noise in paragraph 123, which supports the long term vision of the NPSE.

13.2.20 "Planning policies and decisions should aim to:


- *Avoid noise giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

13.2.21 Reference numbers 27 and 28 of the above quotation point respectively to the Explanatory Note to the Noise Policy Statement for England (NPSE) and the provisions of the EPA 1990 and other relevant legislation.

Planning Practice Guidance (PPG)

13.2.22 In March 2014 the Government published the web-based Planning Practice Guidance. The section on noise includes a table which summarises the noise exposure hierarchy and offers examples of outcomes relevant to the NOEL, LOAEL and SOAEL effect levels described in the NPSE. The term Unacceptable Adverse Effect (UAE) level is introduced which equates to noise perceived as "*noticeable and very disruptive*". The PPG states that UAEs should be prevented. The guidance is summarised in Table 13-1 .

Table 13-1 – PPG Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action	Increasing noise level
Not noticeable	No Effect	No Observed Effect	No specific measures required	
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required	
Lowest Observed Adverse Effect Level				
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum	
Significant Observed Adverse Effect Level				
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid	
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent	

Relevant Guidance Documents

Calculation of Road Traffic Noise (CRTN)

13.2.23 The former Department of Transport/Welsh Office technical memorandum CRTN sets out a standardised method for the calculation of noise from road traffic.

13.2.24 The factors which may influence road traffic noise levels can be divided into three groups:

- Road related factors - gradient and surface type;
- Traffic related factors - flow, speed and the proportion of heavy goods vehicles; and
- Propagation factors – the distance between the road and the receptor location and either the type of ground cover between the road and receptor location or the presence of screening (i.e. barriers or buildings).

13.2.25 The propagation of noise is also covered in CRTN and can influence the noise levels that will be experienced at receptor locations. Assumptions relating to the factors that will affect the propagation of noise from the Scheme are set out in Section 13.3.

Design Manual for Roads and Bridges (DMRB) HD 213/11

13.2.26 The DMRB Volume 11, Section 3, Part 7, HD 213/11 Revision 1 sets out a methodology for assessing road traffic noise in terms of perceived nuisance.

13.2.27 DMRB HD 213/11 states "in terms of permanent impacts, a change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible. Such increases in noise should be mitigated if possible".

13.2.28 Further details of the technical content of DMRB HD 213/11 and how it has been applied to the assessment of traffic noise from the Scheme are set out in paragraphs 13.3.1 to 13.3.5. The Interim Advice Note (IAN) 185/15: *Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB HD 213/11* published by the then Highways Agency has also been taken into account.

World Health Organisation (WHO) Night Noise Guidelines for Europe

13.2.29 The WHO Night Noise Guidelines for Europe presents target night-time criteria based on health based guideline values. The document recommends that an $L_{\text{night, outside}}$ of 40 dB should be the target of the night-noise guideline to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. This 40 dB criterion is stated to be "equivalent to the lowest observed adverse effect level (LOAEL) for night noise". An upper limit of 55 dB $L_{\text{night, outside}}$ is recommended for night-time noise, above which "adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep-disturbed".

British Standards

BS 5228-1: 2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1: Noise

13.2.30 BS 5228-1 provides guidance on the measurement and prediction of construction noise and recommends basic methods of noise control where there is a need to protect persons working or living in the vicinity of, and those working on, construction and open sites.

BS 5228-2: 2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 2: Vibration

13.2.31 BS 5228-2 provides basic recommendations for vibration control where work on construction and open sites generates significant levels of vibration. It includes advice on methods for measuring and predicting vibration and assessing its potential effect on people and buildings.

BS 6472-1: 2008 Guide to Evaluation of Human Exposure to Vibration in Buildings. Part 1: Vibration Sources other than Blasting

13.2.32 BS 6472-1 provides guidance on the methods to assess the effects of environmental vibration on people in residential and other environments. The Standard is primarily concerned with vibration generated by permanent or long-term sources, such as railways or industry, and cross-references the guidance contained within BS 5228-2 for the assessment of vibration from construction sites.

13.3 Methods of Assessment

Introduction to Assessment

13.3.1 Each topic area within the scope of this assessment requires its own methodology as there are different guidelines and standards that relate specifically to road traffic noise and vibration, and construction noise and vibration. The guidance that relates specifically to each topic has been used to derive assessment criteria that meet with the requirements as set out within the relevant standards and guidelines.

13.3.2 However, it is noted that there is some discrepancy between the guidance set out in the NPSE compared to the guidance set out in the DMRB HD 213/11 and the various British Standards relating to noise and vibration. Whereas the LOAELs and SOAELs set out in the NPSE should be defined in terms of observed health effects based on the magnitude of the noise levels, the DMRB HD 213/11 assessment methodology is defined in terms of nuisance effects based on the change in noise levels.

13.3.3 The determination of LOAELs and SOAELs is a subject of current research and to date, there has been no official guidance published on how to reconcile the DMRB and NPSE methodologies. It is of note that the NPSE states in paragraph 2.22 that it is “*acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise*”

13.3.4 Therefore, presented further below is the approach that has been adopted to the determination of NOEL, LOAEL and SOAEL, based on current available guidance and best practice.

13.3.5 The approach adopted for this assessment has been to determine the significance of

temporary impacts during the construction phase against the current British Standards relating specifically to construction noise and vibration, and to determine the significance of operational impacts against the guidance contained within DMRB which relates specifically to road traffic noise. Where significant impacts are predicted, the assessment of mitigation options has been assessed with reference to the LOAELs and SOAELs as set out in NPSE. This approach has been adopted successfully for other recent Nationally Significant Infrastructure Projects (NSIP) road improvement schemes, such as the M20 Junction 10A project.

Defining the Study Area

Construction Noise

13.3.6 The Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7, HD 213/11 Revision 1 (DMRB HD 213/11) states that “*the area in which construction is considered to be a nuisance is generally more localised than where the impacts of the road project are likely to be a cause of concern once it has opened to traffic. The impact of construction nuisance in one form or another diminishes rapidly with distance*”.

13.3.7 Based on the guidance contained within DMRB HD 213/11, the construction noise assessment has been undertaken at the noise monitoring locations, which have been agreed with WDC as representative of the nearest NSRs which are likely to be worst affected by the construction works.

Construction Vibration

13.3.8 Vibration usually affects a smaller area than noise, as vibration tends to diminish much more rapidly with increasing distance from the source of the vibration. Furthermore, the types of construction activity that can result in perceptible levels of vibration are generally limited to piling works, the use of vibratory rollers and, in extreme circumstances, the use of machine-mounted percussive breakers and the passage of heavy construction vehicles. Based on the guidance contained within DMRB HD 213/11 and as per the construction noise assessment, the construction vibration assessment has been undertaken at the noise monitoring locations, which are considered representative of the nearest NSRs to the Scheme and likely to be affected by the construction works.

Operational Noise

13.3.9 The study area for the operational noise assessment has been determined using the guidance contained within DMRB HD 213/11, paragraph A1.11.

13.3.10 The DMRB study area requires calculations of noise impacts within 600m of both the Scheme, and within 600m of any other “*affected routes*” within 1km of the Scheme. This includes all new, improved or bypassed routes. This extent is referred to in the DMRB as the ‘*calculation area*’.

13.3.11 The DMRB also requires consideration of noise changes on the wider road network, beyond the calculation area. The wider road network is identified in DMRB as 50m either side of the carriageway of identified affected routes beyond 1km of the Scheme. The total extent of the area 1km from the Scheme plus the wider road network is the study area for the operational phase assessment.

13.3.12 Paragraph A1.11 of DMRB HD213/11 details the methodology by which the “*affected routes*” are identified. An affected route is one which is predicted to experience a change in noise of more than +/-1 dB(A) in the short term (i.e. in the baseline year), or +/-3 dB(A) or more in the long term (i.e. in the future assessment year) .

13.3.13 In order to determine the number and location of any affected routes, the Basic Noise Levels (BNLs) ($L_{A10,18h}$) have been calculated for each road link (i.e. each road or section of road within the traffic model) based on the traffic data provided. The Do Minimum opening year BNL has been compared against the Do Something opening year BNL, to predict the short-term change, and the Do Something design year BNL, to predict the long-term change.

13.3.14 In summary, the study area for operational noise is defined as:

- 1km from the Scheme carriageway edge (including proposed, bypassed or improved routes); and
- 50m from any affected routes beyond 1km.

13.3.15 The study area for operational noise is shown on Figure 13.2.

13.3.16 The same methodology has also been applied to determine the absolute and change in noise levels at designated sites.

Operational Airborne Vibration

13.3.17 The study area for airborne vibration is limited to 40m from all affected routes identified in the determination of the 600 noise calculation area because the DMRB HD 213/11 methodology for assessing airborne vibration nuisance has not been validated for greater distances.

Noise and Vibration Sensitive Receptors

13.3.18 Noise and/or vibration sensitive receptors (NSR) are defined in the DMRB HD 213/11 as dwellings, hospitals, schools, community facilities, designated areas and public rights of way. NSRs are locations that are sensitive to noise or vibration or a change in noise or vibration and which could therefore be significantly affected as a result. In the case of this assessment, the NSRs are primarily residential dwellings but also include other receptors such as schools and community facilities as well as areas of interest to nature conservation and cultural heritage.

13.3.19 Whilst all of these NSRs have been included in the noise and vibration assessment, in addition noise levels at areas of interest to nature conservation and cultural heritage have been presented in Table 13-25 of this chapter to facilitate additional consideration within the respective chapters of this ES, i.e. Chapter 9 for Cultural Heritage and Chapter 11 for Nature Conservation.

Noise during Construction

13.3.20 Part 1 of BS 5228 contains guidance on the prediction of noise levels from the operation of fixed and mobile noise sources found on construction and open sites. It provides source sound level data for various machinery and tasks associated with the construction activities, together with a method that allows for the calculation of the cumulative noise level from all sources, as would be experienced at a receptor location

outside of the construction site. The calculation method takes into account the distance between the noise source(s) and receptor location, the type of intervening ground cover and the presence of screening from barriers, fences or buildings. The method also allows for the calculation of noise levels from mobile plant that may be working in a fixed area (e.g. dozers used for earthworks) and from construction vehicles (such as delivery wagons and dump-trucks).

13.3.21 Example criteria are presented in BS 5228-1 for the assessment of the significance of noise effects. Such criteria are concerned with fixed noise limits and ambient noise level changes.

13.3.22 With respect to fixed noise limits, BS 5228-1 discusses those included within Advisory Leaflet 72 (AL72): 1976: *Noise control on building sites*. These limits are presented according to the nature of the surrounding environment for a 12-hour working day. The limits presented in AL72 are:

- 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise; and
- 75 dB(A) in urban areas near main roads and heavy industrial areas.

13.3.23 BS 5228-1 also provides methods for determining the significance of construction noise levels considering the change in the ambient noise level brought about by the construction work. Two example assessment methods are presented, these are the '*ABC method*' and the '*5 dB(A) Change Method*'.

13.3.24 The ABC Method is based upon threshold noise levels defined by both time of day and existing ambient noise level. The method requires the ambient pre-construction noise level to be determined and rounded to the nearest 5 dB. This ambient noise level is then compared to the construction noise level. If the construction noise level exceeds the appropriate category value then a potential significant effect is indicated. An assessment shall consider the number of NSRs affected, duration and character of noise; in order to determine significance. The ABC method is presented in Table 13-2.

Table 13-2 – BS 5228-1 Example Method 1 – The ABC Method

Assessment Category and Threshold Value Period	Free-field Threshold Value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23:00 - 07:00)	45	50	55
Evenings and Weekends ^{D)}	55	60	65
Daytime (07:00 - 19:00) and Saturdays (07:00 - 13:00)	65	70	75

NOTE 1 A potential significant effect is indicated if the L_{Aeq} noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 Applied to residential NSRs only

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values

C) Category C: threshold values to use when ambient noise levels (when rounded to nearest 5 dB) are higher than Category A values.

D) 19:00 - 23:00 weekdays, 13:00 - 23:00 Saturdays and 07:00 - 23:00 Sundays.

13.3.25 The ABC method is subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from construction noise alone, for the daytime, evening and night-time periods respectively.

13.3.26 The BS 5228-1 '5 dB(A) change' assessment method is based on a premise that a significant effect is deemed to occur if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more.

13.3.27 To account for the requirements of the NPSE, the approach to defining NOEL, LOAEL and SOAEL are shown in Table 13-3.

13.3.28 The LOAEL is when the assessment criterion applicable to the determined ABC category is met. The NOEL is defined as 5 dB below the LOAEL and the SOAEL is defined as an overall level 5 dB above the LOAEL.

Table 13-3 – Construction Noise – Effect Level Criteria

Difference Between Construction Noise Level and Defined ABC Criteria	Effect Level
Less than Category ABC threshold value minus 5 dB	NOEL
Category ABC threshold value minus 5 dB	LOAEL
Category ABC threshold value plus 5 dB	SOAEL

13.3.29 For the purposes of assessing the significance of noise impacts during the construction phase of the Scheme, it is noted that noise from the construction works will be temporary in nature. Furthermore, noise and vibration levels from construction operations are inherently variable, with noise levels fluctuating on an hour-to-hour, day-

to-day and week-to-week basis.

- 13.3.30** It is therefore appropriate to account for these temporal factors in reconciling the significance of predicted noise levels when assessed in terms of effect levels (as required by NPSE and presented in Table 13-3) with the requirements to classify the significance of effect.
- 13.3.31** Taking the variability of the noise generated into account, consideration has been given to the duration criteria presented in BS 5228-1 such that a significant effect would be determined to arise if the LOAEL at an NSR is “*exceeded for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months*”.
- 13.3.32** A significant effect is deemed to arise where the construction noise level at an NSR is predicted to exceed the SOAEL, irrespective of the duration of the works. Similarly, significant effects will not arise when the construction noise level is below the LOAEL.
- 13.3.33** The adopted significance of effect scale for construction noise in this assessment for receptors of high sensitivity (taken to be residential dwellings for the Scheme) is shown in Table 13-4 below.

Table 13-4 – Significance of Effect Criteria for Construction Noise Combining Duration of Exposure and Effect Levels

Duration of Exposure	Noise Level < LOAEL	LOAEL < Noise Level < SOAEL	Noise Level > SOAEL
Less than 10 days of working in any 15 days and less than 40 days in any 6 consecutive months	Negligible	Minor	Moderate
10 or more days of working in any 15 days or 40 or more days in any 6 consecutive months	Negligible	Moderate	Major

- 13.3.34** For the Scheme, it is considered appropriate to assume that the construction works would exceed at least one of the duration criteria presented in paragraph 13.3.31 (i.e. 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months) and therefore only the criteria on the bottom line of Table 13-4 have been applied in the assessment of construction noise.

Vibration during Construction

- 13.3.35** Part 2 of BS 5228 (BS 5228-2) contains guidance on the prediction of vibration from the operation of fixed and mobile sources found on construction and open sites. It provides source vibration level data for some construction activities such as piling works and various methods to predict vibration from both piling works and other construction plant and activities such as the use of vibratory rollers. The calculation method is primarily based on the separation distance between the source and the receptor location and, for some types of plant, the mode of operation of that plant.
- 13.3.36** BS 5228-2 also contains guidance on measuring and assessing the effects of vibration. With regard to the assessment of significance of vibration relating to human response BS 5228-2 refers to BS 6472-1:2008. However, BS 5228-2 notes that: “...*Whilst the*

assessment of the response to vibration in BS 6472 is based on the Vibration Dose Value (VDV) and weighted acceleration, for construction it is considered more appropriate to provide guidance in terms of the Peak Particle Velocity (PPV), since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage. Furthermore, since many of the empirical vibration predictors yield a result in terms of PPV, it is necessary to understand what the consequences might be of any predicted levels in terms of human perception and disturbance...”

13.3.37 BS 5228-2 presents guidance on vibration levels and effects referenced to PPV criteria as reproduced in Table 13-5.

Table 13-5 - BS 5228-2 Guidance on Effects of Vibration Levels

Vibration Level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with the construction. At lower frequencies, people are less sensitive to vibration
0.3 mm/s	Vibration might be just perceptible in residential NSRs
1.0 mm/s	It is likely that vibration of this level in residential NSRs will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10.0 mm/s	Vibration is likely to be intolerable for any more than very brief exposure to this level

13.3.38 BS 5228-2 also provides limits for transient vibration above which cosmetic damage could occur in terms of the component PPV, which are summarised in Table 13-6.

Table 13-6 - Transient Vibration Guide Values for Cosmetic Damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
NOTE 1:	Values referred to are at the base of the building.	
NOTE 2:	At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.	

13.3.39 It should be noted that the values presented within Table 13-6 are applicable to cosmetic damage only. It is stated within BS 5228-2 that minor structural damage is possible at vibration magnitudes which are greater than twice those given in Table 13-6.

13.3.40 To account for the requirements of the NPSE, the approach to defining NOEL, LOAEL and SOAEL is presented in Table 13-7. The vibration levels adopted for the NOEL and LOAEL are based on the guidance contained within BS 5228-2 for human perception.

However, it is noted that the range of vibration levels within BS 5228-2 is wide and adopting 10mms^{-1} is considered too high to be reflective of the SOAEL. Therefore, a vibration level of 3mms^{-1} has been chosen as more reflective of the SOAEL, which is based on professional judgement and experience.

Table 13-7 - Construction Vibration – Effect Level Criteria

Vibration Level (PPV)*	Effect Level
<1.0 mms^{-1}	No observed effect (NOEL)
1.0 mms^{-1}	LOAEL
3.0 mms^{-1}	SOAEL

13.3.41 Similarly to construction noise, vibration arising from the construction phase of the Scheme will be temporary and variable, with vibration levels fluctuating on an hour-to-hour, day-to-day and week-to-week basis. It is therefore appropriate to account for these factors in reconciling the significance of predicted vibration levels when assessed in terms of effect levels (as required by NPSE and presented in Table 13-7) with the requirements to classify the significance of effect.

13.3.42 To address this issue, consideration has been given to the duration criteria presented in BS 5228-1 such that a significant effect would be deemed to arise if the LOAEL is “exceeded for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months”⁴⁰.

13.3.43 A significant effect is also deemed to arise when the construction vibration level at an NSR is predicted to exceed the SOAEL, irrespective of the duration of the works. Similarly significant effects are not deemed to arise when the construction vibration level is below the LOAEL.

13.3.44 Based on the above, the adopted significance of effect criteria for construction vibration for receptors of high sensitivity (taken to be residential dwellings for the Scheme) is given in Table 13-8.

Table 13-8 – Significance of Effect Criteria for Construction Vibration Combining Duration of Exposure and Effect Levels

Duration of Exposure	Vibration Level < LOAEL	LOAEL < Vibration Level < SOAEL	Vibration Level > SOAEL
Less than 10 days of working in any 15 days and less than 40 days in any 6 consecutive months	Negligible	Minor	Moderate
10 or more days of working in any 15 days or 40 or more days in any 6 consecutive months	Negligible	Moderate	Major

13.3.45 For the Scheme, it is considered appropriate to assume that the construction works

⁴⁰ The duration criteria quoted in paragraph 13.3.42 specifically relates to noise. However, these criteria have been adopted for the vibration assessment as BS 5228-2 offers no specific guidance in relation to vibration.

would exceed at least one of the duration criteria presented in paragraph 13.3.42 (i.e. 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months) and therefore only the criteria on the bottom line of Table 13-8 have been applied to the vibration from construction assessment.

Noise from Construction Traffic

13.3.46 An assessment of off-site construction traffic has been undertaken following the methodology for the operational road traffic noise assessment (paragraphs 13.3.57 to 13.3.69) and based on the numbers of construction vehicles that require compound access, as presented in Section 5.6 of this ES.

Identification of Appropriate Mitigation Measures

13.3.47 The assessment of potential construction phase impacts is used to define appropriate mitigation measures that will be implemented through a Code of Construction Practice (CoCP), which are commensurate to the scale and duration of the identified impacts. If appropriate, the Contractor will request prior consent from Waveney District Council (WDC) under Section 61 of the Control of Pollution Act 1974 (CoPA). This consent would include details of the works and the works methods; and proposed noise and vibration control measures that would be implemented during the works. An interim CoCP is included in Appendix 5A that accompanies this ES which outlines the mitigation measures that the contractor will be required to adopt during the construction phase of the Scheme. This interim CoCP is secured as a requirement to the DCO.

Operational (Road Traffic) Noise

13.3.48 All road traffic noise predictions have been completed in accordance with the calculation methodology presented in CRTN and Annex 4 of DMRB HD 213/11. The IAN 185/15 has also been taken into account.

Operational (Road Traffic) Noise – Processing of Traffic Flow Data

13.3.49 Traffic flow data have been provided for the roads shown within the operational noise study area in Figure 13.2 in the form of Annual Average Weekday Traffic (AAWT) flows for the 18 hour period from 06:00 to 24:00 hours. The traffic data also include percentage HGV and average vehicle speeds.

13.3.50 Traffic data have been provided for the following four scenarios:

- Do Minimum opening year (2022);
- Do Minimum design year (2037);
- Do Something opening year (2022); and
- Do Something design year (2037).

13.3.51 These data have been provided as one way flows and, where appropriate, they have been combined to obtain two way flows. The traffic speeds for the combined two way links have been averaged and weighted according to the one way flows such that the average speed considers the number of vehicles on each of the one way links.

Operational (Road Traffic) Noise – Basic Noise Levels

13.3.52 Basic Noise Levels (BNLs), $L_{A10,18h}$ have been calculated for each road link in isolation to allow for a preliminary assessment of potential significant effects. In accordance with CRTN, the BNL calculations have taken account of the following factors:

- Total vehicle flow;
- Percentage heavy goods vehicles;
- Average vehicle speed; and
- Road surface (hot rolled asphalt (HRA)).

13.3.53 The BNLs have been calculated for the following scenarios:

- Do Minimum opening year (2022);
- Do Something opening year (2022); and
- Do Something design year (2037).

13.3.54 The BNLs have been calculated in order to undertake a preliminary assessment of potential significant effects as defined in Table 13-11 below (i.e. more than a 1 dB change in the short-term and more than 3 dB change in the long-term, which corresponds to the onset of significant effects). Therefore, the Do Minimum design year (2037) scenario has not been included for this preliminary assessment.

Operational (Road Traffic) Noise – Noise Modelling

13.3.55 Following the preliminary assessment of BNLs, a 3D noise model was utilised (built using NoiseMap v5 software) to predict the road traffic noise levels for the scenarios described in paragraph 13.3.50. The model includes the roads shown within the operational noise study area in Figure 13.2, topography and buildings. The noise model settings and assumptions were as follows:

- 18hr (06:00-24:00) AAWT for roads, given as both the total flow for all vehicles and the percentage HGVs within that total flow. HGVs are defined as having an unladen weight of greater than 3.5 tonnes;
- Average speed of all vehicles using each link in kilometres per hour;
- An assumed average building height of 6 m;
- Receptor heights at 4 m above ground level and 1 m from the façade, i.e. at the first floor window;
- Intervening ground between any road and a receptor has been assumed to be acoustically 'hard' to create a worst case with no correction for ground absorption;
- Ground contour data from Environment Agency LIDAR Digital Terrain Mapping (DTM) at 2m contour height;
- Building outline data from OS MasterMap mapping geodatabases;
- Road type (1-way, 2-way or dual carriageway) and carriageway width, where the default for a normal 2-way single carriageway road is 3.5 m; and

- Road surface texture and depth, assumed to be standard 2 mm deep bitumen.

13.3.56 This assessment has relied primarily on a comparison of predicted noise levels to determine the change in noise levels as a result of the Scheme for the following scenarios:

- Comparison 1: Do Minimum opening year (2022) vs Do Something opening year (2022)
 - This comparison will identify the short-term changes in noise level at NSRs as a result of the Scheme.
- Comparison 2: Do Minimum opening year (2022) vs Do Something design year (2037)
 - This comparison will identify the long-term changes in noise level at NSRs as a result of the Scheme.
- Comparison 3: Do Minimum opening year (2022) vs Do Minimum design year (2037)
 - This comparison will identify the long-term changes in noise level at NSRs if the Scheme does not go ahead. This comparison has only been interrogated where a potential significant effect has been identified in the Do Minimum opening year vs Do Something design year to ascertain whether the change in noise level is due to background traffic growth (i.e. is not due to the Scheme).

Approach to the Assessment

13.3.57 The assessment presents both direct and indirect effects associated with the Scheme which are experienced as a result of traffic flow changes on the surrounding road network during the operational phase.

13.3.58 Emphasis has been placed on the adverse effects associated with the Scheme, although these are seen alongside the beneficial effects which have also been identified, albeit in less detail than the adverse effects.

13.3.59 The assessment of predicted noise impacts takes into account the guidance set out in the NPSE and the guidance contained within DMRB HD 213/11.

13.3.60 To account for the requirements of the NPSE, the numerical values used to define the NOEL, LOAEL and SOAEL for this Scheme are shown in Table 13-9.

13.3.61 The adopted threshold value for the SOAEL is based on the 'Relevant Noise Level', as set out in the NIR 1975. This is the level of noise that would (provided that other criteria are met) trigger entitlement to the provision of sound insulated glazing (and, where necessary, ventilation) for residential properties located within 300m of a new road Scheme. The Relevant Noise Level specified in the NIR is 68 dB LA10,18h, although the regulations require that noise levels calculated to be between 67.5 and 67.9 dB are rounded up to 68 dB.

13.3.62 The adopted daytime threshold value for the LOAEL is based on guidance contained within the WHO Guidelines for Community Noise. This states that the lowest observed threshold for the onset of community annoyance occurs for situations where the

outside free-field noise level exceeds 50 dB LAeq,16h (07.00 to 23.00 hours). This uses a different noise measure (LAeq,16h which is used as a general measure of noise from all sources) and time period to that used to quantify road traffic noise (the LA10,18h (06.00 to 24.00 hours)). Conversion from LAeq,16h to LA10,18h uses the relationship set out in Transport Analysis Guidance Unit A3 (LA10,18h = LAeq,16h +2 dB) with a further addition of 2.5 dB applied to account for the conversion from a free-field noise level to a façade noise level (in accordance with CRTN).

13.3.63 The night-time values are based on the guidance contained within the WHO Night Noise Guidelines for Europe.

Table 13-9 – Traffic Noise Effect Levels

Daytime Traffic Noise Level, LA10,18h (dB)*	Night-time Traffic Noise Level, L _{night,outside} (dB)	Effect Level
< 54.5 dB(A)	< 40 dB(A)	No observed effect (NOEL)
54.5 dB(A)	40 dB(A)	LOAEL
67.5 dB(A)	55 dB(A)	SOAEL
* Façade level, 06.00 to 24.00 hours		

13.3.64 The noise effect levels set out in Table 13-9 are based on the absolute daytime traffic noise level. With respect to the change in noise level as a result of a new road scheme, DMRB HD 213/11 states "*in terms of permanent impacts, a change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible*".

13.3.65 Therefore, for the purposes of this assessment, the following road traffic noise change thresholds have been used, to denote the onset of impact:

- $\geq \pm 1$ dB LA10,18h in the 'Do Minimum opening year 2022' to 'Do Something opening year 2022' scenarios (short term); and
- $\geq \pm 3$ dB LA10,18h in the 'Do Minimum opening year 2022' to 'Do Something design year 2037' scenarios (long term).

13.3.66 The approach taken for this assessment has been to analyse the change in all noise levels for both short term and long term scenarios. Where no individual change exceeds the thresholds given in paragraph 13.3.65, then it is assumed that there would most likely be no significant effect (adverse or beneficial). However, where noise levels exceed the stated thresholds, this provides an indication that there is potential for a significant effect (adverse or beneficial) which triggers the need to consider mitigation where the effect is adverse in nature.

13.3.67 When long term significant adverse effects have been identified, the traffic flow data for the 'Do Minimum design year 2037' scenario have been interrogated to assist in determining whether the effects are as a result of the Scheme itself, or are rather a result of general traffic growth or other developments (i.e. Comparison 3 identified in paragraph 13.3.56 above). However, following this review it was concluded that the significant adverse effects were not due to background traffic growth and therefore the

Do Minimum design year data are not considered further in this assessment.

13.3.68 Table 13-10 presents the magnitude of impact for short and long term changes in noise levels, as set out in DMRB HD 213/11. Both adverse and beneficial changes are considered in the assessment.

Table 13-10 - Classification of Magnitude of Noise Impacts (based on DMRB HD 213/11)

Noise Change \pm (dB $L_{A10,18h}$)		Magnitude (adverse or beneficial)
Short Term	Long Term	
0	0	No Change
0.1 – 0.9	0.1 – 2.9	Negligible – No Impact
1.0 – 2.9	3.0 – 4.9	Minor
3.0 – 4.9	5.0 – 9.9	Moderate
>5.0	>10.0	Major

13.3.69 In order to reconcile the different assessment methodologies set out in the NPSE and DMRB HD 213/11, this has been combined in the manner shown in Table 13-11. The overall significance classification (negligible, minor, moderate or major) applies to situations where there is a beneficial effect (noise level decrease) as well as situations where there is an adverse effect (noise level increase). The significance classification applies to noise sensitive receptors of all sensitivity as a worst case scenario⁴¹.

Table 13-11 - Significance Effect Level Criteria for Operational Traffic Noise

Noise Change (dB $L_{A10,18h}$)		LOAEL < Noise Level < SOAEL	Noise Level > SOAEL
Short Term	Long Term		
< 0.9	< 2.9	Negligible	Negligible
1.0 – 2.9	3.0 – 4.9	Minor	Moderate
3.0 – 4.9	5.0 – 9.9	Moderate	Major
>5.0	>10.0	Major	Major

13.3.70 It should be noted that the assessment methodology detailed above is based on the change in daytime (06.00 to 24.00 hours) traffic noise levels. For non-motorway roads, the diurnal patterns in road traffic flows are such that noise levels during the night-time (00.00 to 06.00 hours) are approximately 10 dB lower⁴² than those during the daytime. The relative change in noise levels, due to the introduction of a new scheme, should be the same for both the daytime and night-time periods. An assessment of daytime noise levels against the significance criteria detailed above is therefore considered to be sufficient to provide an overall assessment that would be equally applicable to the night-time period.

⁴¹ Offices have not been included within the operational noise or vibration assessment as they are not considered a sensitive receptor in the DMRB HD 213/11.

⁴² Based on the non-motorway equations of Method 3 of the Transport Research Laboratory report (Abbott P. G. and Nelson P. M., TRL Limited (2002), Project Report PR/SE/451/02 *Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping*) and a typical road with an $L_{A10,18h}$ value of 65 dB, the night-time noise level is predicted to be 55 dB.

13.3.71 In addition to the above, the DMRB HD 213/11 requires an indication of the number of residential properties that could be eligible for noise insulation under the NIR be identified.

13.4 Baseline Environment

13.4.1 Baseline noise surveys were undertaken at seven selected receptor locations over the period Wednesday 28 June to Monday 3 July 2017 and also on Tuesday 7 November 2017. The noise surveys were undertaken outside of school holidays and the weather was conducive to environmental noise monitoring being dry with light winds.

13.4.2 The noise monitoring locations were selected to be representative of the NSRs located close to the Scheme. The survey locations and measurement timings were agreed with WDC and SCC in advance of undertaking the surveys. The survey dates were chosen to be representative of normal conditions and measurements were avoided during times of local road works and A47 Bascule Bridge maintenance activities which were undertaken during the night.

13.4.3 The monitoring locations are shown in Figure 13.1 and presented in Table 13-12. Further details of the noise survey are presented in Appendix 13A and the calibration certificates of the equipment used during the monitoring are presented in Appendix 13C.

Table 13-12 – Noise Monitoring Locations

Reference	Location of monitoring location	Nearby NSRs	Grid reference (XY)
A	Denmark Road / Rotterdam Road	Residential receptors on Denmark Road to the west of Rotterdam Road and Rotterdam Road	653813 293050
B	Denmark Road / Hervey Street	Residential receptors on Denmark Road to the east of Rotterdam Road and Hervey Street	653998 292964
C	Riverside Children's and Family Centre (long-term)	Residential receptors on Waveney Drive and Waveney Crescent, and Trinity House ⁴³	653763 292432
D	Waveney Drive / Riverside Road	Residential receptors on Waveney Drive west of Waveney Crescent	653487 292455
E	Denmark Road / Trafalgar Street	Residential receptors on Denmark Road to the east of Clemence Street	654258 292943

⁴³ Trinity House is an office building located close to the southern end of the scheme. Whereas all residential dwellings are considered as 'high' sensitivity (in terms of the sensitivity of the receptor to noise and vibration impact) within this chapter, Trinity House is considered as a receptor of 'medium' sensitivity. This is in line with the guidance in Technical Advice Note (TAN): *Assessment of Noise*, to Planning Advice Note 1/2011: *Planning and Noise* (albeit published by the Scottish Government, but considered relevant in the absence of other guidance published in England) and reflects the use of the building for speech and communication, which is less sensitive to noise than rest, relaxation and sleeping as is typical for a residential dwelling.

Reference	Location of monitoring location	Nearby NSRs	Grid reference (XY)
F	Waveney Drive / Waveney Crescent	Residential receptors on the A12	654237 292431
G	Durban Road	Residential receptors on Durban Road	653918 292376

13.4.4 Daytime measurements were undertaken to qualify prevailing road traffic noise levels, in general accordance with the shortened measurement method detailed within CRTN which requires measurements over three consecutive one hour periods. As road traffic noise levels were observed to be consistent with little fluctuation, the method adopted was to obtain three fifteen minute measurements each within consecutive hours between 10:00 and 17:00 hours. Post analysis of the measurement data confirmed a stable (i.e. little variation in noise level between the 15-minute measured values) noise environment throughout the surveys at each location, confirming the appropriateness of the adopted approach (only if large variations arose might it be expected that the adopted approach would not yield reliable results).

13.4.5 Attended evening measurements were made between 20:00 and 23:00, a single fifteen minute period was recorded.

13.4.6 Attended night measurements were made between 01:00 and 03:00, a single fifteen minute period was recorded.

13.4.7 The results of the baseline noise survey are presented in Appendix 13A. In these tables, the results of the monitoring undertaken on weekdays (Monday to Friday) and at weekends (Saturday and Sunday) are reported separately.

13.4.8 The dominant noise source at all monitoring locations was noted to be road noise from local traffic on adjacent roads. Other sources included irregular railway noise at monitoring locations A, B and E. General residential activities were also audible during most daytime measurement periods.

Defra Noise Important Areas

13.4.9 Defra NIAs are locations where the local population are amongst the 1% of the total UK population that are affected by the highest noise levels from major roads, according to the results of Defra's strategic noise maps.

13.4.10 There are three NIAs (with reference numbers 5003, 5004 and 11285) within the operational phase noise study area. They are located on Bridge Road and Normanston Drive to the west of the Order limits. The NIAs are all associated with traffic using Mutford Bridge, and are shown in Figure 4.2 and Figure 13.2.

13.5 Predicted Impacts

Predicted Noise Levels during Construction Phase

13.5.1 BS 5228-1 provides guidance on the measurement and prediction of construction noise, and the prediction methods contained within this Standard have been used to estimate the levels of noise that will result from the construction of the Scheme.

13.5.2 Following the ABC assessment methodology contained within BS 5228-1, construction

noise thresholds have been derived from the baseline noise survey measurement results, as presented in Table 13-13.

Table 13-13 – Construction Noise Thresholds

Reference	Weekday daytime $L_{Aeq,T}$ calculated using BS 5228 ABC methodology			Weekday night-time $L_{Aeq,T}$ calculated using BS 5228 ABC methodology		
	Free-field Ambient level	Rounded to nearest 5 dB	Threshold Value (Category)	Free-field Ambient level	Rounded to nearest 5 dB	Threshold Value (Category)
A	68	70	75 (Category C)	52	50	55 (Category C)
B	68	70	75 (Category C)	44	45	50 (Category B)
C [^]	62	60	65 (Category A)	53	55	55 (Category C and Note 2)
D	66	65	70 (Category B)	48	50	55 (Category C)
E	70	70	75 (Category C)	47	50	55 (Category C)
F	70	70	75 (Category C)	64	65	65 (Category C and Note 2)
G	61	60	65 (Category A)	53*	55	55 (Category C and Note 2)

[^] The daytime category is assigned to residential NSRs only, in line with the guidance in BS 5228-1. A daytime threshold value of 75 dB is assigned to Trinity House as a non-residential receptor of 'medium' sensitivity. This threshold value is in line with the guidance in BS 5228-1 and is based on avoiding interference with speech related activities within adjacent buildings, i.e. activities akin to those associated with office/call centre. The night-time threshold value is not applicable to non-residential NSRs as they will not be occupied at night.

* No night-time measurements were undertaken at reference position G. Night-time values for reference position C have been used as representative of the night-time values at reference position G as the two positions are within 150m of each other, are located near to and a similar distance to Waveney Drive and have similar daytime ambient values.

13.5.3 The BS 5228-1 calculation procedures allow accurate noise levels to be determined for various construction activities. However, the value of any such predictions is necessarily limited by the number of assumptions made regarding the number and type of plant to be utilised, their location and detailed operating arrangements.

13.5.4 The information contained within BS 5228-1 and an appropriate plant list for the construction works that will be undertaken is considered sufficient to perform a construction phase noise assessment, focussing on key activities, with the aim of identifying whether a significant, albeit temporary, noise effect might arise at the nearest NSRs.

13.5.5 The main construction phases have been identified as follows:

- Site preparation and earthworks;
- Road pavement construction;
- Compound construction; and
- Bridge construction, including piling.

13.5.6 Appendix 13B details the assumed plant type, quantity, source noise level (in terms of the L_{Aeq} at a distance of 10m) and total sound power level for each construction phase. A summary of the combined sound power levels for each construction phase are

presented in Table 13-14.

Table 13-14 - Combined Activity Sound Power Levels during Each Stage of Construction

Construction Stage	Sound Pressure Level at 10m dB(A)	Overall Sound Power Level, dB(A)
Site preparation and earthworks	91	119
Road pavement	86	114
Compound construction	87	115
Bridge construction	97	125
Bridge construction night-time	90	118

13.5.7 It should be noted that in calculating the overall sound power level for each construction activity it is assumed all plant and equipment is running concurrently for 80% of the time representing a conservative worst case scenario. In order to present a representative assessment, it has been assumed that the main construction activities set out in Table 13-14 will be undertaken in separate phases. It is appreciated that some of the construction stages may overlap; however, the approach adopted is representative of predicting likely significant effects given that in the case of any such overlapping operations it will be the closest operations to the receptor (based on the location of different aspects of the Scheme within the reference design) that will generally dictate the resulting noise levels.

13.5.8 In practice, the plant items identified for each stage will move around the site, operating at different times, for different durations and at different locations on any one day for the duration of the works. As a consequence, noise levels at any receptor may vary considerably day-on-day. Hence, it is necessary to rationalise the geographic and temporal spread of activities to obtain a meaningful prediction (and subsequent assessment) and to this end, various assumptions have necessarily been made as described in the following paragraphs.

13.5.9 The most important assumptions relate to the location of construction plant and their operational 'on-time' during the period of interest.

13.5.10 With respect to the geographical location of the plant, the full complement of plant for each phase, as identified in Appendix 13B, is assumed to operate together at a single point at the centre of the closest working area to each reference position. This is considered to be a pragmatic and reasonably likely worst-case approach given the space constraints associated with this Scheme, whilst still representative of likely significant effects to arise during the construction phase. The assumed single point operating distance for each construction phase and NSR is summarised in Table 13-15.

Table 13-15 - Single Point Operating Distances assumed for Prediction of Construction Noise

Construction Phase	Reference A ⁴⁴	Reference B	Reference C	Reference D	Reference E	Reference F	Reference G
Site Preparation and Earthworks	10 m	105 m	50 m	25 m	330 m	80 m	35m
Road Pavement	15 m	110 m	50 m	20 m	330 m	80 m	35m
Construction Compound	100 m	105 m	220 m	300 m	330 m	450 m	60m
Bridge Construction	150 m	105 m	150 m	280 m	330 m	330 m	150m
Night-time Lake Bridge Construction	240 m	160 m	330 m	340 m	330 m	460 m	450m

13.5.11 Other assumptions which have been made with respect to the construction noise predictions are:

- No temporary or permanent noise barriers have been included;
- Acoustically hard ground cover has been assumed between the noise source and NSR (which therefore removes any attenuation effects due to ground absorption);
- No atmospheric absorption has been included;
- Predicted levels are quoted as equivalent free field levels at the location of the NSR façade where appropriate (i.e. 3 dB has not been added to account for façade reflections);
- Sources and receptors have both been taken to be 1.5 metres high; and
- Meteorological conditions have been taken to be 'neutral'

13.5.12 On this basis, construction noise levels have been predicted at the seven noise monitoring locations. These monitoring locations are considered representative of the nearest NSRs (as detailed in Table 13-12) to the construction works. A summary of predicted noise levels during each construction phase is given in Table 13-16. The effect level (NOEL/LOAEL/SOAE) in line with the criteria presented in Table 13-3 for each reference position is also presented.

⁴⁴ The references here (Reference A-G) relate to the NSRs considered in the baseline noise survey as per Table 13-12 and Figure 13.1

Table 13-16 - Predicted Unmitigated Construction Noise Levels, $L_{Aeq,T}$ dB

Construction Phase	Reference A (Effect level)	Reference B (Effect level)	Reference C (Effect level)	Reference D (Effect level)	Reference E (Effect level)	Reference F (Effect level)	Reference G (Effect level)
Site Preparation and Earthworks	91 (>SOAEL)	70 (<NOEL)	77 (>SOAEL)	83 (>SOAEL)	61 (<NOEL)	73 (>LOAEL <SOAEL)	80 (>SOAEL)
Road Pavement	83 (>SOAEL)	65 (<NOEL)	72 (>SOAEL)	80 (>SOAEL)	56 (<NOEL)	68 (<NOEL)	75 (>SOAEL)
Construction Compound	67 (<NOEL)	67 (<NOEL)	61 (>LOAEL <SOAEL)	58 (<NOEL)	58 (<NOEL)	54 (<NOEL)	72 (>SOAEL)
Bridge Construction	73 (>LOAEL <SOAEL)	77 (>LOAEL <SOAEL)	73 (>SOAEL)	68 (>LOAEL <SOAEL)	67 (<NOEL)	67 (<NOEL)	73 (>SOAEL)
Night-time Lake Bridge Construction	62 (>SOAEL)	66 (>SOAEL)	60 (>LOAEL <SOAEL)	59 (>LOAEL <SOAEL)	60 (>LOAEL <SOAEL)	57 (<NOEL)	57 (>LOAEL <SOAEL)

13.5.13 The core working hours have been assessed as between 07:00 and 19:00 hours on weekdays and 07:00 and 12:00 on Saturdays, with a one hour mobilisation and demobilisation period before and after the working day. Limited non-disruptive work such as office and preparatory work will take place either side of these hours at the site compounds.

13.5.14 Exceptions to the standard hours are likely to be necessary; however they are expected to be non-typical. For example, construction activities which would impact rail movements and those during the possession of the Navigation Channel may need to be completed during the night. It is known that elements of the Lake Bridge construction will be undertaken during the night (between 23:00 and 07:00 hours) due to the requirement to take possession of the Navigation Channel. Therefore, noise levels during this night-time activity have been predicted (as presented in Table 13-16) and assessed (as presented in Table 13-17).

13.5.15 Where further works are required to be undertaken outside of the core working hours presented above, this would be via agreement with WDC prior to works commencing.

13.5.16 There may be a requirement for some delivery of materials to be undertaken outside of the standard hours, but such instances are expected to be uncommon, and it is assumed that working on bank holidays will not occur.

Evaluation of the Significance of Predicted Noise Levels during Construction

13.5.17 The potential construction noise impacts for each phase has been assessed based on the magnitude of predicted noise levels and the effect levels (as defined in NPSE) set out in Table 13-3. As stated in paragraph 13.3.34, it is considered appropriate to assume that the construction works would exceed at least one of the duration criteria presented in paragraph 13.3.31 (i.e. 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months). Therefore, only the criteria on the bottom line of Table 13-4 have been applied to the

noise from the construction assessment, the results of which are presented in Table 13-17.

Table 13-17 – Significance of Impact for Construction Noise

Construction Phase	Reference A	Reference B	Reference C	Reference D	Reference E	Reference F	Reference G
Site Preparation and Earthworks	Major	Negligible	Major	Major	Negligible	Moderate	Major
Road Pavement	Major	Negligible	Major	Major	Negligible	Negligible	Major
Construction Compound	Negligible	Negligible	Moderate	Negligible	Negligible	Negligible	Major
Bridge Construction	Moderate	Moderate	Major	Moderate	Negligible	Negligible	Major
Night time Lake Bridge Construction	Major	Major	Moderate	Moderate	Moderate	Negligible	Moderate

13.5.18 The results presented in Table 13-17 for reference C relate to residential NSRs only. For Trinity House, it is predicted that the works would result in a noise level about the LOAEL with the exception of the construction compound which would result in no observed effect (NOEL), prior to the adoption of mitigation measures.

13.5.19 Based on the above and that significant effects are anticipated at a number of properties, mitigation measures have been proposed to minimise these effects.

Mitigation of Construction Noise

13.5.20 Legislative safeguards are available to reduce the effects of noise during the construction of a development such as the Scheme. These include:

- EC Directives and UK Statutory Instruments that limit noise emissions of a variety of construction plant;
- Guidance set out in BS 5228-1; and
- Sections 60 and 61 of the CoPA.

13.5.21 An interim CoCP has been produced (Appendix 5A) that sets the framework for the production of a noise and vibration management plan which must be submitted to the county planning authority for approval, following consultation with WDC. The noise and vibration management plan will implement and control noise emissions from the construction site and will include the following measures:

- Arrangements for communicating construction details, and likely noisy activities, with local communities and residents, including points of contact;
- Detailed methodologies for each construction activity (to the extent that they are relevant to the control of noise);
- Detailed timescales for each phase of construction (to the extent that they are relevant to the control of noise);

- Identification of the construction activities likely to generate the highest levels of noise, based on working areas;
- Prediction of noise levels from these activities following methods given in BS 5228-1;
- Identification, in consultation with WDC, of appropriate hours of working and construction noise limits;
- An assessment of predicted impacts against the agreed construction noise limits;
- Identification of appropriate noise mitigation measures; and
- Noise monitoring and reporting procedures.

13.5.22 Appropriate noise mitigation measures will include the implementation of Best Practicable Means (BPM). These will be fully detailed in the noise and vibration management plan for the Scheme and will include:

- Maintaining good public relations with local residents that may be affected by noise from the construction works. Effective communication should be established, keeping local residents informed of the type and timing of works involved. Effective methods of keeping local residents informed include leaflet drops, posters, public meetings, exhibitions and guided site visits;
- Provision of contact details for a site representative so that noise and vibration complaints arising from construction works are dealt with pro-actively and that subsequent resolutions are communicated to the complainant;
- Careful planning of construction activities and selection of plant to reduce noise emissions;
- A construction hoarding around the noise generating activity up to a height of at least 2.4m should this significantly attenuate the noise level;
- Locating static noisy plant in use as far away from NSRs as is feasible for the particular activity;
- Using suitable equipment and ensuring such equipment is properly maintained and operated by trained staff;
- Using silenced equipment where possible, in particular silenced power generators if night-time power generation is required for site security or lighting;
- Ensuring that vehicles and mobile plant are well maintained such that loose body fittings or exhausts do not rattle or vibrate;
- Engine compartments should be closed when equipment is in use and the resonance of body panels and cover plates reduced through the addition of suitable dampening materials;
- Ensuring plant machinery is turned off when not in use;
- Ensuring that vehicles do not park or queue for long periods outside NSRs with engines running unnecessarily;

- Generators and water pumps required for 24-hour operation should be silenced and/or screened as appropriate;
- Crane spindles, pulley wheels, telescopic sections and moving parts of working platforms should be adequately lubricated in order to prevent undue screeching and squealing; and
- Where possible, the use of mains electricity rather than generators.

13.5.23 In addition, where works are necessary outside standard hours, the use of silenced equipment and plant is suggested, or temporary barriers installed in order to reduce noise at NSRs to below BS 5228-1 threshold values where practicable.

Residual Effect of Construction Noise after Mitigation

13.5.24 With appropriate noise mitigation in place, including compliance with a full CoCP, as much as a 10 dB noise reduction can typically be achieved⁴⁵. Applying this 10 dB(A) correction to the predicted construction noise levels presented in Table 13-16, the residual construction noise effects (in line with the NPSE) at the NSRs are as presented in Table 13-18.

Table 13-18 – Residual Construction Noise Significance of Effects – Including Mitigation

Construction Phase	Reference A	Reference B	Reference C ⁴⁶	Reference D	Reference E	Reference F	Reference G
Site Preparation and Earthworks	Major	Negligible	Moderate	Moderate	Negligible	Negligible	Major
Road Pavement	Moderate	Negligible	Moderate	Moderate	Negligible	Negligible	Moderate
Construction Compound	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Moderate
Bridge Construction	Negligible	Negligible	Moderate	Negligible	Negligible	Negligible	Moderate
Night time Lake Bridge Construction	Moderate	Major	Negligible	Negligible	Negligible	Negligible	Negligible

13.5.25 The majority of NSRs are predicted to be below the NOEL during the construction works with the adoption of the mitigation measures outlined above. Therefore, no significant effects (negligible) are anticipated, irrespective of the duration of the works.

13.5.26 For properties predicted to be below the SOAEL but above the LOAEL during the construction works, effects of moderate significance are anticipated.

13.5.27 There are three locations where effects of major significance are anticipated, even with the adoption of appropriate further mitigation measures (as outlined in 13.5.22). This is due to a combination of the proximity of the NSRs to the works and the low existing

⁴⁵ The 2.4m high hoarding will “hide the source from the receiver”, and in such a situation BS 5228-1 states that a 10 dB reduction can be assumed.

⁴⁶ As stated for the results in Table 13-17, the results presented in Table 13-18 relate to residential NSRs only. For Trinity House and with the adoption of the mitigation measures outlined above, it is predicted that the works would result in no observed effect (NOEL) for all construction phases.

noise climate. It should be noted that the assessment is based on a worst-case scenario with plant working at a single point at the centre of the closest working area to the receptor for 80% of the working day. Such a scenario is considered to be a reasonably likely worst-case scenario and is therefore unlikely to occur frequently. The full complement of plant required for the construction works will necessarily be spread out over the working area given the space constraints associated with this Scheme, and so effects will be short-lived and temporary.

13.5.28 Finally, should the need arise, WDC has the means to impose, through a Control of Pollution Act Section 60, certain restrictions on working hours, the methods of work and the type of equipment employed to ensure that noise levels are kept to a minimum. These powers may be exercised either before works start or after they have started.

13.5.29 NSRs within the NIAs are unlikely to experience any change in noise level during the construction phase of the Scheme due to the distance between the Order limits and the NIA.

Predicted Levels of Vibration during Construction Phase

13.5.30 Groundborne vibration calculations have been performed for typical activities during construction based on the empirical prediction procedures presented within BS 5228-2, TRL report 246:1990 *Traffic induced vibration in buildings* (applicable to HGV induced vibration), and TRL report 429:2000 *Groundborne vibration caused by mechanised construction works* (applicable to vibratory rollers).

13.5.31 Such predictions have been performed in order to determine the possible distances at which the adopted magnitude of effect criteria may be registered. In this regard, groundborne vibration levels and associated distances have been identified for a sample of typical vibration sources which may be associated with the construction phase as shown in Table 13-19.

Table 13-19 - Predicted Groundborne Vibration Levels Applicable to Typical Vibration Generating Construction Activities

Construction Activity	Construction Phase	Distance (m)	PPV (mms ⁻¹)
Impact piling ¹	Bridge Construction, including piling	250	0.3
		100	1.0
		40	3.0
Vibratory piling (average of all operations)	Bridge Construction, including piling	100	0.3
		40	1.0
		18	3.0
Dynamic compaction piling ²	Bridge Construction, including piling	300	0.3
		150	1.0

Construction Activity	Construction Phase	Distance (m)	PPV (mms ⁻¹)
		75	3.0
Vibratory rollers – start & end ³	All phases	60	0.3
		23	1.0
Vibratory rollers – steady state	All phases	9	3.0
¹ Assumes a hammer energy of 6,000J, a pile toe depth of 10m and all piles driven to refusal. ² Assumes a tamper mass of 8500kg and a drop-height of 12m. ³ Assumes 2 rollers, 0.4mm amplitude, drum width of 1.3m, e.g. heavy duty ride on roller.			

13.5.32 It should be noted that the data presented within Table 13-19 is general in nature and is not specific to any one site but yet is appropriate for producing a robust assessment. Furthermore, there may be a variety of different potential vibration generating activities employed other than those listed. However, the vibration levels and associated distances can be used to determine the typical distances at which specific impacts could be registered (within an associated confidence limit).

13.5.33 The single point distances assumed for the construction noise activities for each phase, as previously presented in Table 13-15, have been assumed for the assessment of construction vibration impacts.

Evaluation of the Significance of Predicted Levels of Vibration during Construction

13.5.34 The significance of the potential construction vibration impacts for each activity has been assessed based on the magnitude of predicted vibration levels and the effect levels set out in Table 13-7. As stated in paragraph 13.3.45, it is considered appropriate to assume that the construction works would exceed at least one of the duration criteria presented in paragraph 13.3.31 (i.e. 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months). Therefore, only the criteria on the bottom line of Table 13-8 have been applied to the noise from the construction assessment, the results of which are presented in Table 13-20.

Table 13-20 - Significance of Construction Vibration Impacts

Construction Phase	Reference A	Reference B	Reference C	Reference D	Reference E	Reference F	Reference G
Site Preparation and Earthworks	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Road Pavement	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Construction Compound	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bridge Construction,	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

including piling							
------------------	--	--	--	--	--	--	--

13.5.35 All are predicted to be below the NOEL during the construction works. Therefore, no significant effects (negligible) are anticipated irrespective of the duration of the works.

13.5.36 Notwithstanding the above, the mitigation measures presented in paragraphs 13.5.20 to 13.5.23 should be adhered to at all times.

Construction Traffic Noise

13.5.37 An assessment of off-site construction traffic has been undertaken based on the methodology presented in paragraphs 13.3.57 to 13.3.69 and the numbers of construction vehicles that require compound access, as presented in Section 5.6.

13.5.38 The 18-hour AAWT data for Commercial Road and Waveney Drive pre- and during construction have been provided in Section 5.6 and reproduced in Table 13-21 below for ease of reference. The speed is assumed to be 48kph (30 mph) pre- and during construction.

Table 13-21- Construction Traffic Data

Road Link	Pre-construction		During construction	
	Traffic Flow (18-hour AAWT)	Percentage Heavy Vehicles	Traffic Flow (18-hour AAWT)	Percentage Heavy Vehicles
Commercial Road	2,400	2%	2,487	6%
Waveney Drive	8,598	1.5%	8,652	2.1%

13.5.39 A Basic Noise Level has been calculated in line with the guidance in CRTN (as detailed in paragraph 13.3.52) for both the pre-construction and during construction scenario at a nominal distance of 10m from the carriageway edge of Commercial Road and Waveney Drive, based on the traffic data presented in Table 13-21 above.

Table 13-22- Short-term Construction Traffic Noise Impacts, dB $L_{A10,18h}$

Road Link	BNL pre-construction	BNL during construction	Short-Term Change in Noise Level
Commercial Road	59.4	60.8	1.4
Waveney Drive (east of access road)	65.2	65.3	0.3

13.5.40 It can be seen from Table 13-22 that the predicted noise levels from Commercial Road and Waveney Drive both pre- and during construction are less than the SOAEL (67.5 dB $L_{A10,18h}$) with a minor change in noise level as a result of construction related traffic. Therefore, the change in road traffic noise levels during the construction phase is not significant and therefore warrants no further consideration.

Operational Road Traffic Noise

Short-term Impacts: Do Minimum Opening Year and Do Something Opening Year (2022)

13.5.41 The modelling outputs for these scenarios are shown in Figure 13.3.

13.5.42 The number of NSRs experiencing a change in traffic noise level (either positive or negative) at year of opening (2022) as a result of the Scheme are presented in Table 13-23 according to the magnitude of the Do Something traffic noise level and the change in traffic noise level compared to the Do Minimum situation.

Table 13-23- Overall Short-term Operational Noise Impacts

Change in noise level		Dwellings	Other sensitive receptors
Increase in noise level, $L_{A10,18h}$	0.1 - 0.9	4646	46
	1.0 - 2.9	3696	23
	3.0 - 4.9	641	1
	5 +	107	1
No change	0	455	1
Decrease in noise level, $L_{A10,18h}$	0.1 - 0.9	3098	46
	1.0 - 2.9	1097	12
	3.0 - 4.9	21	0
	5 +	0	0

13.5.43 In summary, in the short-term with the Scheme in place, there are 8,199 dwellings and 93 other sensitive receptors that are expected to experience either no change or a negligible impact in terms of noise, which are likely to be imperceptible to residents. These are the NSRs in the '0.1-0.9' and 'no change' rows of Table 13-23.

13.5.44 In order to determine the likelihood of significant effects in the short-term with the Scheme, the absolute noise level (in line with the requirements of the NPSE) also needs to be taken into consideration, as presented in Table 13-9. As such, properties above the SOAEL (67.5 dB $L_{A10,18h}$) have been identified and the change at each of these properties calculated. The same process has been applied to all properties above the LOAEL (54.5 dB $L_{A10,18h}$) but below the SOAEL.

13.5.45 There are 423 NSRs above the SOAEL, of which 142 are predicted to experience a significant adverse short-term change in noise level (i.e. greater than +1 dB change) as a result of the Scheme (see Figure 13.3 for the short-term noise change contour plots). However, 71 NSRs are predicted to experience a significant beneficial change in noise level (i.e. greater than -1 dB change) as a result of the Scheme.

13.5.46 Further to the above, there are 3,275 NSRs above the LOAEL but below the SOAEL. Of these, 1,780 are predicted to experience a significant adverse short-term change in noise level whilst 186 are predicted to experience a significant beneficial change in noise level as a result of the Scheme.

Long-term Impacts: Do Minimum Opening Year (2022) and Do Something Design Year (2037)

13.5.47 The modelling outputs for these scenarios are shown in Figure 13.4.

13.5.48 The number of NSRs experiencing a change in traffic noise level (either positive or negative) at the design year (2037) compared to the year of opening (2022) as a result of the Scheme are identified in Table 13-24 according to the magnitude of the noise change.

Table 13-24 - Overall Long-term Operational Noise Impacts

Change in noise level		Dwellings	Other sensitive receptors
Increase in noise level, $L_{A10, 18h}$	0.1 - 2.9	10363	100
	3.0 - 4.9	1324	2
	5.0 - 9.9	141	1
	10 +	0	0
No change	0	231	2
Decrease in noise level, $L_{A10, 18h}$	0.1 - 2.9	1702	25
	3.0 - 4.9	0	0
	5.0 - 9.9	0	0
	10 +	0	0

13.5.49 In summary, in the long-term with the Scheme in place, there are 12,296 dwellings and 127 other sensitive receptors that are expected to experience either no change or a negligible impact in terms of noise, which are likely to be imperceptible to residents. These are the NSRs in the '0.1-2.9' and 'no change' rows of Table 13-24.

13.5.50 In order to determine the likelihood of significant effects in the long-term with the Scheme, the absolute noise level (in line with the requirements of the NPSE) also needs to be taken into consideration, as presented in Table 13-9. As such, properties above the SOAEL (67.5 dB $L_{A10, 18h}$) have been identified and the change at each of these properties calculated. The same process has been applied to all properties above the LOAEL (54.5 dB $L_{A10, 18h}$) but below the SOAEL.

13.5.51 There are 565 NSRs above the SOAEL, of which 72 are predicted to experience a significant adverse long-term change in noise level (i.e. greater than +3 dB change) as a result of the Scheme (see Figure 13.4 for the long-term noise change contour plots). No NSRs are predicted to experience a significant beneficial change in noise level (i.e. greater than -3 dB change) as a result of the Scheme.

13.5.52 Further to the above, there are 3,492 NSRs above the LOAEL but below the SOAEL. Of these, 113 are predicted to experience a significant adverse long-term change in noise level whilst none are predicted to experience a significant beneficial change in noise level as a result of the Scheme.

Designated Sites

13.5.53 There are a number of designated sites within the vicinity of the Scheme, as shown on Figure 4.2. The predicted range of noise levels at each of the designated sites, based

on the results from the 3D noise model, are presented in Table 13-25 for the following scenarios:

- Do Minimum opening year (2022);
- Do Something opening year (2022); and
- Do Something design year (2037).

13.5.54 The range of noise levels presented reflects the geographic extent of each receptor to account for how noise levels vary across the extent of each site.

Table 13-25 – Predicted Noise Levels at Designated Sites

Designated site	Range of Noise Levels dB LA10,18h		
	Do Minimum Opening Year	Do Something Opening Year	Do Something Design Year
Kirkley Ham County Wildlife Site (CWS)	63 – 68	64 – 70	65 – 70
South Lowestoft Conservation Area (CA)	54 – 63	53 – 61	54 – 62
North Lowestoft CA	54 – 64	53 – 64	54 – 64
Lowestoft Outer Harbour CWS	47 – 54	46 – 53	46 – 54
Brooke Yachts and Jeld Wen CWS	46 – 48	48 – 51	48 – 52
Oulton Broad CA	42 – 50	41 – 48	42 – 49
Broadland RAMSAR	41 – 45	40 – 44	41 – 45
The Broads National Park	42 – 66	41 – 65	42 – 66
Leathes Ham Local Nature Reserve (LNR)	54 – 57	56 – 59	56 – 60
Gunton Wood LNR	40 – 43	43 – 43	41 – 44
Gunton Warren and Corton Woods LNR	38 – 39	38 – 39	39 – 40

13.5.55 The assessments of these designated sites are presented in Chapter 9: Cultural Heritage and Chapter 11: Nature Conservation.

Noise important Areas

13.5.56 As stated in paragraph 13.4.10, there are three NIAs, with reference numbers 5003, 5004 and 11285, located within the operational study area (see Figure 13.2).

13.5.57 According to the results of Defra’s strategic noise maps, dwellings within NIAs are already exposed to the highest noise levels from major roads and residents are at a greater risk of experiencing a significant adverse impact to health and quality of life. Therefore, a more detailed analysis of the predicted noise level and noise level change as a result of the Scheme has been undertaken at each NSR within each NIA, as presented in Table 13-26.

Table 13-26 - Operational Noise Impacts within NIAs – Number of NSRs

Short/Long term change	NIA	Number of dwellings in NIA	Noise level change where DM NSR above SOAEL, dB		Noise level change where DM NSR above LOAEL and less than SOAEL, dB	
			<minus 0.9	minus1.0 – minus 2.9	<minus 0.9	minus1.0 – minus 2.9
Short-term change	5003	67	0	19	1	13
	5004	61	0	3	7	12
	11285	42	0	19	7	10
Short/Long term change	NIA	Number of dwellings in NIA	<minus 2.9	minus 3.0 – minus 4.9	<minus 2.9	minus 3.0 – minus 4.9
Long-term change	5003	67	19	0	12	0
	5004	61	4	0	17	0
	11285	42	16	0	19	0

13.5.58 As shown in Table 13-26 all dwellings within each of the three NIAs are predicted to experience a decrease in noise level in the short and long-term as a result of the Scheme.

13.5.59 In the short-term, 19 dwellings in NIA 5003, 3 dwellings in NIA 5004 and 19 dwellings in NIA 11285 are predicted to experience a significant decrease (i.e. greater than -1 dB change) in noise level as a result of the Scheme.

Mitigation

13.5.60 Significant adverse effects are predicted during the operational phase of the Scheme at a number of NSRs due to magnitude of change in road traffic noise above the NPSE effect levels (as per the significance criteria in Table 13-11). Consequently, mitigation measures have been explored in order to consider whether these effects can be offset. Consideration has been given to the following mitigation measures:

- Changing location or alignment of the road;
- Changing the height of the road;
- Reducing traffic speed;
- Use of low-noise thin surface course system; and
- Use of roadside acoustic barriers, screens or bunds.

13.5.61 The majority of NSRs that are significantly adversely affected are located fronting the existing local road network and within close proximity to the Scheme. The practicalities of employing the above mitigation measures are explored in turn below.

13.5.62 The location and alignment of the Scheme was determined following a Route Options Appraisal as explained in the Outline Business Case (document reference 7.4) and in Chapter 3, during which various factors were considered, including noise. The route necessarily needs to connect with Waveney Drive and Durban Road to the south and Denmark Road to the north, meaning that it will necessarily always pass in close

proximity to existing dwellings.

13.5.63 Lowering or increasing the height of the existing roads, including Waveney Drive, Durban Road and Denmark Road, by a significant amount to provide any screening would restrict access to dwellings which front directly onto the road and in any event are located outside of the Order limits. Furthermore, the new road necessarily has to have enough height to span the Inner Harbour. No further consideration has therefore been given to route alignment and height changes.

13.5.64 Whilst low noise road surfaces are available, these are most effective at higher speeds (around 50 mph and above), where the noise from the tyre / road interaction is dominant. At lower speeds, as in this case, where the engine / exhaust noise is dominant, any noise reduction afforded by such a measure would be minimal. Furthermore, given the route speed for this section is already relatively low, a further reduction in speed is also not considered a viable measure.

13.5.65 Furthermore, installing acoustic barriers to protect NSRs would not be practicable given that access is required into the existing properties fronting the local road network.

13.5.66 The residual effects of the Scheme are presented below.

Residual Effects

13.5.67 Opportunities for mitigation measures to offset the predicted significant adverse effects as a result of the operation of the Scheme are limited due to the residential nature of the surrounding area. Therefore, significant adverse effects will remain as a result of the operation of the Scheme. There are significant benefits that the Scheme will provide to other NSRs.

Noise Insulation Regulations

13.5.68 The assessment of significant effects is based on the external noise levels predicted at a NSR, in line with the guidance in the DMRB HD 213/11. Therefore, a scheme for noise insulation of a property through the application of the NIR will not alter the conclusions of the operational noise assessment. However, the DMRB HD 213/11 requires an indication of the number of properties that may be eligible for the provision of noise mitigation (or a grant in respect thereof) under the NIR.

13.5.69 In order to qualify for compensation under the NIR, four criteria must be fulfilled as presented in paragraph 13.2.6.

13.5.70 There are 559 residential dwellings which are predicted to satisfy condition 1, having a predicted noise level above 67.5 dB $L_{A10,18h}$ within the first fifteen years of use of the Scheme. Of these, 117 properties are within 300m of the Scheme and are predicted to have an increase of at least 1 dB as a result of the Scheme (i.e. the Relevant Noise Level in the design year is greater than the Prevailing Noise Level in the year of opening by 1 dB or more).

13.5.71 At detailed design stage, further analysis will need to be undertaken to determine whether the noise from traffic on the road to which the Regulations apply contributes at least 1 dB $L_{A10,18hr}$ to the Relevant Noise Level.

Operational Noise and Vibration Nuisance Assessment

13.5.72 The DMRB HD213/11 also requires an assessment of the operational noise and vibration nuisance change at receptors as a result of the Scheme. As this assessment is independent from the EIA process and does not determine significant effects, the results are presented in Appendix 13D.

13.6 Conclusions and Effects

13.6.1 A noise and vibration assessment has been undertaken in terms of the potential effects on NSRs during the construction and operation of the Scheme. In particular, the potential effect of changes in road traffic noise at NSRs as a result of the operation of the Scheme has been considered in accordance with DMRB HD 213/11.

13.6.2 The assessment of construction activities has highlighted that significant adverse impacts are predicted during worst case conditions, when plant is operating in close proximity to NSRs. However, through the adoption of Best Practicable Means (BPM) and a 2.4m high hoarding around the construction site and other mitigation measures recommended in this chapter, it will be possible to reduce noise levels such that during the majority of the construction phase the effects would be minor, but with some chance of significant adverse effects, albeit that these would be temporary and short-term.

13.6.3 With the inclusion of the mitigation measures, it is anticipated that for the majority of time, effects in terms of vibration arising during the construction works will be insignificant for the nearest NSRs. However, occasional significant adverse effects and therefore significant adverse health and quality of life impacts could not be entirely discounted during some activities when works are at their closest to nearby sensitive receptors and extend beyond the duration criteria presented in paragraph 13.3.31.

13.6.4 In terms of the operational impact of the Scheme, significant adverse effects and therefore significant adverse health and quality of life impacts because the noise level becomes greater than the SOAEL, are predicted at a number of NSRs both in the short and long-term. The majority of these are located within the immediate vicinity of the Scheme and may be eligible for a scheme of noise insulation under the NIR 1975.

13.6.5 There are also major beneficial effects and therefore major beneficial health and quality of life impacts predicted at a number of NSRs along Denmark Road, close to the existing eastern bridge, and on Prospect Road, Romany Road and Borrow Road due to the traffic flow reduction on these roads once the Scheme is in operation.

14 Materials

14.1 Scope of the Assessments

14.1.1 This Chapter focusses on the material resources required and waste generation during the construction of the Scheme and follows the SoS's Scoping Opinion (Appendix 6B) which stated that an assessment of materials was a requirement for the ES.

14.1.2 Construction of the Scheme will require raw materials and will create waste. This could result in potentially significant environmental effects associated with the extraction of primary raw materials, the manufacture of products, and their use on construction sites. Key considerations have been grouped under two main areas:

- Material Resources – this includes natural resources and manufactured products required to construct the Scheme, for example aggregates, soils and concrete; and
- Waste – excavated materials from the site, road planings, and contaminated materials that may be found on site and which need to be excavated and disposed of. Some of these “waste” materials could be re-used on site and may therefore be considered as material resources but for the purposes of the assessment, in order to assess a robust worst case, it has been assumed that this material is unsuitable for re-use on site.

14.1.3 The operation of the Scheme has been scoped out of this Materials assessment as maintenance is not likely to require a significant amount of materials. This is following consultation with the designers of the bascule mechanics who have confirmed that ongoing maintenance, with the exception of replacement hydraulics on a 10 year cycle, will largely be limited to lubrication of the moving elements which not involve significant quantities of materials.

Study area

14.1.4 The study area for this assessment is defined as the Order limits of the Scheme as well as any sites that have been identified as suitable for accepting waste, or providing construction materials for the Scheme, which includes facilities in both Norfolk and Suffolk.

14.2 Directives, Statutes and Relevant Policy

EU Directives and Policy

The Waste Framework Directive

14.2.1 Council Directive 2008/98/EC (the Waste Framework Directive) provides a framework of waste management requirements and sets out the basic waste management definitions for the EU. The Waste Framework Directive includes a target to recover 70% of construction and demolition waste by 2020.

14.2.2 The Waste Framework Directive introduces the waste hierarchy and provides the following definitions:

- Prevention – Using less material in design and manufacture, keeping products

for longer, using less hazardous materials;

- Preparing for reuse – Checking, cleaning, repairing and refurbishing;
- Recycling – Turning waste into a new substance / product, includes composting if it meets quality protocols;
- Recovery – Anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and recovering materials from waste; and
- Disposal – Landfill and incineration without energy recovery.

European Union Sustainable Development Strategy 2006

14.2.3 This provides a single coherent strategy on how the EU can progress the long standing commitment to meet the challenges of sustainable development including high energy consumption, loss of biodiversity and natural resources.

National Legislation and Policy

14.2.4 The following UK legislation and policy documents are also relevant to the Scheme.

The Waste (England and Wales) Regulations 2011

14.2.5 The Waste (England and Wales) Regulations 2011 transposes the requirement of the Waste Framework Directive into UK law. It also requires the application of the waste management hierarchy in preventing or reducing the adverse impacts of waste generation.

The Environmental Protection Act, 1990

14.2.6 The Environmental Protection Act 1990 requires all producers of controlled waste to ensure that they only transfer wastes that they produce to authorised carriers or to operators with suitable permits for the management of these wastes.

The Landfill (England and Wales) Regulations, 2002

14.2.7 The Landfill (England and Wales) Regulations 2002 overall objective is to supplement the requirements of the Waste Directive to prevent or reduce as far as possible the negative effects of landfilling on the environment as well as any resultant risk to human health.

The Hazardous Waste (England and Wales) Regulations, 2005

14.2.8 The key implications of The Hazardous Waste (England and Wales) Regulations, 2005 are that the list of Hazardous Wastes will be defined by the European Waste Catalogue under the List of Wastes Regulations 2005 and that each hazardous waste producing site, unless exempt, is required to be pre-registered with the Environment Agency (EA) before waste can be collected.

Environmental Permitting Regulations (England and Wales), 2011

14.2.9 The Environmental Permitting Regulations (England and Wales) 2011 produces a single regulatory framework by streamlining and integrating a number of regimes including waste management licensing, pollution prevention and control, water discharge consenting and groundwater authorisations.

The NPS for National Networks

14.2.10 The NPS for National Networks (NNNPS) re-iterates the waste hierarchy as a method of achieving sustainable waste management. It also states that an applicant should set out the arrangements that are proposed for managing any waste produced by a scheme.

The Ports National Policy Statement

14.2.11 The Ports National Policy Statement (PNPS) also mentions the use of the waste hierarchy in order to attain sustainable waste management as well as providing information on dredging and disposal of waste at sea.

Securing the Future – The UK Government Sustainable Development Strategy 2005

14.2.12 This provides the UK strategy to prioritise sustainable consumption and production, natural resource protection and sustainable communities.

National Planning Policy for Waste, 2014

14.2.13 This outlines the Government's ambition to promote a sustainable approach to resource use and management. It sets out waste planning policies, and should be read alongside: the National Planning Policy Framework; the National Waste Management Plan for England and successor policies, guidance or documents. Policies include:

- Delivery of sustainable development and resource efficiency, including provision of modern infrastructure, local employment opportunities and wider climate change benefits, by driving waste management up the waste hierarchy;
- Ensuring that waste management is considered alongside other spatial planning concerns, such as housing and transport, recognising the positive contribution that waste management can make to the development of sustainable communities;
- Helping to secure the reuse, recovery or disposal of waste without endangering human health and without harming the environment; and
- Ensuring the design and layout of new residential and commercial development and other infrastructure (such as safe and reliable transport links) complements sustainable waste management, including the provision of appropriate storage and segregation facilities to facilitate high quality collections of waste.

National Planning Policy Framework

14.2.14 The National Planning Policy Framework (NPPF) does not include policies for waste management as it defers to the National Waste Management Plan for England (see Paragraph 14.2.15) but does encourage the prudent use of natural resources.

National Waste Management Plan for England

14.2.15 This identifies Government's approach to the management of waste, promotes the waste hierarchy and encourages the reuse of materials at their source.

*Local Planning Policy**Suffolk*

14.2.16 The Suffolk Waste Core Strategy (2011) highlights that applicants need to demonstrate proposals according to set principles. Policy WDM17 requires demonstration that proposals accord with:

- Construction and demolition methods that minimise waste generation and reuse/recycle materials, as far as practicable on site; and
- Design principles and construction methods that minimise the use of primary aggregates and encourage the use of high quality building materials made from recycled and secondary sources.

Norfolk

14.2.17 The Norfolk Minerals and Waste Development Framework Core Strategy (2010) sets out mineral extraction and waste management in Norfolk. The strategy for waste management conforms to the Waste Strategy for England 2007 and the national waste hierarchy.

14.3 Methods of Assessment

14.3.1 The Secretary of State in the Scoping Opinion (Appendix 6B) stated that a materials assessment was a requirement for the construction phase of the Scheme and that this should include information on the likely volume of waste and the materials required during construction. An assessment has therefore been undertaken with reference to draft DMRB Volume 11 Section 3 Part 6 (draft HD212/11) and focuses on the construction phase.

14.3.2 As per draft HD212/11, a detailed assessment of impacts has been undertaken as there is the potential for the use of materials and production / management of waste to cause significant environmental effects and estimated volumes of material resource / waste arisings are available.

Depletion of Natural Resources

14.3.3 An assessment of the predicted use of natural resources, mainly the depletion of non-renewable mineral resources (i.e. crushed rock, sand and gravel) has been undertaken.

14.3.4 The depletion of natural resources assessment has been undertaken by estimating the quantities of aggregate using products as part of the Scheme design.

Embodied Carbon Emissions

14.3.5 An assessment of the potential embodied carbon impacts associated with the material resource demands of the Scheme has been undertaken using Highways England (HE) Task 446 Carbon Tool v1.03 (Carbon Tool) in line with the requirements of draft HD212/11.

14.3.6 The material quantities required for the Scheme were ascertained from the reference design for the Scheme and were entered into the Carbon Tool which calculates the CO₂ equivalent (CO₂e) of each of the materials.

14.3.7 The material import data was entered into the tool taking into account of the following assumptions:

- Civil engineering structures: concrete.
- Drainage: filter material only.
- Earthworks: imported fill.
- Road pavement: surface and sub-base.

Waste Assessment

14.3.8 The waste assessment identifies and estimates the likely waste arisings as a result of the Scheme during the construction phase and to provide a worst case assessment it has been assumed that all terrestrial excavated material requires landfill disposal.

14.3.9 The assessment also considers the potential for reuse of site-won materials. All material that did not qualify for re-use on site by virtue of the type of material or there being no capacity within the design for re-use was recorded.

14.3.10 U1A, U1B and U2 are references given to materials (including dredged material) considered to be unsuitable and which will require treatment to render them to be a reusable resource within the Scheme. These definitions are provided within the Manual of Contract Documents for Highway Works (MCHW) – Specification for Highways Works. Within the MCHW guidance:

- U1A is defined as material that is geotechnically unsuitable for use;
- U1B relates to materials that do not meet the relevant chemical criteria for reuse and generally relates to contaminated materials; and
- U2 materials are those that are considered to be hazardous materials.

14.3.11 Consultation with the waste management departments of Suffolk County Council (SCC) and Norfolk County Council (NCC) has been undertaken in order to understand the available capacity for the treatment of construction and demolition waste in proximity to the Scheme.

Value / Sensitivity

Depletion of Natural Resources

14.3.12 The assessment of the scale and significance of the impacts related to the depletion of natural resources has been based on a combination of the predicted quantities of mineral resources to be used in the Scheme, and the effects that this predicted consumption will have on available mineral resources.

14.3.13 As such, the assessment identifies both the relative quantities of primary aggregates to be used and the sensitivity of regional mineral resources.

14.3.14 The sensitivity of the regional mineral resource (crushed rock, and sand and gravel) has been determined using the terminology presented in Table 14-1 below, as per draft HD212/11.

Table 14-1 – Sensitivity of Regional Natural Resources

Sensitivity	Description
Very High	There are no supplies of mineral resources within the study area
High	There are limited supplies of mineral resources within the study area
Medium	There are adequate supplies of mineral resources within the study area.
Low	There are good supplies of mineral resources within the study area

Embodied Carbon Emissions

14.3.15 Draft HD212/11 does not define sensitivity for material consumption and use (calculated as embodied carbon emissions), and therefore the significance of the impact cannot be defined. As such the assessment reports on the magnitude of impact only, through the use of a proxy in the form of the embodied carbon emissions associated with specific materials and construction products.

Waste Assessment

14.3.16 With regard to waste, the sensitivity of the waste capacity and therefore sensitive receptors within the study area is determined by using the terminology in Table 14-2 below, as per draft HD212/11.

Table 14-2 – Sensitivity of Receptor(s) – Waste Assessment

Sensitivity	Description
Very High	There is no available waste management capacity for any waste arising from the project
High	There is limited waste management capacity in relation to the forecast waste arising from the project
Medium	There is adequate waste management capacity for the majority of wastes arising from the project.
Low	There is adequate available waste management capacity for all wastes arising from the project.

Magnitude of Impact

Depletion of Natural Resources

14.3.17 The magnitude of the impact related to the depletion of natural resources has been assessed against the scale provided in Table 14-3 below, as per draft HD212/11.

Table 14-3 – Scale of Impact Magnitude – Depletion of Natural Resources

Magnitude	Description
Major	Considerable impact (by quantity) of more than local significance in relation to the use of mineral resources
Moderate	Moderate impact (by quantity) of more than local significance in relation to the use of mineral resources
Slight	Slight impact (by quantity) of more than local significance in relation to the use of mineral resources

Negligible	Negligible impact (by quantity) of more than local significance in relation to the use of mineral resources
------------	---

Embodied Carbon Emissions

14.3.18 The embodied carbon emissions are considered a proxy measure of the environmental impacts of materials according to the scale of impact magnitude summarised in Table 14-4, as per draft HD212/11.

Table 14-4 – Scale of Impact Magnitude – Material Resources

Impact Magnitude	CO ₂ e represented as tonnes of carbon
No change	<1,000
Negligible	1,000 – 5,000
Minor	5,000 – 20,000
Moderate	20,000 – 40,000
Major	>40,000

Waste Assessment

14.3.19 The scale of the magnitude of impact for waste is ranked according to scale, as summarised in Table 14-5 below, as per draft HD212/11.

Table 14-5 – Scale of Impact Magnitude - Waste

Magnitude	Description
Major	Wastes are predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation
Moderate	Wastes are predominantly disposed of to incineration with energy recovery
Slight	Wastes are predominantly segregated and sent for composting, recycling or further segregation and sorting at a material recovery facility
Negligible	Wastes are predominantly re-used on site or at an appropriately licensed or registered exempt site elsewhere

Nature of Impact

14.3.20 The nature of each impact for natural resources, material resources and waste is classified as being:

- Adverse (a detrimental or negative impact to an environmental resource or receptor) or beneficial (an advantageous or positive impact to an environmental resource or receptor);
- Direct or indirect;
- Short term or long term; and
- Temporary or permanent.

Impact Significance

Embodied Carbon Emissions

14.3.21 Draft HD212/11 does not define significance for material resource in terms of

embodied carbon emissions. The scale of magnitude as outlined in Table 14.4 gives an indication of the scale of the identified impacts.

Depletion of Natural Resources and Waste Assessment

14.3.22 For depletion of natural resources and waste, the assessment of significance is based on the characteristics of the impact and the sensitivity of the receptor. By establishing the sensitivity / value of the receptor and the magnitude / nature of the impact, the significance level of the environmental effect is determined, as per Table 14-6, taken from draft HD212/11. Where two magnitudes are shown in a single cell, professional judgement is applied to choose the most appropriate option.

Table 14-6 – Significance of Depletion of Natural Resources and Waste Effects Matrix

Magnitude of Impact	Level of Significance Relative to Sensitivity / Value of Receptor			
	Very High	High	Medium	Low
Major	Very Large	Large / Very Large	Moderate / Large	Slight / Moderate
Moderate	Large / Very Large	Moderate / Large	Moderate	Slight
Minor	Moderate / Large	Slight / Moderate	Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral

14.3.23 Impacts of a moderate effect or greater are considered to be significant. Mitigation measures to avoid or reduce impacts have been considered and reported in Section 14.7 of this chapter.

14.4 Baseline Environment

14.4.1 It should be noted that this section differs to other chapters in that it provides background information rather than a baseline. For a scheme that has yet to be constructed, there are no baseline conditions relating to material resources / waste.

Depletion of Natural Resources

14.4.2 Primary aggregates are materials extracted directly from the ground and are defined by the British Geological Survey (BGS) as “aggregates produced from naturally occurring mineral deposits, extracted specially for use as aggregates and used for the first time” within the Mineral Planning Factsheet – Construction Aggregates (June 2003).

14.4.3 The BGS 2014 Aggregate Minerals Survey for England and Wales indicates that there are total permitted reserves in the East of England of 128,395,000 tonnes and that there are a number of quarries / sources of primary aggregates located within East of England counties.

Embodied Carbon Emissions

14.4.4 As mentioned in Paragraph 14.4.1 there are no baseline conditions with regard to embodied carbon emissions for a development that has yet to be built.

Waste Assessment

14.4.5 The local waste infrastructure and the potential waste management capacity have been identified using data from the EA, Suffolk County Council and Norfolk County Council.

Construction and Demolition Wastes

14.4.6 This assessment defines Construction and Demolition (C&D) waste as waste materials arising from UK C&D sites as wastes comprises, but not limited to:

- Offcuts and waste timber;
- Plastics (such as uPVC and HDPE);
- Glass;
- Packaging waste materials (such as card, wood and plastic film);
- Inert materials (such as soil); and
- Aggregate materials (such as masonry, brick, block paving, tiles and ceramics) and plasterboard in mixed waste.

14.4.7 In addition, the following represent additional waste materials associated with the Scheme that are anticipated:

- Green waste / vegetation (site clearance);
- Asbestos;
- Sediment from Lake Lothing;
- Japanese Knotweed (see Chapter 11); and
- Disposal of unsuitable materials (U1A, U1B and U2).

Waste Capacity in Suffolk

14.4.8 The Waste Core Strategy (2011), part of the Minerals and Waste Development Framework, states that no sub-regional apportionment for inert waste exists. Inert waste includes construction, demolition and excavation waste. However, at current rates of filling the existing inert capacity will not be filled at current rates until 2032.

14.4.9 The Waste Core Strategy highlights that there are Recycled Aggregate Facilities to the south of the Scheme at the Brick and Pipe Works in Gisleham, approximately 9.5km away, and the Industrial estate in Ellough, which is approximately 16km from the Scheme.

Waste Capacity in Norfolk

14.4.10 The Minerals and Waste Core Strategy states the strategy for waste management in Norfolk is to provide sufficient waste management capacity to meet the arisings of commercial and industrial waste and to ensure there is capacity to provide for inert waste.

14.4.11 The Waste Site Specific Allocation Development Plan Document (2013) states that the quantity of additional landfill/quarry void space for inert material will increase by 2,060,000m³. Estimations of capacity for a further five sites at existing or proposed

quarries increased the total capacity of inert landfill by 3,375,000 tonnes.

Combined Waste Capacity of Suffolk and Norfolk

14.4.12 In assessing potential waste arisings from the Scheme it is necessary to evaluate local waste capacity potential. In discussions with the Environment Agency, SCC and NCC the following landfill sites have been identified as suitable for accepting waste from the Scheme. These are shown in Table 14-7 and on Figure 14.1. Should hazardous landfill disposal be required, the nearest facility is in Peterborough 187km from the Scheme, also shown on Figure 14.1.

Table 14-7 – List of Landfill Sites in Proximity to the Scheme

Landfill name	Landfill type	Distance from the Scheme	Remaining capacity (m ³ at 31 December 2015)
Shrubland Quarry	Inert Landfill	70km	546,940
Masons Landfill	Non-hazardous Landfill (with stable non-reactive hazardous waste cell)	84km	3,821,952
Aldeby Landfill	Non-hazardous Landfill	24km	53,936
East Northants Resource Management Facility (Kings Cliffe)	Hazardous landfill	187km	1,101,1100

14.4.13 Table 14-7 indicates the volume of potential waste sites for the variety of waste types that may be associated with a C&D project. These facilities are considered to have a Low sensitivity in relation to the type and volume of waste expected to be generated by the Scheme.

14.5 Predicted Impacts

Depletion of Natural Resources

14.5.1 Aggregates will be required for earthworks, structures, drainage and road pavement construction. These could be either primary, secondary or recycled aggregates. In order to provide a worst case scenario, it has been assumed that all aggregates will be from a primary source.

14.5.2 The predicted aggregate requirement is a total volume of 136,890m³ to cover imported fill, sub base / capping and drainage material.

14.5.3 The baseline data indicates that there is a sufficient landbank of aggregates at the time of assessment. As such, there is considered to be a Low sensitivity with regard to the depletion of natural resources should it not be suitable to re-use site won material.

14.5.4 Given that the natural resources have been given a Low sensitivity, there is considered to be a negligible impact from the natural resource consumption during construction of the Scheme. Therefore, the significance of the depletion of natural resources is considered to be adverse, permanent, direct and Neutral.

Embodied Carbon Emissions

14.5.5 An estimate of the quantity of materials resources required for the Scheme has been

calculated from the Scheme reference design.

14.5.6 The main materials that will be required to construct the Scheme have been calculated from the Scheme design and are presented in Table 14-8 .

14.5.7 Additional materials such as pre-cast kerbs, reinforcing steel, and landscaping features that are not significant in volume will also be required to construct the Scheme. These have been scoped out of the assessment as they are readily available, will only be required in small volumes, and will not generate a significant number of HGV movements.

Table 14-8 – Material Quantities to be Imported for Construction

Material	Volume (m ³)
Concrete	25,370
Sub base / capping	9,460
Imported fil / drainage material	127,430
Black top	7,610

14.5.8 The likely source for the components of the Scheme Bascule Bridge, and steel to form the bridge decks, cannot at this stage be identified because they will be specific to the chosen Contractor. These components are, however, likely to be sourced from a national supplier and within the context of the national market it is concluded that they are a negligible impact because they are frequently used materials and no capacity issues are anticipated.

14.5.9 The Scheme will require both fill and concrete material to be imported to site. Five concrete batching plants have been identified within reasonable distance of the Scheme and their location is shown on Figure 15.1. Two of these concrete batching plants are in Beccles, two are in Great Yarmouth and one is in Lowestoft. To provide a worst case scenario, it has been assumed that the Contractor will source concrete from the market, rather than using a concrete batching plant on site.

14.5.10 The HE Carbon Tool has been utilised to assess the total embodied carbon emissions associated with the predicted material resources for the Scheme. The anticipated volume of embodied carbon emissions has been calculated as 11,669tCO₂e. Therefore, the impact would be adverse, direct and permanent with the scale of magnitude of Minor in accordance with the criteria set out in Table 14-4.

Waste Assessment

14.5.11 The main likely waste arisings from the construction of the Scheme are associated with earthworks. Excavated materials which are considered unacceptable, either geotechnically or chemically, for reuse as part of the Scheme would require offsite disposal.

14.5.12 It has been identified from the reference design that a total of 76,000m³ of unsuitable terrestrial material may be present and will require disposal as part of the construction of the Scheme. A further 10,440m³ of sediment from both the cofferdams and from the pontoon area will require disposal.

14.5.13 The potential waste soil within the Order limits has been assessed following the

Ground Investigation (see Chapter 12 and Appendix 12B) using the WM3 Waste Classification – Guidance on the Classification and Assessment of Waste (1st Edition, 2015). This has highlighted several areas of soil that possess hazardous properties. This material would require offsite disposal as hazardous material. Waste Acceptance Criteria (WAC) testing has been completed on these soils and they meet the criteria for disposal as stable non-reactive hazardous waste.

- 14.5.14** Several sheds are present in the western part of the study area on the Jeld Wen site and these are believed to include asbestos within their construction (see Paragraph 14.4.7). These will be surveyed and demolished in accordance with the appropriate legislation / guidance with the material disposed of to a suitably licensed facility (i.e. stable non-reactive hazardous waste landfill).
- 14.5.15** In terms of available waste facilities to deal with these materials, these were classified as low sensitivity due to an adequate waste capacity to deal with all waste streams. To provide a worst case scenario, this assessment has assumed that all unsuitable excavated terrestrial material will require off-site disposal to landfill i.e. Major magnitude.
- 14.5.16** It has been assumed that, given the volumes of sediment arising, that disposal at sea is the most appropriate approach and this has been approved in principle with the MMO subject to the controls in the Deemed Marine Licence which includes the appropriate receptor site for these materials.
- 14.5.17** Therefore, the significance of the likely waste arisings is expected to be adverse, direct, permanent and slight significance.

14.6 Embedded Mitigation

- 14.6.1** The Government removed the statutory requirement of implementing Site Waste Management Plans (SWMP) in October 2013. However, the use of a SWMP is still considered good practice to ensure that C&D wastes are dealt with in an appropriate manner and in accordance with the waste hierarchy, and is proposed for this Scheme, secured through the interim CoCP.
- 14.6.2** The Contractor will be required to dispose of waste in accordance with the waste hierarchy which is to consider waste management in the following order:
- prevention;
 - preparing for reuse;
 - recycling;
 - other recovery, including energy recovery; and
 - disposal.
- 14.6.3** The above objectives are included in the interim CoCP for the Contractor to consider in developing the full CoCP, how it can deliver the Scheme through:
- reduced raw materials costs;
 - reduced waste destined for landfill;

-
- reduced waste disposal costs; and
 - meeting legislative requirements.

14.6.4 The interim CoCP also requires the Contractor to deal with material supply in the following order of priority:

- on site reuse / recycled;
- off-site reuse / recycled; and
- new materials.

14.6.5 The Contractor will be required to segregate recyclable waste materials at source and provide suitable storage on site within the construction compounds where wood, metal, plastic and contaminated packaging can be source segregated to maximise the opportunity for reducing the amount of waste that needs to be disposed of.

14.7 Conclusions and Effects

14.7.1 Material resources will largely consist of imported fill, aggregates, bitumen, reinforced concrete and steel. As such, there will be opportunities to specify some materials from a recycled source. A worst case scenario with regard to depletion of natural resources is only using aggregates from primary sources, which resulted in a neutral significance impact. Regarding other material resources, the total embodied carbon for the Scheme was classified as minor. Therefore, it has been concluded that a negligible environmental effect will arise due to the need to use a proportion of raw materials for construction of the Scheme. This does not constitute a significant effect.

14.7.2 Volumes of waste arising from the Scheme are predicted to be small and the assessment based on a worst case scenario of assuming all waste will be disposed of to landfill resulted in a slight to moderate adverse effect. However, the majority of waste is likely to be reused and recycled in line with Suffolk and Norfolk Waste Strategies, with Contractors encouraged to maximise diversions to landfill by re-using, recycling and recovering waste as well as to record and monitor their performance and compliance with regulatory controls. Therefore the impact of waste is considered to be slight adverse which does not constitute a significant effect.

15 Private Assets

15.1 Scope of the Assessments

Introduction

15.1.1 This chapter describes the assessment of the likely significant effects of the Scheme on private assets during the construction and operational phases of the Scheme. It is supported by Figure 15.1 and Figure 15.2 and Appendix 15A.

15.1.2 The assessment of this topic area considers potential impacts relating to the following aspects:

- Demolition of buildings and land-take for the construction and operation of the Scheme;
- The Effects of disruption on business operations;
- Effects on development land;
- Effects on agricultural land; and
- Effects on statutory undertakers' assets and operations.

Study Area

15.1.3 The study area for the purposes of assessment of private assets is defined as the Order limits of the Scheme and adjacent land parcels (see Figure 5.1).

15.1.4 This chapter should be read in connection with the following chapters:

- Chapter 8: Air Quality, where the effects of the Scheme upon neighbouring businesses are identified;
- Chapter 12: Soils and Geology, where chemical analysis of the sediment in Lake Lothing is presented;
- Chapter 13: Noise and vibration, where the change in noise as a result of the Scheme upon neighbouring businesses is identified;
- Chapter 16: Socio-economics and Recreation, where the impacts of the Scheme upon employment is presented;
- Chapter 17: Road Drainage and the Water Environment, where the effects of the Scheme upon sediment transport in Lake Lothing are identified (and the results of which inform the assessment within this chapter); and
- Chapter 19: Traffic and Transport, where the impacts of the Scheme, from traffic changes is discussed.

15.2 Directives, Regulations and Relevant Policy

Regulations

15.2.1 The following regulations are relevant to the consideration of the impacts upon Private Assets:

- The Merchant Shipping (OPPRCC) Regulations 1998, (as amended) requires

every harbour authority to have an oil pollution emergency plan that is updated following any material change to the implementation of that plan; and

- The International Regulations for Preventing Collisions at Sea (1972) identifies rules for safe operations of vessels within high seas and connected waters.
- The Ship and Port Facilities (Security) Regulations 2004 and The Port Security Regulations 2009 implement the International Ship and Port Facility Security Code (ISPS Code) This ISPS Code is a code for the security of vessels whilst at port and at sea and will inform the detailed design of the marine elements of the Scheme.

Relevant Policy and Guidance

15.2.2 Table 15-1 provides an outline of guidance, policies and plans considered relevant to the Scheme with respect to its impact on the local private assets.

Table 15-1: Private Assets Policy Framework

Policy Summary	Scheme Summary
National Networks National Policy Statement (NNNPS) (January 2015)	The Government's vision and strategic objectives for national networks includes "supporting a prosperous and competitive economy and improving overall quality of life". It also states that "The applicant should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan".
National Policy Statement for Ports (PNPS) (January 2012)	The PNPS provides a framework for decisions on proposals for new port development to provide port capacity, as well as associated road and rail links for which consent is sought alongside the principal development. Paragraph 3.3.5 of the PNPS states that the Government sees port development as an engine for economic growth that supports sustainable transport and supports sustainable development.
National Planning Policy Framework (NPPF)	The NPPF was published in March 2012 by the Government. The document streamlines national planning policy into a consolidated set of priorities, replacing most Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) notes. The NPPF sets out 12 core planning principles that should underpin decision taking including the need for the planning system to support the development of infrastructure that meets the country's needs and responds to the opportunities for growth.
East Inshore and East Offshore Marine Plans	Policy DD1 sets a framework and preferences for how projects within or adjacent to licensed dredging areas will be assessed. Policy GOV3 identifies how proposals will be assessed should they displace existing or authorised activities. Policy PS3 identifies how proposals for development will be assessed should they interfere with current and future opportunities for expansion of ports and harbours.

Policy Summary	Scheme Summary
MGN543: Safety of Navigation: Offshore Renewable Energy Installations	MGN543 is a Marine Guidance Note (MGN) that identifies the issues that should be taken into consideration when assessing the navigational safety of renewable energy installations. This is the most recent publication relating to marine navigational safety and hence represents best practice.
Port Marine Safety Code	The Port Marine Safety Code, and its corresponding Guide ⁴⁷ sets out a national standard for port marine safety.
Guide to Good Practice on Port Marine Operations	This provides guidance on issues relevant to the management of ports.

15.2.3 The governing requirements for the security of the Port are the implementation of the ISPS Code of which clause 14.2 covers port facility security requirements. The sub clauses specifically relevant to the Scheme are 14.2.2 – controlling access to the port facility and 14.2.4 – monitoring restricted areas to ensure that only authorised persons have access.

15.2.4 The Code specifically requires (clause 15.4) an update to the Port Facility Security Assessment (PFSA) when major changes to the port facility take place, this process should determine any alterations to the port facility security plan that may be required as a result of the changes.

Regulatory Processes

15.2.5 As discussed in paragraph 1.2.1 the Scheme is seeking development consent under the powers of the Planning Act 2008 because it is a NSIP. A DCO is a means of obtaining multiple consents required for NSIPs including compulsory acquisition powers. Therefore, to deliver the Scheme the Applicant will seek authorisation from the SoS through the DCO for the compulsory acquisition of interests in, and rights over, land; the temporary use of land and the overriding of easements and all other rights in connection with land.

15.2.6 However, in line with the MHCLG guidance on compulsory procedures relating to acquisition, the Applicant will continue to engage with those parties affected by the Scheme following submission of the DCO application, with a view of agreeing the terms of the acquisition wherever possible to do so. Nevertheless, as is explained in the Statement of Reasons (document reference 4.1, the Applicant seeks to secure the relevant powers to construct and operate the Scheme through the DCO to ensure that the Scheme can be delivered. The current status of landowner discussions is set out in document reference 4.4.

15.2.7 The areas subject to compulsory acquisition, temporary use and the overriding of easements and other rights are shown in detail in the Land Plans (document reference 2.3).

⁴⁷ Guide to Good Practice on Port Marine Operations, Department for Transport and Maritime and Coastguard Agency, February 2017

15.3 Methods of Assessment

- 15.3.1** This assessment adopts relevant aspects of the DMRB Volume 11, Section 3, Parts 6 and 8 as well as IAN 125/15 which provide guidance on assessing the potential impact of a Scheme in relation to land use and community effects.
- 15.3.2** The assessment of the effects on private assets takes into account demolition and/or land-take from private properties and effects on development land within the Order limits. This involves detailed consideration of the number of residential, commercial and industrial buildings at risk of demolition or land-take and the probable effect of such loss of land (including gardens, car parking spaces or garages) from private dwellings.
- 15.3.3** In relation to businesses and commercial operations within the study area, the assessment within the ES considers the number of people employed at the affected sites and the potential operational impacts on affected businesses given the temporary or permanent loss of land and any constraints during both the construction and operational phases.
- 15.3.4** The WDC local plan and planning register (up to 10 of May 2018) has been reviewed to identify areas of land allocated for development within the study area, and to then assess any potential impact on the development lands within the Order limits.

Significance Criteria

- 15.3.5** The significance criteria that have been used in this assessment are shown in Table 15-2. For clarity, a moderate adverse impact is considered to be a significant effect.

Table 15-2 – Significance Criteria for the Private Assets Assessment

Impact Rating	Criteria
Negligible	<ul style="list-style-type: none"> • A barely discernible impact on use or amenity value that does not impact use
Slight Adverse	<ul style="list-style-type: none"> • Landtake that is not essential to existing or intended use; • Activity that temporarily compromises or precludes use; and • Loss of amenity that does not compromise use.
Moderate Adverse	<ul style="list-style-type: none"> • Landtake that compromises but does not preclude existing or intended use; • Activity that compromises or precludes use for a protracted period; and • Loss of amenity that compromises but does not preclude use.
Substantial Adverse	<ul style="list-style-type: none"> • Landtake that precludes existing or intended use; • Activity that permanently compromises or precludes use; and • Loss of amenity that precludes use.

Desk Study

- 15.3.6** Data and evidence base for this chapter has been collated from a number of sources to inform the private assets baseline. The desk-based sources used include:
- Ordnance Survey (OS) open data;

-
- DEFRA's 'MAGIC' online GIS portal;
 - Information from Local Planning Authority website;
 - National and local policies;
 - Local development plan documents; and
 - Consultation with local authorities and relevant stakeholders, including landowners and statutory undertakers.

Vessel simulation

15.3.7 A model of the Port of Lowestoft along with its approaches has been prepared with East Coast College. The objectives of the simulation were to:

- Establish the navigability through and adjacent to the Scheme bascule bridge;
- Establish the suitability of the passage width beneath the Scheme bascule bridge;
- To confirm the requirements for protection in the form of fenders;
- To determine any aids to navigation that the Scheme bascule bridge may require; and
- To establish the opening timings and interaction between the Scheme and existing bridges.

15.3.8 The vessel simulation model was built on a base model that was derived from mapping provided by ABP in its role as harbour authority for Lowestoft Harbour. The model included the navigation channel from the seaward approach of Lake Lothing to the bend travelling westwards towards Mutford Lock. A number of scenarios, including different vessel sizes, times of day, visibility conditions, weather and tide conditions were tested by ABP's pilots in the model to verify its adequacy and understand the effects of the Scheme on navigation.

15.3.9 The first simulation exercise in November 2016 (involving ABP's Harbour Master) sought to verify the accuracy of the existing model and to confirm that the model reflected the actual navigation conditions. Following confirmation of the accuracy of the existing model, the then Third Crossing model (a twin leaf trunnion bascule design) was run in the simulator. ABP identified a number of visual references/markers that needed to be adjusted and some other adjustments to the model were required to better simulate the navigational conditions. With respect to the design of the Scheme, some adjustments to fendering were requested.

15.3.10 The second stage simulations in May 2017 also involved ABP's Harbour Master, and an independent navigation consultant, Shipmove Marine Consultancy. The model was altered to address points raised during the first simulation, update fendering positions (having regard to the earlier feedback), and some other adjustments to the bridge design. The subsequent feedback from ABP largely related to the mechanics of the model, though a further comment on fendering led to a further adjustment to its layout, as then included in the third simulation.

15.3.11 Following a change in the design philosophy from a twin lead trunnion bascule to a

single leaf rolling bascule a third simulation model was run in March 2018, again involving ABP's Harbour Master and Shipmove Marine Consultancy, to investigate issues raised by ABP in its statutory consultation response, in particular the differential wind shear effects of a single versus dual lifting span, which had been used in previous simulations. Additionally, the simulation tested the positioning of a waiting pontoon for recreational vessels.

15.3.12 Appendix 15A contains a full report on the vessel simulations undertaken and includes two reports from Shipmove Marine Consultancy. The third simulation showed no material difference in navigation compared with the second simulation, that is to say it did not identify any increase in impacts the Scheme would have.

15.3.13 For the purposes of the ES, the assessment of effects upon navigation has focused entirely upon the most recent vessel simulation model (as discussed in 15.3.12) undertaken for the single lifting bascule bridge.

15.4 Baseline Environment

15.4.1 Land-use within the study area is predominantly industrial and commercial with some residential land use. The larger land interests within the Order limits (Figure 5.1) include:

- Port of Lowestoft, owned, occupied and operated by ABP;
- Network Rail estate;
- Wickes DIY store;
- Nexen Trucks;
- NWES Riverside Business Centre;
- Essex and Suffolk Water;
- Motorlings car showroom;
- Enterprise;
- Former Jeld Wen site at Waveney Drive;
- Three residential properties on Waveney Drive;
- Bella Blue Beauty Clinic on Waveney Drive;
- Land owned by WDC at Riverside Road/Canning Road;
- Highway land, as well as land owned by SCC at Denmark Road and at Riverside Road/Canning Road;
- Private storage; and
- Utility and statutory undertakers' infrastructure.

15.4.2 Further information is provided on current land use within the study area in Table 15-3.

Table 15-3 – Description of Land Use

Land interest	Description of land use
ABP (terrestrial assets)	Quay and associated port land owned and operated by ABP in both their role as port operator and Statutory Harbour Authority is included within the Order limits. The area over which the Scheme passes is known as North Quay. Shed 3 is to the west and the grain silo building to the east of the Order limits. There is also a weigh bridge to the east of the Order limits. As shown in Figure 15.1, the Port of Lowestoft covers an area adjacent to Lake Lothing and as stated in Paragraph 15.5.10 covers an area of approximately 40 hectares.
ABP (marine assets)	The Scheme extent includes a section of Lake Lothing used for berthing and a navigation channel used for commercial and leisure vessels. The channel is maintained by ABP.
Network Rail Estate	Land over the East Suffolk Line, including adjacent associated storage and yard areas will be required for the construction phase.
Wickes DIY Store	A small area (261m ²) of non-operational land that is presently landscaped will be required for both the construction and operation phases.
Nexen Trucks	Hardstanding immediately to the west of Nexen's building including the access to the site is included within the Order limits. The majority of this land is only required for the construction phase. Land to the south of the Nexen building, proposed for development by Nexen (but currently vacant and without planning permission), is also included in the Order limits. A strip of this land abutting the Scheme alignment to the east of the elevated highway will be required for construction and incorporated in the permanent works. Adjacent to that, a strip of land is required for the installation of diverted utilities. The remainder of the land is included within the Order limits for temporary use during the construction phase by Motorlings, which borders the property to the south. Access to land adjacent to the structure for maintenance by the Applicant and other statutory undertakers, whose equipment has been diverted in to this area, will be required
NWES Riverside Business Centre	A strip of land along the eastern and southern boundary of the NWES' land will be required for construction, operation and access for maintenance purposes. The land is currently used for parking and landscaping.
Essex and Suffolk Water	A strip of land along the western edge of the Scheme carriageway will be required for construction and access for maintenance (see the Landscaping Plans). The land is presently an area of rough grassland created to mitigate the impacts of past development on the five-banded weevil wasp <i>Cerceris quinquefasciata</i> .
Motorlings car showroom	The site comprises a 3,700m ² showroom on a 1.6 hectare site, 385 display spaces, workshops, customer and staff parking. The area required for the Scheme comprises forecourt and one standalone showroom, adjacent to the Scheme alignment.
Enterprise	Enterprise has a leasehold interest in part of the site, which the Applicant proposes to acquire to allow the reconfiguration of the forecourt to mitigate the impact of the landtake from Motorlings.
Former Jeld Wen site at Waveney Drive	Land currently occupied by a number of large, open sided sheds. The site is generally vacant, but sub-letting has occurred and is expected to continue to occur in the short-term until the lease for the site expires in December 2020. The Scheme will require the demolition and removal of up to eight vacant open sided sheds to facilitate the construction of the Waveney Drive access and the new Access Road to reconnect properties at Riverside Business Park.

Land interest	Description of land use
Residential dwellings	The Scheme requires the demolition of one residential dwelling at 42 Waveney Drive. There will be permanent land take from both 32 and 34 Waveney Drive although neither dwelling will need to be demolished. 34 Waveney Drive will lose vehicular access to the property from the highway as a consequence of the Scheme.
Bella Blue Beauty Clinic	A private business providing beauty treatments. The entire land parcel is required permanently and the building will be demolished.
Waveney District Council	WDC owns vacant land on the southern quay (where the crossing makes landfall on the south side of Lake Lothing) although this is vacant and does not have planning permission. WDC owns 32 Waveney Drive, and also the Registry Office and Riverside Council Offices – the latter two jointly with SCC.
Highway Land (SCC)	Land within the highway boundary will be required to facilitate construction of the Scheme and to form new highway.
Suffolk County Council	SCC owns land to the north of the East Suffolk Line having purchased this parcel of land specifically for the Scheme. There is an extent planning permission in place on this land for A1, A3 and A5 uses.
Private storage	Two garages used for storage adjacent to the southern roundabout will be demolished to facilitate construction of the Scheme and to form new highway.
Utility and Statutory Undertakers	Within the Order limits there are services belonging to, Anglian Water, BT, Virgin, Essex & Suffolk Water, UKPN and Cadent. Diversions of these services will be required to facilitate construction of the Scheme.

15.4.3 There is no agricultural land within the study area.

Vessel Survey

15.4.4 In addition to the compilation of desk based information, a Vessel Survey of the users of Lake Lothing was undertaken for an initial period from the 13 of June 2017 to the 30 of September 2017 and for a second period from the 2 of January 2018 to the 13 of April 2018 to identify the number of vessels that pass through Lake Lothing which could require the Scheme Bascule Bridge to open. This survey was undertaken to confirm the number and timings of openings of the existing A47 Bascule Bridge and to inform the likely opening frequency of the Scheme Bascule Bridge for the purposes of the ES. Greater detail on this survey is provided in Appendix B of the Preliminary Navigation Risk Assessment (document reference 6.7).

Boat movements

15.4.5 As shown in Plate 5-1, the Scheme Bascule Bridge has a clearance of 12m above HAT and this is greater than the A47 Bascule Bridge which has a clearance of 2.2m⁴⁸ above MHWS. The Scheme Bascule Bridge, will therefore have to open on fewer occasions than the A47 Bascule Bridge as a greater number of vessels will be able to pass beneath without an opening.

15.4.6 The Vessel Survey Report identified 2,443 vessel movements over the initial survey period in Lake Lothing and that 450 of these would require an opening of the Scheme Bascule Bridge. Of these 450, 217 would have been attributable to commercial

⁴⁸ Information from ABP website.

vessels and 233 would be for the movements of recreational vessels, which are discussed in greater detail in Chapter 16.

15.5 Predicted Impacts and mitigation

15.5.1 Predicted impacts upon private land users and any mitigation that is embedded within the Scheme are described in Table 15-4. Please also refer to the Book of Reference (document reference 4.3) where the extent of land take within the Order limits is quantified. The impacts upon ABP are discussed in greater detail in section 15.5.5 to 15.5.38.

15.5.2 Table 15-4 assesses the impact of the Scheme upon the present land use within and adjacent to the Order limits, although it is acknowledged that some land owners may have aspirations for future development. Any such development would need to be dealt with through local planning processes and these have been considered where the Applicant has been made aware that there are proposals to do so.

Table 15-4 – Predicted Impacts upon Private Assets

Land interest	Description of impact (land use)	Significance of effect
Network Rail	<p>A clearance of 4.98m over the East Suffolk Line (see Table 3-10) has been agreed with Network Rail. As discussed in Chapter 5, the ES has described an option of the span over Network Rail land being constructed perpendicular to the railway and swung into place, though there are alternative means of construction for this section that will be discussed with Network Rail as the detailed design progresses.</p> <p>For the purposes of the assessment within this ES, a temporary possession is assumed to be required and therefore there may be some disruption for a limited period during construction to rail operations into Lowestoft although this would be with the agreement of Network Rail to keep disruption to a minimum.</p> <p>There may be a need for an infrequent possession of the railway line during the operational phase for maintenance of the Scheme, though as these will be rare occasions and agreed with Network Rail in advance, no significant operational impacts are expected.</p>	Slight Adverse (construction) Negligible (operation)
Wickes DIY Store	<p>The loss of land is limited to a narrow slither of verge that is not presently used in connection with the operation of the store.</p>	Negligible (construction) Negligible (operation)
Nexen Trucks	<p>The Scheme will provide a new permanent access to Nexen and the height of the underpass has been designed to allow HGVs up to 5.3m in height to continue to access the Nexen site.</p> <p>During the operational phase, a narrow strip of land constituting 1% of total land in their ownership would be incorporated in the structure of Crossing A. Adjacent to that an easement of 1,562m² is required, which would restrict the forms of development that could be undertaken within it.</p> <p>During the construction phase, the undeveloped part of the site 4,863m² is temporarily required for the Scheme. This would delay its potential redevelopment until the land is vacated by the Applicant and returned to the landowner.</p> <p>Access to the site will be maintained during construction, except in exceptional circumstances.</p>	Slight Adverse (construction) Negligible (operation)
NWES Riverside Business Centre	<p>The Scheme will result in the relocation of 8 parking spaces on the eastern boundary of the NWES Riverside Business Centre site to its southern boundary.</p> <p>During construction access will be maintained to the site and to its associated parking areas. A permanent right of access will be acquired to allow for inspections and maintenance.</p>	Slight adverse (construction) Negligible (operation)
Essex and Suffolk Water	<p>The Scheme will result in the loss of a strip of a larger area of rough grassland that, as identified in Table 15-3, has been landscaped to mitigate, as part of a planning commitment the impacts of the Essex and Suffolk Water office premises on the five-banded weevil wasp <i>Cerceris quinquefasciata</i>.</p>	Slight Adverse (construction) Negligible (operation)

Land interest	Description of impact (land use)	Significance of effect
	<p>A total of 287m² and 291m² of permanent and temporary land from this area is required for the Scheme. Further discussion of the ecology impact of the Scheme is included in Table 11-4. This land is not integral to the current operation of Essex and Suffolk Water. Any alternative proposals for the use of this land by the landowner would be subject to the local planning process.</p> <p>With regard to the right of access over Essex and Suffolk Water land, this will be for maintenance purposes and therefore will be infrequent and will therefore not prejudice the use of the land.</p>	
Motorlings	<p>Part of the forecourt area for this car showroom is included within the Scheme Order limits, to accommodate the southern roundabout and diverted utilities. Additionally, land adjacent to the alignment would be required for the construction phase and access for maintenance will be required. Permanent land take during the operational phase is approximately 9% of the total land and as identified in the significance criteria presented in Table 15-2, this compromises but does not preclude the existing or intended use of the overall site. However the site will also benefit from an increase in passing traffic along its Waveney Drive and Riverside Road frontages where passing traffic has been modelled to increase from 11,291 to 29,507 per day.</p> <p>A temporary building alongside Riverside Road will be demolished and a new 'left in, left out' access will be created from Waveney Drive.</p> <p>To mitigate the loss of forecourt during construction, land immediately to the north of Motorlings (in the ownership of Nexen) will be made available for additional display space (see above).</p>	Moderate adverse (overall)
Enterprise	<p>An Enterprise car and van rental business also operates from the Motorlings site and it is proposed that this is removed to offset some of the loss of the forecourt. Car transporters associated with site currently unload from Riverside Road, which would no longer be possible and an alternative access via Waveney Drive is provided.</p>	Substantial adverse
Former Jeld Wen site at Waveney Drive	<p>The Scheme will require the removal of up to two rows of the unoccupied sheds (up to 8) to enable construction of the New Access Road to reconnect Riverside Road. As the Jeld Wen site is underutilised (and proposed for redevelopment, likely on expiration of the current lease in December 2020), this will have a barely discernible impact upon operations, although overall the site is likely to benefit from improved access, enhancing its prospects for future development.</p>	Negligible (construction and operation)
Residential properties	<p>The footprint of one house is required, so there would be the permanent loss of one dwelling. Of the two further dwellings (32 and 34 Waveney Drive), one currently does not have a vehicular access, but land-take from some of its garden is required. Vehicular access to 34 Waveney Drive would be affected, and land would be required from the garden and the demolition of the adjacent garage.</p>	Substantial Adverse (overall)
Bella Blue Beauty Clinic	<p>As the entire land parcel would be required permanently, the impact upon land use would be substantial in so far that the existing use will be precluded.</p>	Substantial Adverse (overall)
Waveney DC	<p>WDC owns a number of land parcels in the Order limits and this aspect of the assessment is based upon WDC's employment and vacant land interests. The Scheme requires the permanent acquisition of (currently vacant) land on the south quay which the</p>	Moderate Adverse (overall)

Land interest	Description of impact (land use)	Significance of effect
	crossing over sails (5,173m ²). The remainder of this land is also required temporarily for a construction compound and thus the Scheme would either prohibit or delay redevelopment proposals for this land (which is allocated for employment development). To the south of this, WDC also owns land adjacent to the Registry Office, part of which is required to construct highway. It is also identified for employment development, although there are no current proposals.	
Suffolk County Council	The Applicant is in control of a number of parcels of land in the Order Limits, much of it being highway. SCC acquired the northern landing point in June 2017 after discussions with the landowner who indicated an intention to implement an extent planning permission (DC/16/3844/OUT) for the construction of retail floor space and a fast food restaurant. This planning permission will therefore not be implemented.	Negligible (construction and operation)
Private Storage	Two garages, which exist independent of dwellings on a standalone plot would also need to be demolished.	Substantial Adverse (overall)
Utility and statutory undertakers	Within the Order limits there are statutory undertakers whose services will need to be diverted during the construction of the Scheme. Protective Provisions are included in the DCO such that the affected undertakers are able to secure the diversions on the terms they require.	Negligible (construction and operation)
ABP	Land in the ownership of ABP, and the marine area for which they have a statutory duty to manage, will be required in both the construction and operational phase of the Scheme. Greater information is provided in Paragraphs 15.5.5 to 15.5.39.	Slight adverse (overall)

- 15.5.3 During the construction phase of the Scheme, there is the potential for businesses to be adversely affected from construction noise and dust, and during the operational phase from increased road traffic noise. Further information is included in Chapter 8: Air Quality and Chapter 13: Noise and Vibration which conclude that there are no significant effects upon businesses during the construction and operational phase arising from these aspects.
- 15.5.4 In addition to the impacts identified in Table 15-4, there are four other land interests within the Order limits where limited land take in both the construction and operational phase is required resulting in negligible impacts. These are as follows:
- Land to the south of Waveney Drive owned by Howlett Property. Approximately 5m² of land will be permanently required;
 - Land tenanted by ASDA and owned by McLagan Investments Ltd. 154m² of land is within the Order limits, proposed for the acquisition of rights to enable a new transport access to the Motorlings site;
 - Land at the North Quay Retail Park where 16m² of land is permanently required. This land is currently highway, and is included in the DCO to ensure that the Scheme is able to be delivered effectively; and
 - Lidl UK own land at the Peto Way roundabout that forms the entrance to both Lidl and Wickes. Works in this area will not directly affect the operation of this entrance.

Impacts upon Port Operations

- 15.5.5 Impacts upon ABP's operation in both the construction and operation phase are identified in Paragraphs 15.5.7 to 15.5.38.
- 15.5.6 The construction effects should be seen in the context that the Applicant and its consultants and contractors will continue to refine the construction phasing and methodologies in discussion with ABP in accordance with ABP's Protective Provisions within the DCO.

Construction phase – Navigation Channel impacts

- 15.5.7 During the construction phase the construction of the piers and the placement of the bascule bridge have the potential to impact vessel movements and Port operations.
- 15.5.8 As discussed in Paragraph 5.6.21, the assessment has assumed as a worst case that two steel sheet piled cofferdams will be constructed from both the north and south quay as shown in Figure 5.6. During construction these cofferdams through their nature will extend into the Lake no further than the eventual fenders and thus the width of the navigation channel that remains available during construction will not impede vessel navigation.
- 15.5.9 The Contractor will be required to maintain the navigation channel at all times, except when possession of the entire channel or a restriction on navigation is required to facilitate construction (such as narrowing the vessel size that can pass through the area). Such occasions will be notified in advance to ABP and at this stage prior to the appointment of a Contractor, the constructability advice (see Paragraph 5.6.1) has determined that possession will be likely to be three weeks. As the A47 Bascule Bridge

has a width restriction of 22m and as the majority of vessels do not navigate to the west of the Scheme, this temporary narrowing is unlikely to adversely affect Port operations. Using the criteria within Table 15-2, impacts of the closure of the navigation channel therefore constitutes a slight adverse impact due to the loss of access to berthing space west of the Scheme during this period.

Construction phase – Berth, Quay and land impacts

15.5.10 As shown in Figure 15.1, the Port of Lowestoft covers an area adjacent to Lake Lothing and as stated in Table 15-3 covers an area of approximately 40 hectares. Figure 5.4 shows the Contractor's compound on North Quay of Lake Lothing on land owned and occupied by ABP and Network Rail. This will be required to facilitate the construction of the Scheme bascule bridge and the bridge over the East Suffolk line. The area of this compound (Figure 5.4) is 1.3 hectares and the compound's frontage along the quay is approximately 160m.

15.5.11 Impacts upon quay and land based Port operations during construction are therefore likely to be upon:

- loss of quay side storage and berth; and
- The effects of the (see Paragraph 15.5.9) closure of the navigation channel and the need to berth to the east of the Scheme and possibly transport cargo through the Port during this period;

15.5.12 ABP has provided information that has allowed Figure 15.2 to be presented in this ES.

15.5.13 The North Quay within the Order limits is a suspended quay with a four-tonne axle limit. Berth occupancy data has not been made available to the Applicant, as ABP has noted that the Port does not work on a static programmed basis and thus occupancy fluctuates. ABP has highlighted a growth in commercial activities in the Port over recent years, and its expectation is that this will continue, principally associated with the offshore wind sector. In February 2018, ABP unveiled a vision for an 'East of England Energy Hub' based around land to the west of the Scheme. There are however no detailed development proposals or timescales associated with this vision. ABP considers business plan predictions for growth/development in the Port to be commercially confidential. The Applicant is however aware that a large number of the current Crew Transfer Vessels, CTV's, (vessels which service the offshore wind sector) in the market have an air draft of less than 11.5m and as such travelling to the west of the Scheme would not necessitate the Scheme Bascule Bridge to open.

15.5.14 Information supplied by ABP identifies that the North Quay of Lake Lothing and the inner harbour have a length of approximately 2.1km and therefore, the 160m used for the construction compound constitutes approximately 8% of total operational quay length. As shown on Figure 15.2 the construction phase of the Scheme would require four of the berths that ABP have identified to be temporarily removed from use.

15.5.15 The part of the North Quay used for the construction compound is land that is currently used as a marshalling yard. It is regularly used by grain lorries associated with the grain silo to the east (see Figure 4.1). As stated in Table 15-3 there is a weigh bridge to the east of the Order limits on the North Quay and access and operation of this will be maintained at all times. The contractor will be required to keep the construction

compound secure as required by ABP’s commitments under the ISPS Code.

15.5.16 The North Quay berth is a common user facility that is the area is not assigned to a particular shipping line or operation, and therefore its temporary loss does not create a specific issue for any individual operator, rather it creates a small reduction in the flexibility of the port as a whole to accommodate vessels simultaneously. Based on the numbers of vessel movements observed during the vessel survey, and the Applicant’s knowledge of berth occupancy, the impact of this loss upon the Port is considered to be no greater than slight adverse. Discussions with ABP to ascertain the use of quays and the possibility of temporarily relocating any uses to elsewhere in the Port will continue.

Operational phase – Navigation Channel impacts

15.5.17 The Scheme will introduce a new structure within Lake Lothing. Plate 5-1 shows that the clear span of 32m between fenders, which is greater than the width of the existing A47 Bascule Bridge, will allow all existing commercial vessels that enter Lake Lothing to navigate west of the Scheme. An infinite air draught will also not constrain a vessel of any height that wants to navigate west of the Scheme Bascule Bridge once lifted.

15.5.18 The structure will require maintenance inspections and replacement of parts (see Paragraph 5.7.2) over its lifetime. These will be infrequent and coordinated with ABP.

15.5.19 The DCO provides for a Scheme of Operation for the Scheme to be developed in consultation with ABP, although it is proposed and assumed for the purposes of this chapter that the Scheme Bascule Bridge will not lift during peak AM and PM periods (as defined by the Applicant).

15.5.20 Plate 15-1, taken from the Vessel Survey Report (Appendix B of the Preliminary Navigation Risk Assessment, document reference 6.7) identifies that the A47 Bascule Bridge has pronounced dips in openings during the AM and PM peak traffic periods. Notwithstanding that the Scheme Bascule Bridge will not open in the AM and PM peak hour, Plate 15-1 shows particularly in the AM peak, there is a marked reduction in demand for bridge openings but this is less pronounced in the PM peak.

15.5.21 During the AM Peak and PM peak, ABP and their tenants will have to arrange for vessels that require an opening of the Scheme Bascule Bridge to either delay departure or arrival until the peak hour has passed.

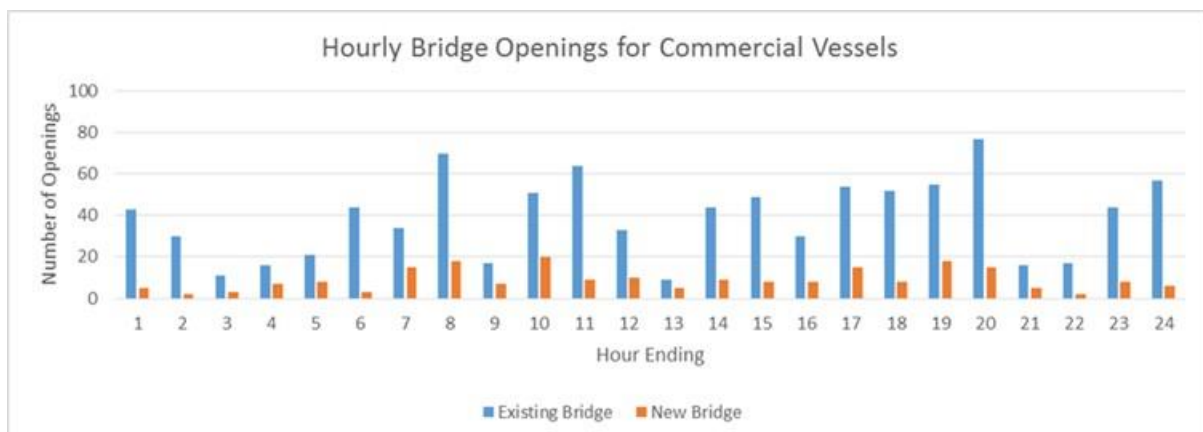


Plate 15-1 – Potential Demand for Bridge openings Hourly Bridge Openings identified from the Vessel Survey (dates 13 June to 30 September 2017)

- 15.5.22** Following discussion with ABP a dedicated control tower is included within the Scheme. Its location on the south bank was directed by ABP who considers this position provides the best vantage point of the Lake. ABP considers that the control tower's principal role is to direct the passage of vessels through the Scheme Bascule Bridge and overall port control will remain with the existing control tower associated with the A47 Bascule Bridge. The dedicated control tower on the Scheme Bascule Bridge also assists in the supervision and management of behaviours on the crossing.
- 15.5.23** The third simulation referred to above indicated that the Scheme Bascule Bridge will not have a significant effect on the navigation of safety of vessels within the port.
- 15.5.24** A Navigation Risk Assessment has been prepared with reference to the Port Marine Safety Code and its corresponding Guide⁴⁷ to assess the risks to vessels during transit of the Scheme Bascule Bridge. This has been prepared in consultation with the Navigation Working Group comprised of ABP, vessel operators within the port and members of the boating community. The Navigation Risk Assessment is contained in document reference 6.7.
- 15.5.25** A number of recommendations are included in the Navigation Risk Assessment and compliance with this document is secured through the DCO. It is therefore concluded that the risks created between the bridge and vessels navigating through and around it are 'As Low As Reasonably Practicable' which is a term used in the maritime industry to identify when all reasonable measures have been undertaken to reduce the risks to vessel safety.
- 15.5.26** Navigation lighting comprising red and green channel marks combined with amber hazard marks are considered necessary to aid safe navigation. The final layout and design of Aids to Navigation is to be agreed with the General Lighthouse Authority (Trinity House).
- 15.5.27** Control of vessel traffic through the Scheme Bascule Bridge passage will be managed using red/green stop/go lights positioned on the main abutments at suitable locations to ensure visibility from approaching vessels both east and west of the Scheme. Operation of these control lights will be integrated into the wider Scheme Bascule Bridge operation systems to prevent accidental activation as required by the NRA and pursuant to the DCO's protective provisions for ABP's benefits.
- 15.5.28** Control of vessel traffic through the Scheme Bascule Bridge passage will be managed using red/green stop/go lights positioned on the main abutments at suitable locations to ensure visibility from approaching vessels both east and west of the Scheme. Operation of these control lights will be integrated into the wider Scheme Bascule Bridge operation systems to prevent accidental activation.
- 15.5.29** The introduction of a new structure and associated fenders in Lake Lothing will have an impact on the existing dredging regime undertaken by ABP in Lake Lothing. As a consequence of ABP's statutory duty to keep the Port open to the public for port purposes, it is reasonable to assume that any dredging around the structure will be continue to be undertaken by ABP. The Applicant continues to discuss with ABP the

practical and financial implications of this – though the sediment modelling, as discussed in Chapter 17 and Appendix 17A suggests the impacts as a result of the Scheme are likely to be limited.

- 15.5.30** In the absence of such agreement, the Applicant has included powers to dredge around the Scheme Bascule Bridge structure in the DCO, and the environmental effects have been assessed in Chapters 11: Nature Conservation and 12: Geology, Soils and Contamination. In either scenario, dredging will be able to continue in the navigation channel.
- 15.5.31** ABP has indicated that the Scheme may necessitate the provision of additional pollution response equipment; however, as the Scheme Bascule Bridge is a lifting bridge and could be opened in emergency situations, it is not clear that this is necessary, though the Applicant has sought further information from ABP on this matter and this aspect is not considered further in the assessment.
- 15.5.32** Given that the Scheme includes a lifting section and that immovable structures will only be constructed outside a navigation channel of 32m (almost 10m wider than the entrance to the Inner harbour), and given the limited loss of berthing space it is accordingly concluded that the Scheme has a no greater than Slight Adverse impact upon commercial vessel movements.

Operational phase – Berth, Quay and Land impacts

- 15.5.33** The loss of quay space on the north of Lake Lothing has the potential to permanently impact Port operations through the loss of operational port land and berthing space (see Figure 15.2).
- 15.5.34** Approximately 2,100m of Quay length is available within the Entrance Channel and Inner Harbour although ABP have advised in the S42 response that a fair proportion of this is committed to existing customers. The loss of berthing space resulting from the Scheme is unlikely to be greater than 60m but as shown on Figure 15.2 would require three of the berths that ABP have identified to be redefined (i.e. changed in length).
- 15.5.35** The berth is a common user facility that is the area is not assigned to a particular shipping line or operation, and therefore its loss does not create a specific issue for any individual operator, rather it creates a small reduction in the flexibility of the port as a whole to accommodate vessels simultaneously. Based on the numbers of vessel movements observed during the vessel survey the impact of this loss upon the Port is considered to be no greater than slight adverse. Discussions with ABP to ascertain the use of quays and the possibility of relocating any uses to elsewhere in the Port will continue.
- 15.5.36** The clearance provided underneath the Scheme as it crosses ABP's operational Port is a minimum of 5.3m which will allow all road-licensed vehicles to be able to pass underneath. ABP has confirmed that, the area beneath the Scheme is used as an access for commercial vehicles, road transportable cranes and project cargo items. There may be some larger pieces of equipment that cannot transit beneath the Scheme, although ABP do not currently have any equipment based on this quay that this applies to. .

15.5.37 ABP has indicated that it may store substances that could be considered hazardous in relation to the Scheme as part of its operations, although the Health and Safety Executive has confirmed in their response to a Scoping Opinion that the Scheme does not lie within any area for consultation. Any materials stored beneath the Scheme will need to be appropriate for such a location and discussions with ABP are continuing to identify if hazardous materials will need to be located elsewhere during the operational phase of the Scheme.

15.5.38 There are a number of potential areas where the Scheme may impact on the security of the port, most notably by creating a new potential access route onto a berth, which could form part of a restricted area. However access from the Scheme to the port would be problematical given the minimum height difference between the Scheme and the quay of 7.8m, as well as the high containment barrier in this location.

15.5.39 Based upon the information available with regard to use of the North Quay and the effect of the Scheme on its use (see Paragraph 15.5.35), it is concluded that operational phase impacts upon the quay and land are no greater than slight adverse.

Impacts upon other land users in the Study Area

15.5.40 No impacts are predicted upon agricultural land as there is none within the immediate study area.

15.5.41 Impacts upon other statutory undertakers (see Paragraph 5.6.22) will be of negligible significance as diversions will be provided for within the Scheme extent proposals and no loss of service is presently envisaged, pursuant to the operation of their protective provisions.

15.6 Conclusions and Effects

15.6.1 The assessment has identified that the Scheme will have a significant adverse and hence effect upon residential and business owners due to the demolition of a property and a business.

15.6.2 All other impacts have been identified as not significant.

15.6.3 Through further consultation with affected parties the construction methodologies and timings will be refined with statutory undertakers in particular, to further mitigate impacts where possible.

16 Socio-Economics including Recreation

16.1 Scope of the Assessments

Introduction

16.1.1 This chapter describes the assessment of the likely significant effects of the Scheme on socio-economic factors and recreation during the construction and operational phases of the Scheme. It is accompanied by Figure 16.1.

16.1.2 The assessment of this topic area considers potential impacts relating to:

- The creation of jobs and training opportunities within the local economy during the approximate two year construction period (see Section 5.6);
- Changes in accessibility for leisure-related vessels which gain access to the Broads or the North Sea via Lake Lothing and the consequent effect on tourism;
- Access to the town centre of Lowestoft and the impact upon spend in it during construction ;
- Changes in accessibility for users of the local and strategic road network visiting Lowestoft and the consequential effect on tourism;
- The demand for temporary accommodation during the approximate two year construction period and the likely effect on established business / tourism accommodation within the town; and
- Indirect employment.

16.1.3 The assessment of the creation of direct jobs during the operational phase was scoped out of the assessment (on the basis that the potential for significant effects would be limited bearing in mind the nature of the Scheme) after following publication of the Scoping Opinion.

16.1.4 The assessment of indirect job creation, or loss, as a result of the Scheme is undertaken qualitatively and is based upon published forecast data for development within the study area (see Paragraph 16.1.6). The assessment of impact upon job losses has been undertaken for those business that are directly affected by the Scheme through land take or change in access rather than those that lie out with the order limits and are namely:

- Bella Blue Beauty Parlour;
- NWES;
- Motorlings;
- Nexen; and
- Associated British Ports.

16.1.5 This Chapter should be read in conjunction with Chapter 15 which considers the impacts on private assets, including commercial operations within the Port of Lowestoft. Chapter 19 considers the traffic effects of the Scheme, including in relation

to severance from community facilities, which in turn addresses effects on social cohesion and should also be read alongside this Chapter. Chapter 20: Cumulative Effects also addresses the effects of the Scheme alongside other proposed projects, particularly with regard to construction employment. In addition, Appendix 1A identifies that there is a connection between health and employment opportunities and this Chapter will assess where employment will be impacted (either positively or negatively) as a result of the Scheme.

Study area

16.1.6 The study area for the assessment encompasses the entire area administered by Waveney District Council (Waveney) and Great Yarmouth Borough Council (GYBC) collectively known as the Great Yarmouth and Waveney sub-region. These areas are shown in Figure 16.1.

16.2 Directives, Regulations and Relevant Policy

16.2.1 Table 16-1 provides an outline of, guidance, policies and plans considered relevant to the Scheme with respect to its impact on socio-economic features.

Table 16-1 - Socio-Economic Regulatory and Policy Framework

Policy Summary	Scheme Summary
National Networks: National Policy Statement (NNNPS) (January 2015)	<p>The Government's vision and strategic objectives for national networks includes '<i>supporting a prosperous and competitive economy</i>' and specifically:</p> <ul style="list-style-type: none"> • Networks with the capacity and connectivity to support national, regional and local economic activity and facilitate growth whilst creating jobs; and • Networks which sustain cohesion and decreases severance of communities and effectively providing linkages to each other. <p>Paragraph 2.27 of the NNNPS states that "<i>in some cases...it will not be sufficient to simply expand capacity on the existing network. In those circumstances new road alignments and corresponding links, including alignments which cross a river or estuary, may be needed to support increased capacity and connectivity.</i>"</p> <p>Paragraph 3.3 requires that in delivering new schemes, "<i>reasonable opportunities to deliver environmental and social benefits as part of the schemes</i>" should be considered and that environmental and social impacts should be mitigated in line with the principles set out in the National Planning Policy Framework (NPPF) and the Government's planning guidance.</p>
National Policy Statement for Ports (PNPS) (January 2012)	In Paragraph 5.14.3, the PNPS states that an ES for port infrastructure should consider all relevant socio-economic impacts.
National Planning Policy Framework (NPPF) (March 2012)	<p>The NPPF was published in March 2012 by the Government. The NPPF sets out 12 core planning principles that should underpin decision taking including proactively supporting sustainable economic development including delivery of the infrastructure that the country needs and responding positively to wider opportunities for growth.</p> <p>NPPF Paragraph 7 refers to the policy framework providing a three dimensional guideline for achieving sustainable development, two of which are economically and socially driven. From an economic point of view, the document highlights the importance of '<i>ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by</i></p>

Policy Summary	Scheme Summary
	<p><i>identifying and coordinating development requirements, including the provision of infrastructure.'</i></p> <p>From a social point of view, the policy document also states the importance of <i>“supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community’s needs and support its health, social and cultural well-being”</i>.</p> <p>In the context of plan making, paragraph 21 emphasises the need to positively and proactively encourage sustainable economic growth and to identify priority areas for economic regeneration and infrastructure provision. The Waveney Local Plan and the Lake Lothing and Outer Harbour Area Action Plan recognise the need to regenerate the Lake Lothing area and the role that a Third Crossing will play in helping to achieve that objective;</p> <p>NPPF Paragraph 21 addresses the need of development to be supported by appropriate local plans especially in infrastructure. The policy recognises that a lack of infrastructure can be a potential barrier to investment and that local authorities should plan for infrastructure provision.</p> <p>NPPF paragraph 28 supports a prosperous rural economy through policies that encourage economic growth in rural areas by creating jobs, prosperity and taking a positive approach to sustainable new development. Paragraph 28 also supports sustainable rural tourism and developments that provide positive benefits to local businesses, communities and visitors.</p>
East Inshore and East Offshore Marine Plans (April 2014)	<p>Marine plans set the approach for managing marine regions, both inshore and offshore, and its remit includes the area submerged at mean high water spring tide and hence is pertinent to the elements of the Scheme within Lake Lothing.</p> <p>Policy TR1 addresses how an applicant should address matters relating to tourism and recreation, which is namely that their proposals should:</p> <ol style="list-style-type: none"> a) Not adversely impact tourism and recreation activities; b) How, if there are adverse impacts on tourism and recreation activities, they will minimise them; c) How, if the adverse impacts cannot be minimised, they will be mitigated; and d) The case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts. <p>Within this Chapter, the impacts upon tourism have been identified and mitigation has been proposed.</p> <p>Policy SOC1 also notes that proposals which maintain or enhance access to the coast and marine areas should be supported.</p>
Transport Investment Strategy (July 2017)	<p>Paragraph 1.36 of the Government’s Transport Investment Strategy identifies that good transport infrastructure help to encourage tourism and enables visitors to reach all parts of the country.</p>

16.3 Methods of Assessment

16.3.1 The aspects that have been included within the assessment methodology have been informed by guidance within DMRB Volume 11 with particular reference to Section 3, Parts 3, 6, and 8 which identifies the aspects of the environment that could be significantly impacted by a road scheme proposal. The aspects that have been adopted within this assessment have been adopted following consideration of the likely

significant effects that could arise from the construction and operation of the Scheme.

- 16.3.2 The assessment combines qualitative and quantitative elements, involving the analysis of numeric data and descriptive criteria to enable substantiated conclusions to be drawn as to the nature and magnitude of change that is likely to occur, and the potential of such changes to be significant in the context of the 2009 Regulations.
- 16.3.3 The evaluation of impacts associated with jobs created during the approximate two year construction period is based on consideration of the total number of jobs created for the approximate two year period (as a proportion of current jobs and job opportunities within the study area), relative to all employment sectors and the construction sector as a specific sector.
- 16.3.4 As stated in Chapter 5, the Scheme will employ just over 100 people at the peak of construction. As shown in Plate 5-3 employment on site will rise to this peak and taper off as construction progresses. The assessment in this Chapter has been undertaken using the peak construction employment figure of approximately 100 people so that the worst case scenario for impact upon the employment market and the temporary accommodation sector can be assessed.
- 16.3.5 The assessment also includes an evaluation of changes in accessibility for leisure-related vessels which gain access to the Broads from Lake Lothing via Mutford Lock and vice versa. This is based on an analysis of the findings of the assessment of impacts on maritime operations following the vessel surveys, whose conclusions are set out in the Vessel Survey Report (Appendix B of the Preliminary Navigation Risk Assessment, document reference 6.7).

Desk Study

- 16.3.6 Data and evidence base for this chapter has been collated from a number of sources to inform the socio-economic and recreation baseline. The desk-based sources used include:
- Population and labour market statistics provided by the Office for National Statistics (ONS) and Nomis⁴⁹ including;
 - Key demographics;
 - Economic activity;
 - Unemployment; and
 - Workforce qualifications.
 - The DEFRA's online GIS portal - <http://www.magic.defra.gov.uk/>;
 - National and Local Policies;
 - Local development plan documents and supporting studies;

⁴⁹ Nomis is a service provided by the Office for National Statistics, ONS, to give free access to the most detailed and up-to-date UK labour market statistics from official sources.

- Definitive Public Right of Way (PRoW) mapping including information on recreational and tourist resources; and
- Consultation with local authorities and relevant stakeholders.

Site surveys

16.3.7 In addition to the compilation of desk based information, a vessel survey of the users of Lake Lothing was undertaken from the 13 of June 2017 to the 30 of September 2017 (the initial vessel survey) and from the 2 of January 2018 to the 13 of April 2018 (the second vessel survey) to identify the number of vessels that pass through Lake Lothing which would require the Scheme Bascule Bridge to open. This survey was undertaken to confirm the number and timings of openings of the existing A47 Bascule Bridge and to assess the likely opening frequency of the Scheme Bascule Bridge. Greater detail on this survey is provided in Appendix B of the Preliminary Navigation Risk Assessment, (document reference 6.7).

16.3.8 The discussion of the Vessel Survey in this chapter is limited to leisure vessels only as this is pertinent to the assessment of impacts upon recreation. Recreational vessel movements within the initial vessel survey from June to September 2017 have been used as this allows a worst case assessment to be presented as this period (i.e. the summer months) is when a greater number of recreational vessels are using Lake Lothing.

Temporary Accommodation

16.3.9 Lowestoft and Great Yarmouth, the two major towns within the study area, are both tourist resorts with a number of different temporary accommodation types available. Accurate information on the number of beds and their occupancy rate is not available from Waveney District Council or the Destination Management Organisation, in this case The Suffolk Coast. Information on accommodation has therefore been sourced from available tourist information sources as appropriate and referenced in footnotes in the assessment as appropriate.

Significance of effect

16.3.10 The importance of receptors is defined by how sensitive they are to changes in the socio-economic environment. Table 16-2 below identifies how receptors have been categorised.

Table 16-2 – Socio-economic sensitivity

Sensitivity	Criteria
High	A receptor with little or no capacity to absorb change
Medium	A receptor with limited capacity to absorb change
Low	A receptor with capacity to absorb change

16.3.11 The magnitude of an effect is measured by a change in the baseline conditions that result from the Scheme. The following magnitude of impact parameters in Table 16-3 have been adopted.

Table 16-3 – Socio-economic magnitude of impact

Impact	Criteria
Major	A long term and permanent effect that extends beyond the boundaries of the study area that affects the well-being of many socio-economic receptors.
Moderate	A medium term effect that lasts for longer than a year within the study area that affects the well-being of socio-economic resources.
Minor	A short term effect that lasts for less than a year within the area of Lowestoft that affects the well-being of a few socio-economic receptors; or A long term and permanent effect that affects the well-being of a small amount of socio-economic receptors
Negligible	A short term effect that does not extend beyond the extent of the Scheme that affects the well-being of a few socio-economic receptors.

16.3.12 Significance has been appointed to each type of effect as shown in Table 16-4 although professional judgement has also been applied to ensure an appropriate identification of significant effects is provided.

Table 16-4 – Socio-economics significance of effect

Impact/Sensitivity	Negligible	Minor	Moderate	Major
High	Not significant	Significant	Significant	Significant
Medium	Not significant	Not significant	Significant	Significant
Low	Not significant	Not significant	Not significant	Significant

16.4 Baseline Environment

16.4.1 The existing environment in relation to socio-economic and recreational features has been based on available data and strategies and plans currently in place within the defined study area.

16.4.2 Lowestoft is Waveney Borough's largest town and the second largest in Suffolk. It is the most easterly town in the country and is situated between the eastern edge of The Broads National Park and the North Sea. Great Yarmouth lies approximately 15km to the north of Lowestoft.

16.4.3 Lake Lothing creates a significant barrier to movement within and across Lowestoft and the wider area. Lake Lothing effectively splits Lowestoft in two, with the main employment area located to the northern side and a sizeable residential population to the south. The two existing lifting bridges (see Figure 1.1) are located at the eastern and western ends of the town, this creates significant bottlenecks at the points where several roads merge into one. Further information on the present and future traffic movements is included in Chapter 19 and Appendix 19A.

Population and Labour Market

16.4.4 The 2017 Nomis figures show the total resident population in Waveney as 117,200 and the total population of Great Yarmouth as 99,000 making a total of 216,200 within the study area.

16.4.5 The estimated working age population in the study area between the ages of 16 and

64 years is 65,600 in Waveney and 58,200 in Great Yarmouth making a total of 123,800 within the study area which is 57.4% of the total resident population. This is lower than that for the East of England (regional) and Great Britain (national) at 61.8% and 63.3% respectively.

- 16.4.6 The sub-national population projections of the ONS estimates that the total resident population in Great Yarmouth is projected to keep increasing to 101,300 by 2022 and the population of Waveney to 118,500.
- 16.4.7 The estimated increases in population numbers is significantly influenced by the ageing population across the local authority areas, regionally and nationally. Between 2014 and 2022 the population of working age (20-64) is due to stay reasonably static falling from 114,300 to 113,900 within the study area. However, the retired population (65+) is due to increase from 36,700 to 43,100 within the study area.
- 16.4.8 Lake Lothing divides the town of Lowestoft into two halves, similar in size but different in character. Data obtained from the ONS Census 2011, shows that the northern half has a population of 36,180 people, and includes the main shopping centre and marina. The southern half is home to 26,041 people and includes the main seafront, pier and beach.

Economic Activity

- 16.4.9 Economic activity from July 2016 to June 2017 in Waveney is 74.7% and 77.9 in Great Yarmouth which are lower with those recorded for the East of England at approximately 80% and lower than that of Great Britain at 78%. Both Great Yarmouth and Waveney have wards which qualify for Assisted Area Status (AAS) where government can offer additional financial supports to businesses.
- 16.4.10 The employment rates show a similar profile where the Waveney rate is at 69.5% and Great Yarmouth at 70.3% compared to the Great Britain rate at 74.4%.
- 16.4.11 Rates of self-employment are 9.2% in Waveney but are unavailable for Great Yarmouth. This is lower than the East of England and Great Britain average of 11.2% and 10.6% respectively.
- 16.4.12 Similarly, unemployment is 6.1% in Waveney and 6.8% in Great Yarmouth which is higher than 3.9% and 4.6% in the East of England and Great Britain respectively.
- 16.4.13 This information identifies that the Study Area has a higher than average unemployment, and lower than average economic activity both of which imply a need for investment as well as the likely availability of labour for construction.

Employment by Occupation

- 16.4.14 A review of the ONS annual population data between October 2015 and September 2016 shows that the Waveney and GYBC sub-region has a significantly lower proportion of Standard Occupational Classification (SOC) 2010 Major Groups 1-3 and a significantly higher SOC 2010 Major Groups 8-9 than the regional and national figures respectively. A breakdown of this categorisation is presented in Table 16-5.
- 16.4.15 This occupational profile indicates that overall, there are less workers in the highly skilled categorisation and more in the elementary categorisation in the study area in comparison to the East of England and national figures.

Table 16-5 - Employment by occupation category

SOC 2010 Major Group	Waveney (%)	Great Yarmouth (%)	East of England (%)	Great Britain (%)
Groups 1-3: (Managers, Directors, Senior Officials / Professional Occupations / Associate Professional & Technical)	32.0	33.2	45.2	45.1
Groups 4-5: (Administrative & Secretarial / Skilled Trades)	22.5	15.9	22.1	20.9
Groups 6-7: (Caring, Leisure and other service Occupations / Sales and Customer Services Occupation)	23.7	32.5	16.0	16.8
Groups 8-9: (Process Plant & Machine Operatives / Elementary Occupations)	21.8	18.4	16.6	17.2

16.4.16 In Lowestoft, the decline in employment in key industries has been a major change in the past two decades. Employment in the manufacturing sector has continued to fall and employment has increasingly depended upon a small number of larger employers, particularly in engineering and food processing.

16.4.17 However, compensatory growth employment is also occurring in retail, tourism, service, construction and public service sectors. In their joint response to the Scoping Opinion, SCC and WDC confirmed that tourism accounted for 7% of employment in Lowestoft and 15% in Waveney. Significant economic growth in the tourism sector is also anticipated in the Waveney Economic Area up to 2031 with modest growth in the life science, information technology, ports and logistics sectors⁵⁰. The Waveney Draft Local Plan identifies in paragraph 8.58 that 43 hectares of employment land needs to be identified and developed in Waveney to plan for an additional 5,000 jobs in the period to 2036.

16.4.18 Employment in the construction sector in Waveney is 5% of the workforce and 3.9% in Great Yarmouth compared to 5.5% and 4.6% in the east region and Great Britain as a whole.

16.4.19 The proportion claiming Job Seeker's Allowance in Waveney is 3.5% and 4.8% in Great Yarmouth, compared to 1.4% in Suffolk, 1.4% in Norfolk and 1.9% in England. The Waveney Core Strategy highlights the problem of long-term unemployment and the proportion of low skilled jobs. The Great Yarmouth Core Strategy identifies that unemployment in the borough is high relative to the regional average and that the unemployment rate is seasonal in so far that it is lowest in the summer months.

16.4.20 According to the Index of Multiple Deprivation (IMD) ranking Waveney has an IMD ranking of 95 and GYBC has a rank of 29. Waveney remains the most deprived local authority in Suffolk and has become relatively more deprived between 2010 and 2015, dropping 32 places on the national rankings. GYBC is one of the most deprived areas in the country.

16.4.21 According to the IMD (2015) composite index, the level of deprivation in Lowestoft is

⁵⁰ Ipswich and Waveney Economic Areas, Employment Land Needs Assessment, Nathaniel Lichfield & Partners, March 2016.

relatively high. Parts of the Harbour, Normanston and St Margaret's, all to the north of Lake Lothing and Whitton and Kirkley wards to the south, are among the 10% most deprived areas in England. All parts of these wards are amongst the 20% most deprived areas in England.

Qualifications

16.4.22 The analysis of data for workplace qualifications within the study area in comparison to the East of England and Great Britain national figures is shown in Table 16-6.

Table 16-6 – Qualification levels

Qualification Levels	Waveney (%)	Great Yarmouth (%)	East of England (%)	Great Britain (%)
NVQ 4 and above	20.6	23.0	33.6	37.1
NVQ 3	36.7	34.6	52.0	55.8
NVQ 2	56.3	52.8	71.5	73.6
NVQ 1	81.5	77.9	84.9	84.9
Other Qualifications	8.3	8.3	7.1	6.5
No Qualifications	10.2	13.8	8.0	8.6

Employment Infrastructure

16.4.23 Lowestoft has a traditional economic structure characterised by a large manufacturing sector, a smaller services sector and a noticeable dependence on larger employees within key sectors such as food and drink. The manufacturing sector has continued to decline and growth in employment has occurred in retail, tourism, service, construction and public service sectors. The Port of Lowestoft is a significant employer in Lowestoft supporting around 1,200 jobs and contributing around £80 million to the economy per annum⁵¹.

16.4.24 The decline in the oil and gas and fishing industries in the UK has impacted on economic and employment levels in Lowestoft. However, the UK's need for alternative energy sources places the area in a position to encourage investment, most notably the establishment of Orbis Energy which undertakes to develop the energy supply chain across the whole of the region. This includes providing support and advice to enable local businesses to enter the supply chain or to help businesses diversify their products to capture the benefits of being into the supply chain. The locations of offshore wind farms around the UK places Lowestoft in a prime position to reap the benefits of such development. As an example, the proposed £15bn windfarm development entitled the 'East Anglian Array' is to be built off the Suffolk and Norfolk coast, and forms part of the Government's Round Three phase of offshore wind developments. 'East Anglian Array' windfarm will be one of the largest in the world with at least 1,000 turbines located about 15 miles offshore between Lowestoft and Great Yarmouth.

16.4.25 The Port of Lowestoft is already established as a hub for offshore wind operations and

⁵¹ Lowestoft Coastal Community Team Seafront Strategy.

this is set to increase further. The Operations and Maintenance (O&M) base for the Greater Gabbard Offshore Windfarm (comprising 140 turbines capable of providing enough renewable energy to supply around 530,000 homes each year) is located at Lowestoft. The O&M base has created around 100 permanent jobs, 95% from the local area. In addition, the Galloper Offshore Windfarm and East Anglia ONE offshore windfarm will be using the port as a construction coordination base over a two year period bringing jobs into the area and acting as a catalyst for further growth in the sector. Furthermore in November 2015 ScottishPower Renewables announced a thirty-year agreement with the Port of Lowestoft for it to act as a construction and operations hub for the East Anglia ONE offshore windfarm. The East Anglia ONE offshore windfarm is the first phase of the East Anglia Array, a 7.2GW Round 3 allocation which received development consent in June 2014. East Anglia ONE is currently under construction and has been identified in the National Infrastructure Plan as a key project.

16.4.26 Lowestoft town centre (defined as the core and the main shopping streets) has the following A1 to A5 (as defined in the Town and Country Planning (Use Classes) Order 1987) retail establishments as shown in Table 16-7. The town centre also has a vacancy rate of 18%⁵².

Table 16-7 – Retail establishments within Lowestoft Town Centre

	Number
Shops (A1)	134
Financial and professional services (A2)	35
Restaurants and cafes (A3)	15
Drinking establishments (A4)	9
Hot food takeaways (A5)	4

Recreation and Tourism

16.4.27 Lowestoft's fishing heritage, and the historical extent of the port, contribute to the cultural and tourism sector. There is a modern fish market with fish auction and processing facilities. There are significant developments in the marine leisure industry in the outer and inner harbours. The Royal Norfolk and Suffolk yacht club is located on the south side of the outer harbour and the Lowestoft Haven Marina is located at the west of Lake Lothing. Lake Lothing provides one of only two accesses to the Broads National Park from the North Sea, the other being at Great Yarmouth which has similar lifting bridges to Lowestoft that need to be navigated.

16.4.28 Tourism is an important contributor to the economy of Waveney District with an almost 5 million day trips to the district in 2015⁵³ and a contribution of £293 million to the economy of the local area in 2015. Tourism in the borough of Great Yarmouth

⁵² Lowestoft Town Profile

⁵³ Waveney District Council, Authority Monitoring Report, 2015/16

contributed almost £600m to the local economy in 2017⁵⁴.

16.4.29 Other tourism facilities and assets in the study area within Waveney include the North and South Beach of Lowestoft as well as access points to the Broads.

16.4.30 As identified in Chapter 2, and in Chapter 19, Lake Lothing acts as a barrier to travelling between the northern and southern halves of the town of Lowestoft, which therefore acts as a barrier to visiting tourists and those seeking to access recreational facilities.

Boat movements

16.4.31 As shown in Plate 5-1, the Scheme Bascule Bridge has a clearance of 12m and this is greater than the A47 Bascule Bridge which has a clearance of 2.17m HAT.

16.4.32 The initial vessel survey identified that the A47 Bascule Bridge had to open 416 times to allow recreational vessels to pass through.

Temporary accommodation capacity

16.4.33 There are nine hotels in Lowestoft⁵⁵ although no information on occupancy is available from Waveney DC or the Suffolk Coast Destination Management Organisation. This figure does not include guest houses, bed and breakfast accommodation or self-catering holiday accommodation and therefore underestimates the total overnight accommodation that is available in the town. Information on the Lowestoft tourist information website identifies a further 14 bed and breakfast businesses in the town⁵⁶.

16.4.34 Also in the study area is the town of Great Yarmouth, which whilst 17km by road from Lowestoft, does have a much larger number of hotels and guesthouses. A 2007 study⁵⁷ identified a total of 5,465 beds in the GYBC area.

16.5 Predicted Impacts

16.5.1 The following are identified as having a potential to impact on the receiving environment:

- The creation of jobs and training opportunities within the local economy during the anticipated two year construction period for the Scheme;
- Changes in accessibility for leisure-related vessels which gain access to the Broads or the North Sea via Lake Lothing and the consequent effect on tourism;
- Changes in access to the town centre of Lowestoft and the impact upon spend as well as the broader investment from construction;
- Changes in accessibility for users of the local and strategic road network visiting

⁵⁴ Great Yarmouth Borough Council, Annual Planning Monitoring Report, December 2017.

⁵⁵ <http://www.eastsuffolk.gov.uk/assets/Planning/Suffolk-Coastal-Local-Plan/Local-Plan-Review/Issues-and-Options-Consultation/Retail-Leisure-Study-Volume-1-Issued-20-10-17.pdf>

⁵⁶ <http://www.lovelowestoft.co.uk/accommodation-b-bs/> - accessed 21st November 2017

⁵⁷ Appropriate Land Uses in Secondary Holiday Accommodation Areas, Bone Wells Associates for Great Yarmouth Borough Council, 2007.

Lowestoft and the consequential effect on tourism;

- Changes in the demand for accommodation during the approximate two year construction period and the likely effect on established business / tourism accommodation; and
- Indirect employment.

16.5.2 These six aspects have been assessed as having socio-economic sensitivity (as defined in Table 16-2) as shown in Table 16-8. As the sensitivity applies to the receptor, it is noteworthy that it is applicable to both the construction and operational phases of the assessment.

Table 16-8 – Socio-economic sensitivity of environmental aspects

Environmental Aspect	Receptor	Sensitivity	Reasoning
The creation of jobs and training opportunities within the local economy during the approximate two year construction period for the Scheme.	The labour market within the study area	Low	As identified in Paragraph 16.4.12, unemployment in the Study Area is above the national and regional average, and therefore there is capacity within this receptor to absorb change, such as the introduction of a new employer during the construction phase of the Scheme.
Changes in accessibility for leisure-related vessels which gain access to the Broads via Lake Lothing and the consequent effect on tourism.	Recreational vessel users in Lake Lothing	Medium	Time spent on recreational activities is of medium sensitivity due to the reasonable expectation of the receptor compared to the relative scarcity of leisure and vacation time.
Changes to access to the town centre of Lowestoft and the impact upon spend in the town centre of Lowestoft during construction	The economy of the town centre	Low	The economy and degree of expenditure within the town centre of Lowestoft is dependent upon a number of factors and is constrained at present due to the severance caused by Lake Lothing and the A47 Bascule Bridge. The receptor is of low sensitivity due to the broad range of services that are present that serve a number of sectors.
Changes in accessibility for users of the local and strategic road network who gain access to the Broads and the consequent effect on tourism.	Users of the road network	Medium	The road network in the study area is known to be congested (see Chapter 19 and the Transport Assessment in document reference 7.2) and the network is considered to be of medium sensitivity related to tourist usage given that such usage will not place excessive demands on the road network at peak periods.
The demand for temporary accommodation during the approximate two year construction period and the likely effect on established business / tourism	The temporary accommodation sector	Low	The temporary accommodation sector in the study area has been shown to be considerable in size and given its seasonal nature is likely to be able to absorb considerable fluctuations in demand.

Environmental Aspect	Receptor	Sensitivity	Reasoning
accommodation within the town.			
Indirect employment	The labour market within the study area	Low	The baseline section above has identified that unemployment in the Study Area is greater than the national and regional average. A low sensitivity has been adopted because it has been assumed within the assessment, based upon employment figures that the labour market within the study area will be able to adapt to any change attributable to the Scheme.

16.5.3 These Environmental Aspects have been described in turn in Table 16-9 although indirect employment in the operational phase is addressed in Paragraph 16.5.10.

16.5.4 With regard to the assessment upon recreational vessels, the assessment has been informed by the results of the initial vessel survey as follows.

16.5.5 Plate 16-1 shows the number of occasions that the A47 Bascule Bridge was opened to allow a recreational vessel to pass through during the initial vessel survey, and, for comparison purposes how frequently the Scheme Bascule Bridge would be required to open over a similar three and a half month period.

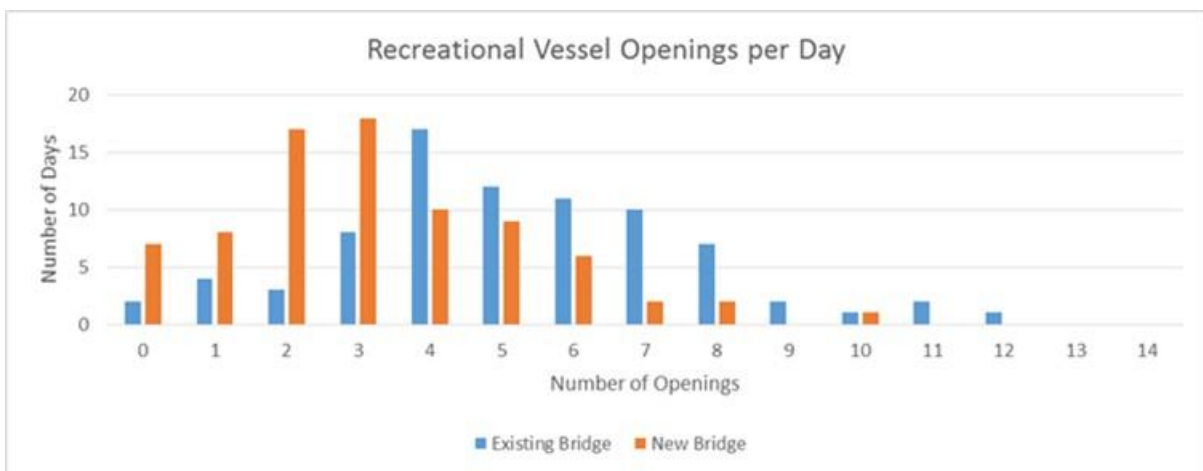


Plate 16-1 – Openings per day for recreational vessels only

16.5.6 Assuming similar levels of maritime traffic to that identified in the initial vessel survey, the Scheme Bascule Bridge would have to open specifically for recreational vessels a total of 233 times in a three and a half month period. This is an average of 2.8 times a day with a maximum of 10 and a minimum of 0 as shown in Plate 16-1. The second vessel survey identified a total of nine recreational vessels over the entire period that would require an opening of the Scheme Bascule Bridge.

16.5.7 However, this 233 figure for openings does not identify the actual number of vessels that may pass through the area of the Scheme Bascule Bridge, in so far that vessels will often traverse Lake Lothing in a flotilla arrangement. For the 233 occasions that would necessitate an opening of the Scheme bascule bridge, the Vessel Survey

identified that a total of 318 recreational vessels would pass through Lake Lothing.

- 16.5.8** In addition to the 318 recreational vessels passing through Lake Lothing during the survey period, a further 616 recreational vessels with an air draft less than 11.5m⁵⁸ in height were able to pass without requiring an opening of the Scheme Bascule Bridge.
- 16.5.9** To cater for a recreational vessel when being held between the two bridges, following S42 consultation (see Chapter 7 and document reference 5.1) with the Navigation Working Group, a pontoon has been incorporated as part of the Scheme that will allow recreational vessels to moor. The location of the pontoon is outside of the Navigation Channel and therefore ongoing access will be maintained through an extension of the present dredging regime (please see Chapters 11, 12, 15 and 17 for further information on the effects of dredging in this area).

⁵⁸ Whilst there is a 12m air draft, all vessels over 11.5m will require an opening of the Scheme Bascule Bridge to provide a factor of safety

Table 16-9 – Assessment of effects

Environmental aspect	Sensitivity	Phase of impact	Nature of impact	Magnitude of impact (Adverse and Beneficial)	Significance of effect
The creation of jobs and training opportunities within the local economy during the approximate two year construction period for the Scheme.	Low	Construction	<p>The Scheme will employ approximately 100 FTE at the peak of construction as shown in Plate 5-3.</p> <p>The study area is known to have a similar percentage of people employed in the construction sector than the national and regional average and therefore it is likely that some construction workers can be sourced from within the study area.</p> <p>SCC's policy on procurement (see Section 16.5.16) will provide enhancement for job opportunities through ensuring that contractors who will tender to construct the Scheme are assessed against matters relating to using local suppliers and employing apprentices.</p>	Negligible	Not significant
Changes in accessibility for leisure-related vessels which gain access to the Broads via Lake Lothing and the consequent effect on tourism.	Medium	Construction	<p>As discussed in Chapter 5, the construction of the Scheme will be undertaken in a manner that allows continued use of the Navigation Channel except in those circumstances where a temporary closures or restrictions are required which will always be with prior notification to ABP as Statutory Harbour Authority.</p> <p>Impacts upon the leisure related vessels, and the degree of delay and disruption that they could experience will be temporary.</p>	Minor adverse	Not significant
	Medium	Operation	<p>As stated in Paragraph 16.5.6 the Scheme Bascule Bridge could need to open for recreational vessels up to 10 times per day. The Scheme Bascule Bridge will not open on demand for recreational users and only within a scheme of operation required to be produced by an article to the DCO.</p>	Moderate adverse	Significant

Environmental aspect	Sensitivity	Phase of impact	Nature of impact	Magnitude of impact (Adverse and Beneficial)	Significance of effect
			<p>Should a recreational vessel be held in the inner harbour between the A47 Bascule Bridge and the Scheme Bascule Bridge, the vessel will be able to make use of a pontoon which will be constructed adjacent to the south quay (see Figure 5.1) where they can moor should they need to wait for a bridge opening. The length of delay will be predictable based upon the known restrictions and opening regime. Should a recreational vessel be granted passage following a commercial vessel through either of the bascule bridges, and be subsequently made to wait at the pontoon, the maximum period that this vessel would have to wait until the next scheduled request opening would be three and a quarter hours based upon the present opening regime. As this arrangement will continue during the operational phase, and it would last longer than a year and in accordance with the criteria in Table 16-3, this constitutes a moderate adverse effect.</p> <p>It is noted that the conclusions of the Navigation Risk Assessment (see document reference 6.7) equally apply to recreational users of Lake Lothing as they do to commercial vessels and that the safety risks to navigation from the Scheme can be made "<i>As Low As Reasonably Practicable</i>". The DCO requires compliance with the terms of the Navigation Risk Assessment.</p> <p>There will be no impact to Marinas on Lake Lothing as no there will be no loss of land or mooring space as a result of the Scheme.</p>		
Changes to access to the town centre of Lowestoft	Low	Construction	Road users passing through the Order limits on their journey to the town centre during the construction phase will experience temporary traffic management measures	Moderate adverse	Not significant

Environmental aspect	Sensitivity	Phase of impact	Nature of impact	Magnitude of impact (Adverse and Beneficial)	Significance of effect
			at the northern and southern roundabouts that will extend journey times along Denmark Road and Waveney Drive. This traffic management will be temporary and cannot be quantified at this stage, but is likely to last over a year at the southern roundabout.		
	Low	Operation	During the operational phase, the Scheme will greatly increase access across Lake Lothing and reduce journey times to the town centre from the urban areas of Lowestoft to the south of Lake Lothing (see Chapter 19 and the Transport Assessment in Appendix 19A). Tourism and recreational access across Lake Lothing will also be improved through shorter and more reliable journey times.	Major beneficial	Significant
The impact upon spend in the town centre of Lowestoft during construction	Low	Construction	During the construction phase it is likely that there will be an increase in demand for hotel accommodation (see below) and this will likewise result in an increase in spend in Lowestoft. The impact is, however, limited to construction workers who will need temporary accommodation i.e. those not sourced from the local labour market. The construction supply chain will contribute towards the local economy as construction equipment and materials (particularly concrete) can be sourced within the study area.	Minor beneficial	Not significant
Changes in accessibility for users of the local and strategic road network who gain access to the Broads and the consequent effect on tourism.	Medium	Construction	During the construction stage there is unlikely to be a significant change to the traffic flow on the local and Strategic Road Network (see Chapter 6 and Chapter 19), although this is considered to be of medium sensitivity due to the limited capacity that is available to accommodate change given the existing traffic issues	Negligible	Not significant

Environmental aspect	Sensitivity	Phase of impact	Nature of impact	Magnitude of impact (Adverse and Beneficial)	Significance of effect
			within Lowestoft during an opening of the A47 Bascule Bridge, or the Mutford Bridge.		
	Low	Operation	<p>The operational phase of the Scheme will lead to a reduction in flow along the Mutford Bridge and the A47 Bascule Bridge. This will improve access to tourism and leisure assets.</p> <p>Notwithstanding the assessment in Chapter 19, the assessment in this chapter relates only to access for tourism rather than for all travelling purposes as presented in Chapter 19 and therefore the impact is of a lesser degree as it affects a smaller number of travellers.</p>	Minor beneficial	Not significant
The demand for temporary accommodation during the approximate two year construction period and the likely effect on established business / tourism accommodation within the town.	Low	Construction	<p>As stated above, there is likely to be approximately 100 FTE employed at the peak of construction although it is likely that a number of these employees will be sourced from the local labour market although there will be some construction workers who will require temporary accommodation.</p> <p>As shown in Plate 5-3 peak employment is due to take place in the second quarter of 2020 and whilst this doesn't correspond with the likely peak holiday season of the summer months, it does include holiday periods such as Easter and the May Bank Holidays.</p> <p>However, even at peak times, the Scheme is unlikely to generate demands for overnight accommodation that cannot be accommodated within the study area. Given the low numbers of workers that are likely to require accommodation, the Scheme is unlikely to generate a significant positive benefit to the overnight accommodation business sector in the study area given</p>	Negligible	Not significant

Environmental aspect	Sensitivity	Phase of impact	Nature of impact	Magnitude of impact (Adverse and Beneficial)	Significance of effect
			the short duration of construction. Furthermore, there is no wider economic effect upon tourism through construction workers taking accommodation that could otherwise be used by tourists.		

Indirect employment

16.5.10 Impacts related to the indirect effects of the Scheme upon employment in the study area have focused upon the likely benefits from increased access and the likely disbenefits from land take and loss of business.

Improved access and financial benefits

16.5.11 In their response to the Scoping Report (Appendix 6A), Great Yarmouth Borough Council (GYBC) stated that they considered that the Scheme will enhance connectivity between the Enterprise Zones in Great Yarmouth and Lowestoft, particularly Riverside Road and Lowestoft Industrial Estate to the south of Lake Lothing.

16.5.12 The Outline Business Case (document reference 7.4) includes information on a business survey that was undertaken in 2015. This identified that businesses perceived that beneficial effects would arise should a third crossing of Lake Lothing be implemented.

16.5.13 Both of these are considered in greater detail in the Case for the Scheme (document reference 7.1).

Loss of business, and the effects upon employment

16.5.14 The assessment of impact upon employment for businesses within the Order limits of the Scheme is provided in Table 16-10. This should be read in conjunction with Chapter 15 where the likely significant effects upon Private Assets, and therefore businesses, is considered in greater detail. It is noteworthy that effects considered in Table 16-10 refer to effects upon employment within the Study Area as a whole and not to the individual business.

16.5.15 With regard to indirect employment benefits, the employment sector in the study area is considered to be of low sensitivity as it has capacity to absorb change.

Table 16-10 – Assessment of effects upon employment

Business	Sensitivity	Nature	Magnitude	Significance of effect
Bella Blue Beauty Parlour	Low	As assessed in Chapter 15, the Scheme will result in the loss of the Bella Blue Beauty Parlour which employs a small number of staff. This business is a low value receptor as the number of employees is negligible compared to the employment market in Lowestoft. The magnitude of impact is assessed as being Moderate as it is assumed, to provide a worst case scenario that the business not be able to relocate and hence this would result in an impact lasting longer than a year.	Moderate adverse	Not significant
NWES	Low	As assessed in Chapter 15 there will be the temporary loss of 8 parking spaces.	Negligible	Not significant
Motorlings	Low	As discussed in Chapter 15, the Scheme will amend the access to Motorlings and permanently acquire some land that is	Negligible	Not significant

Business	Sensitivity	Nature	Magnitude	Significance of effect
		currently used as a forecourt. However, this will not adversely affect the viability of the business and hence will not affect employment.		
Enterprise	Low	Enterprise's building within the site of Motorlings will be demolished which will result in the loss of the business. Enterprise is a low value receptor as the number of employees is negligible compared to the employment market in Lowestoft. The magnitude of impact is assessed as being Moderate as it is assumed, to provide a worst case scenario that the business not be able to relocate and hence this would result in an impact lasting longer than a year.	Moderate adverse	Not significant
Nexen	Low	As discussed in Chapter 15, the Scheme will amend the access to Nexen and permanently acquire some land that is currently used as a hardstanding. However, this will not adversely affect the viability of the business and hence will not affect employment.	Negligible	Not significant
ABP	Low	As discussed in Chapter 15, there will be a loss of berthing space during both the construction and operational phases. In addition there will be a loss of quay and storage space during the construction phase as a compound will be located as shown in Figure 5.4. However, this is a small proportion of the total available quay space and it is not thought that the use of this land and quay will result in any direct loss of employment for ABP (see Paragraph 15.5.16).	Negligible	Not significant

16.5.16 During the operational phase of the Scheme, improved access will have benefits beyond Lowestoft that affect the well-being of a socio-economic resource, in this case access for employment and services, and therefore the impact is moderate positive. This, however, does not constitute a significant effect.

16.6 Mitigation and enhancement

Procurement

16.6.1 Embedded mitigation for the Scheme, will be provided through SCC's Social Value and Sustainable Procurement Policy. The contractor will be required to adhere to these requirements. Similarly the contract will be assessed in accordance with Procurement Policy Note (PPN) 09/16 which is a government policy for the procurement of public works such as the Scheme.

16.6.2 PPN 09/16 requires the following to be material considerations in the decision making of the appointment of contractors:

- Solution Quality;
- Supply Chain;
- Cost;
- Employment/Skills;
- Sustainability;
- Health & Safety; and
- Outcome Benefits.

16.6.3 Those that are pertinent to the assessment of socio-economics are identified in greater detail below in Paragraphs 16.6.4 to 16.6.6, although at this stage a contractor is yet to be appointed and therefore specific measures cannot be provided. However, it is not considered that these measures will reduce the significance of effect that has been presented in this chapter.

Supply Chain

16.6.4 SCC will require contractors bidding to construct the Scheme to detail how they will engage local suppliers and labour. This will include the requirement for a supplier event where local suppliers will be able to meet the contractor to discuss its sub-contracting requirements.

Employment and Skills

16.6.5 SCC will require bidders to detail what their commitment to skills/training will be and how it will be continued down the supply chain. This will follow government guidance within PPN 14/15. Typically this requirement can include information on the number of apprenticeships the contractor will create and community initiatives they will implement.

Outcome benefits

16.6.6 Outcome benefits are additional community benefits that will be provided by the contractor as part of the delivery of the Scheme.

Pontoon

16.6.7 As discussed in Paragraph 16.5.9, a pontoon will be provided as shown in Figure 5.1 that will allow recreational vessels to moor should they need to wait for a bridge opening. This pontoon constitutes essential embedded mitigation that has been provided following consultation with the Navigation Working Group although it does not reduce the magnitude of impact.

16.6.8 Additional embedded mitigation will be provided through the publication of the 'opening regime' for the Scheme Bascule Bridge which will allow recreational users to identify when scheduled openings can be requested and is required by the DCO. With this information any adventitious recreational vessel that enters Lake Lothing following a lift of the A47 Bascule Bridge for a commercial vessel will knowingly enter into a potential three and a quarter hour wait as mentioned in Table 16-9. This can therefore

be considered a worst case assessment.

16.7 Conclusions and effects

16.7.1 The following conclusions have been identified during the socio-economic assessment.

- The creation of jobs within the construction phase of the Scheme will have a negligible impact given the skills that are likely to be available in the construction sector within the study area and does not constitute a significant effect;
- The Scheme will have a minor and non-significant adverse effect upon recreational users of Lake Lothing in the construction phase and a moderate and significant adverse effect in the operational phase despite the embedded mitigation in the form of the pontoon and the opening regime. This is attributable to the closure of the navigation channel in the construction phase being short term in nature and with advance notice. The moderate and significant effect in the operational phase is attributable to the delay that a recreational vessel may encounter should they be refused an opening of the Scheme Bascule Bridge, although this does constitute a worst case assessment;
- The Scheme will have a significant major beneficial impact upon access to the town centre of Lowestoft during the operational phase. During the construction phase there will be moderate, but non-significant, adverse impacts;
- There will be minor beneficial impacts upon spend in the town centre in the construction phase due to the investment of construction. These impacts will be negligible in the operational phase and neither will be significant;
- The change in accessibility for users of the road network will have a minor beneficial impact in the operational phase to those accessing the Broads and other leisure resources and does not constitute a significant effect;
- During the construction phase there will be a negligible impact upon the temporary accommodation sector as there is a very large existing capacity due to the importance of tourism to the study area; and
- During the operational phase, the indirect effect upon employment will be a moderate positive effect due to the increased access but this does not constitute a significant effect.

17 Road Drainage and the Water Environment

17.1 Scope of the Assessments

Introduction

17.1.1 This chapter describes the assessment of the likely significant effects of the Scheme on the water environment (surface water and groundwater) during construction and operation. It is supported by Figures 17.1, 17.2 and 17.3 and Appendices 17A, 17B and 17C. The assessment of this topic area considers potential direct impacts relating to the following aspects as identified in the Scoping Report (Appendix 6A) and Scoping Opinion (Appendix 6B), to include:

- Construction: Erosion and sedimentation related pollution;
- Construction: Chemical and hydrocarbon pollution;
- Operation: Surface water pollution related to routine run-off;
- Operation: Pollution related to accidental spillage;
- Construction and Operation: Hydromorphological changes; and
- Operational: Subsurface flows.

17.1.2 A Water Framework Directive (WFD) Assessment has also been undertaken to determine potential impacts on WFD waterbodies.

17.1.3 Indirect impacts on the aquatic ecology of the affected waterbodies are reported in Chapter 11 including the benthic and fish trawl surveys. Aquatic ecology also forms a part of the WFD Assessment presented in Appendix 17A.

17.1.4 Chapter 12 of this ES identifies the assessment with regard to soils and contamination.

17.1.5 The findings of the Flood Risk Assessment (FRA) are reported in Chapter 18 and are not considered further within this chapter.

Study area

17.1.6 The 'study area' is illustrated in Figure 17.1 and has been defined as:

- the physical area of the Scheme within the Order limits;
- a buffer of 1km in line with The Design Manual for Roads and Bridges (DMRB) HD 45/09 (Highways Agency, 2009) assessment criteria; and
- the upstream extent to Mutford Bridge where the tidal regime ceases, and where there is a barrier to upstream flow (approximately 2km); and downstream extent as far as the coastal boundary of Lake Lothing (approximately 1km).

17.1.7 The 'WFD Protected Areas Search Area' has been defined as a 2km buffer around the Order limits. This search area is used for the WFD assessment which is included in Appendix 17A.

17.2 Directives, Statutes and Relevant Policy

17.2.1 A summary of the current legislation, policy and guidance documents relevant to the

assessment of impacts of the Scheme on road drainage and the water environment is presented below.

The Water Framework Directive – Directive 2000/60/EC

17.2.2 The Water Framework Directive (WFD) makes provision for the maintenance and improvement of the ‘ecological and chemical status’ of the water environment, which includes rivers, lakes, wetlands, groundwater, estuaries and coastal waters. Chemical status is determined from compliance with environmental standards for chemicals that are classed as ‘priority hazardous substances’. The ecological status of a surface waterbody is measured through a range of biological quality elements, supported by measurements of physicochemistry, hydromorphology and compliance with environmental standards for chemicals that are classed as ‘specific pollutants’. For groundwater the overall status has a quantitative and a chemical component. The aim is for surface waterbodies to achieve ‘good ecological status’ by 2015 (where this is not possible and subject to the criteria set out in the Directive, aim to achieve good status by 2021 or 2027) and prevent deterioration of status of surface waters and groundwater. Certain surface waterbodies may be classified as artificial/heavily modified and will have less stringent targets to meet, however these will still need to demonstrate ‘good ecological potential’.

17.2.3 River Basin Management Plans (RBMP) have been produced regionally, which set out the characteristics of the waterbodies in that region, the pressures upon them and management measures that seek to maintain and improve the ecological status/potential of those waterbodies. The objectives set out in the RBMP are based on those from the WFD. Guidance published by the Environment Agency (EA) provides further information on assessing the risk of activities in relation to the River Basin Management Plan (RBMP) objectives.

Groundwater Directives

17.2.4 The WFD and the Groundwater Daughter Directive (GDD) (2006/118/EC), which were enacted in 2003 and 2009 respectively, replace the original Groundwater Directive (80/68/EEC) which was repealed in 2013. The GDD introduces procedures for assessing the ‘Chemical Status’ of groundwater as per the WFD, and protects groundwater by preventing direct discharge of ‘hazardous pollutants’ and limiting the direct discharge of non-hazardous pollutants.

National Legislation

17.2.5 The following statutes are also relevant to this assessment

- The Water Resources Act 1991;
- The Water Act 2003;
- The Flood and Water Management Act 2010;
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- The Groundwater (England and Wales) Regulations 2009;
- The Environmental Permitting (England and Wales) Regulations 2016;

- The Surface Waters (Fishlife) (Classification) Regulations 1997;
- The Surface Waters (Fishlife) Direction 2007;
- The Control of Pollution (Oil Storage) (England) Regulations 2001; and
- The Environmental Damage (Prevention and Remediation) Regulations 2009.

17.2.6 Under the Acts and Regulations listed above, consents will be required from the Environment Agency (EA) for temporary construction and permanent operational discharges as well as any temporary abstractions, impoundments and in-channel works related to construction activities, although the need for some consents is dispensed through the provisions of the DCO - this is considered further in the Consents and Agreements Position Statement (document reference 7.7).

17.2.7 The Marine Management Organisation (MMO) is responsible for licensing, regulation and planning of marine activities. They are also consultees in relation to non-marine developments with the potential for impacts on the marine environment. The Deemed Marine Licence is a schedule to the DCO.

National Networks National Policy Statement

17.2.8 Specific policies for Nationally Significant Infrastructure Projects (NSIP) for which particular considerations apply are set out in national policy statements. The key document for this Scheme is the National Policy Statement for National Networks. In relation to water quality and resources, this policy recognises that infrastructure development can have a direct adverse effect on all waterbody types as defined in the WFD; and also that there can be indirect adverse effects on health, protected species and habitats. It sets out detailed policy on assessment, decision making and mitigation (para 5.249 – 5.231).

17.2.9 It sets out that applicants should undertake early consultation with the relevant regulators such as the EA, and with water companies.

17.2.10 It sets out that the Secretary of State should be satisfied that applicants have demonstrated compliance with pollution control and other environmental protection regimes; considered the effects on achievement of environmental objectives under the WFD, River Basin Management Plans and other relevant plans; and put forward adequate proposed mitigation measures; including water resource efficiency, sustainable drainage; and considerate design to minimise pollution.

National Policy Statement for Ports

17.2.11 The National Policy Statement for Ports (PNPS) identifies policies specific to coastal environments in which ports are located, particularly with the need to consult the MMO on projects that impact on coastal change.

National Planning Policy Framework (NPPF)

17.2.12 The NPPF for England was published in March 2012. Sustainability principles are embedded within the framework, which include enhancement of the natural environment and pollution reduction. These principles are a recurrent theme throughout the document. It also refers to the consideration of River Basin Management Plans.

17.2.13 Additionally, it is stated in the NPPF (para. 109) that the planning system should contribute to and enhance the natural environment by “*preventing both new and existing development from contributing to, being put at unacceptable risk from or being adversely affected by, unacceptable levels of soil, air, water, or noise pollution or land instability*”.

17.3 Methods of Assessment

17.3.1 The road drainage and the water environment assessment includes the following key tasks:

- Ongoing consultation and engagement with the relevant statutory and non-statutory bodies to establish the principal water environment issues, including local authority consultation regarding private water supplies, EA consultation regarding assessment methodology and EIA Scoping and Preliminary Environmental Information Report consultation (see Chapter 6);
- Detailed desk studies and field surveys to ascertain the current baseline conditions;
- Assessment of the potential impacts related to the construction and operation of the Scheme; and
- Identification of measures to avoid, minimise or mitigate predicted impacts.

17.3.2 The assessment for the ES focuses upon identifying, defining and assessing the characteristics and subsequent potential impacts of the Scheme upon the surface water and groundwater receptors, including the wider hydrological catchments as categorised by the EA under the WFD. This hydrological catchment-based approach enables due consideration to be given to both individual locations where interactions occur and any cumulative impacts within larger water body areas.

Scoped Out Impacts

17.3.3 The specific characteristics of the Scheme enable particular impacts to be considered as highly unlikely to occur. Based on professional judgement and taking account of water environment characteristics and the Scheme design, the following aspects are not considered further, thus enabling focus upon the more likely impacts on the water environment (as discussed in the following subheadings):

- Loss of standing water - scoped out by the Secretary of State (SoS) (see paragraph 3.25 of the Scoping Opinion in Appendix 7B) based on the urban setting and the lack of standing water bodies below or adjacent to the Scheme;
- Loss or change to Groundwater Dependent Terrestrial Ecosystems - scoped out by the SoS (see paragraph 3.26 of the Scoping Opinion in Appendix 7B) due to the urban setting of the study area (illustrated in Figure 17.1 and defined in section 17.2.4) and the lack of such ecosystems below or adjacent to the Scheme as confirmed in Chapter 11: Nature Conservation;
- Changes to groundwater level or flow impacts due to cuttings and related dewatering - scoped out by the SoS (see paragraph 3.27 of the Scoping Opinion

in Appendix 7B) as no cuttings are anticipated for the Scheme, due to local topography, urban setting and flood risk characteristics; and

- Routine run-off discharge to groundwater – scoped out as there are no discharges to groundwater associated with the Scheme. At the EIA Scoping stage the design was not sufficiently progressed to enable this to be scoped out. The design now limits routine runoff discharge to surface waters, as set out in the Drainage Strategy secured through the DCO.

Construction Pollution

17.3.4 Evaluation of the potential for pollution of surface waters as a result of accidental spillage, and of the release of sediments into watercourses or water bodies, has included a review of areas where construction works are required within or in close proximity (i.e. within 50m) to surface watercourses and water bodies. 50m is considered to be a reasonably conservative stand-off distance and represents good practice for consideration of construction pollution risk to the surface water environment.

17.3.5 Sediment sampling at Lake Lothing has been undertaken to gain a better understanding of the type and level of contamination currently present in the sediments of this waterbody, which could be mobilised; details are presented in Chapter 12, but the results inform the assessment carried out in this chapter.

17.3.6 The potential for pollution of groundwaters/aquifers has been determined by looking at the vulnerability of groundwater to pollution and the potential for contaminants to infiltrate to groundwater. In addition, there is the potential for contamination of the groundwater aquifer from piling activities creating pathways for contaminated sediments. A Piling Risk Assessment has been undertaken and discussed in Chapter 12: Geology, Soils and Contamination of the ES and presented in Appendix 12C.

Operational Pollution from Routine Run-off

17.3.7 The Design Manual for Roads and Bridges (DMRB) HD 45/09 (Highways Agency, 2009) specifies procedures for the assessment of pollution impacts from routine run-off on surface waters, known as 'Method A'.

17.3.8 The Method A assessment comprises two separate elements:

- HAWRAT Assessment: the Highways Agency Water Risk Assessment Tool (HAWRAT) is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road run-off. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants, respectively; and
- EQS Assessment: Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.

17.3.9 To carry out these assessments, baseline and drainage design information is required, including; traffic volumes, areas of impermeable and permeable road surfaces to be

drained, proposed treatment train, receiving watercourse dimensions and flow data, water hardness, presence of sensitive sites (considered as international / national designated conservation sites) and in-stream structures or features which may influence the flow.

17.3.10 Method A was developed for the assessment of discharges into freshwater bodies rather than transitional water such as Lake Lothing, with such water bodies having different characteristics, receptors and baseline conditions due to tidal influence and dilution factors. Further to consultation with the EA, the HAWRAT assessment methodology has been used as a means to determine the impacts from routine run-off for the ES. Inputs have been derived using available data, design details and consultation with the EA, as described in detail in Appendix 17B.

Operational Pollution from Accidental Spillage

17.3.11 The DMRB document HD 45/09 (Highways Agency, 2009) specifies procedures for the assessment of pollution impacts from accidental spillage during operation, known as 'Method D'. A summary of the methodology is provided below, with full details provided in HD 45/09.

17.3.12 The assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:

- The probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway; and
- The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

17.3.13 The probability of a serious spillage occurring is dependent on a variety of factors:

- Traffic volumes;
- Percentage of heavy goods vehicles in the traffic volumes;
- Whether the road is motorway, rural or urban trunk road;
- The road type categories within the road drainage catchment under assessment (i.e. 'no junction', 'slip road', 'cross road' or 'roundabout'); and
- The length of each road type within the catchment.

17.3.14 The probability of a serious spillage subsequently causing a serious pollution incident is dependent on the receiving surface water body and the response time of the emergency services; i.e. less than 20 minutes, less than one hour, or greater than one hour.

Operational Impacts on Groundwater Flows and Supported Water Supplies

17.3.15 Groundwater aquifers have been identified and their importance evaluated through review of British Geological Survey (BGS) aquifer productivity and groundwater vulnerability mapping, and review of the WFD groundwater body status.

17.3.16 Groundwater abstraction data has been identified and receptors noted, with potable water supplies of particular concern. Other potential groundwater receptors such as

base flow to surface waterbodies have been noted.

17.3.17 There is the potential for impacts on the groundwater flows should the piles be deep enough to penetrate the aquifer. Piling Risk Assessments for both marine and terrestrial piling have been undertaken and are presented in Chapter 12 and Appendix 12C of the ES and an assessment is undertaken in this chapter.

Changes to Hydromorphological Regime

17.3.18 Sediment transport modelling has been undertaken for the ES to understand baseline sediment transportation processes in Lake Lothing and changes to sediment regime during construction and whilst the Scheme is in operation, including any implications this may have on mobilisation of potentially contaminated material.

17.3.19 A hydraulic model extending from Mutford Bridge to the A47 Bascule Bridge at the eastern extreme of Lowestoft inner harbour has been constructed using TUFLOW FV 3D for the ES. Bathymetric survey data collected as part of this project has been used to define the model grid. The model boundary conditions are defined based on hydrological analysis and include the tidal inflow and outflows of Lake Lothing as well as the freshwater flow at Mutford Bridge.

17.3.20 The hydraulic model has been verified using historical tidal data, and a suite of sensitivity tests have been undertaken to determine the outcome of a variety of parameters on the model results. The model has been used to investigate three scenarios:

- Baseline: the existing regime within Lake Lothing;
- Construction Phase: the predicted regime during construction of the Scheme; and
- Operational Phase: the predicted regime during operation, following construction of the Scheme.

17.3.21 For each scenario modelled, the distribution of currents over time within Lake Lothing has been determined at various locations for different tidal conditions, as illustrated in the Sediment Transport Assessment in Appendix 17C. Bed particle size and density, as identified in a shallow Ground Investigation (GI) survey undertaken as part of this Scheme, has been used to calculate the fall velocity of any disturbed sediment. Given the water depths and currents calculated by the model and fall velocities calculated based on the GI data, the distances travelled by disturbed and suspended material before it resettles on the bed have been determined. The passage and dispersion of any sediment plume can therefore be estimated and areas prone to siltation and scour identified.

17.3.22 Hydraulic modelling methodology detailing the development of the sediment transport model is presented in Appendix 17C, which has been used to inform the assessment of potential impacts on the hydromorphology of Lake Lothing. It has also been used to inform the ecological impact assessment in Chapter 11 of the ES in addition to impacts upon the Port as discussed in Chapter 15.

Impact Assessment Criteria

17.3.23 The predicted significance of impacts on surface waters and groundwater for the ES

has been based on the importance or sensitivity of the relevant waterbody and the magnitude of the impact from the Scheme, as recommended in DMRB document HD 45/09 (Highways Agency, 2009) (“HD 45/09”).

17.3.24 The importance or sensitivity of the waterbodies has been evaluated taking into account their quality, rarity, scale and substitutability. The criteria used is based on the guidance and examples given in HD 45/09 and represented in Table 17-1. Flood risk elements have been removed from the table and are covered in Chapter 18.

Table 17-1: Estimating the Importance of Water Environment Attributes (taken from HD 45/09, Table A4.3)

Importance	Criteria	Type	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	Surface Water	EC Designated salmonid / Cyprinid fishery WFD Class ‘High’ Site protected/designated under EC or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site, salmonid water)/ Species protected by EC legislation
		Groundwater	Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation SPZ1
High	Attribute has a high quality and rarity on local scale	Surface Water	WFD Class ‘Good’ Major Cyprinid Fishery Species protected under EC or UK habitat legislation
		Groundwater	Principal aquifer providing locally important resource or supporting river ecosystem SPZ2
Medium	Attribute has a medium quality and rarity on local scale	Surface Water	WFD Class ‘Moderate’
		Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water SPZ3
Low	Attribute has a low quality and rarity on local scale	Surface Water	WFD Class ‘Poor’
		Groundwater	Unproductive strata

17.3.25 The magnitude of the various impacts has been evaluated taking into account the extent of loss and effects on integrity of the relevant waterbody attributes. The criteria used is based on the guidance and examples given in HD 45/09 and represented in Table 17-2.

Table 17-2: Estimating the Magnitude of an Impact on an Attribute (taken from HD 45/09, Table A4.4)

Magnitude	Criteria	Type	Typical Examples
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface Water	<p>High risk of pollution during construction, significant temporary or long-term change in water quality, resulting in a permanent change in WFD status or permanent loss of surface water supply</p> <p>Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) and compliance failure with EQS values (Method B)</p> <p>Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex I)</p> <p>Loss or extensive change to a designated Nature Conservation Site</p>
		Geomorphology	<p>Major change in geomorphological conditions i.e. major changes in sediment patterns due to deposition or erosion, major reduction in morphological diversity, or major interruption to fluvial processes such as channel planform evolution, all with significant consequences for ecological quality.</p>
		Groundwater	<p>Loss of, or extensive change to, an aquifer</p> <p>Calculated risk of pollution from spillages >2% annually (Spillage Risk Assessment, Method D, Annex I)</p> <p>Loss of, or extensive change to, groundwater supported designated wetlands and water abstractions</p>
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	Surface Water	<p>Moderate risk of pollution during construction, moderate temporary change in water quality, resulting in a temporary change of WFD status or preventing attainment of overall status of 'Good', or temporary loss of water supply.</p> <p>Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) but compliance with EQS values (Method B)</p> <p>Calculated risk of pollution from spillages >1% annually and <2% annually</p> <p>Contribution of a significant proportion of effluent in a waterbody.</p>

Magnitude	Criteria	Type	Typical Examples
		Geomorphology	Moderate change in geomorphological conditions i.e. moderate changes in sediment patterns due to deposition or erosion, moderate changes in morphological diversity, or moderate interruption to fluvial processes such as channel planform evolution, all with moderate consequences for ecological quality
		Groundwater	Partial loss or change to an aquifer Calculated risk of pollution from spillages >1% annually and <2% annually Partial loss of the integrity of groundwater supported designated wetlands and water abstractions
Minor Adverse	Results in some measurable change in attributes quality or vulnerability	Surface Water	Minor risk of pollution during construction, relatively minor temporary changes in water quality such that ecology is temporarily affected. Equivalent to a temporary minor, but measurable, change within WFD status class Failure of either soluble or sediment-bound pollutants in HAWRAT Calculated risk of pollution from spillages >0.5% annually and <1% annually Measurable change in attribute, but of limited size and/or proportion
		Geomorphology	Minor change in geomorphological conditions i.e. minor changes in sediment transport, minor changes in morphological diversity, or minor interruption to fluvial processes such as channel planform evolution, all with minimal impact on ecological quality. Any changes are likely to be highly localised
		Groundwater	Calculated risk of pollution from spillages >0.5% annually and <1% annually Minor effects on groundwater supported wetlands and water abstractions
Negligible		The Scheme is unlikely to affect the integrity of the water environment	

Magnitude	Criteria	Type	Typical Examples
	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	Surface Water	Negligible risk of pollution during construction, very slight temporary change in water quality with no discernible effect on watercourse ecology No risk identified by HAWRAT (Pass both soluble and sediment-bound pollutants) Risk of pollution from spillages <0.5%
Geomorphology		Negligible change in geomorphological conditions i.e. No discernible changes in sediment patterns, negligible changes in morphological diversity, no change to fluvial processes, all with no discernible impact on ecological quality. Any changes are likely to be highly localised	
Groundwater		No measurable impact upon an aquifer and risk of pollution from spillages <0.5% Negligible groundwater flow changes with no discernible impact on nearby groundwater dependent habitats/abstractions	

17.3.26 The estimation of the significance of effect has been derived by combining the estimated importance of the affected waterbodies and the magnitude of the impacts. Table A4.5 in HD 45/09 provides a significance matrix which has been used to determine significance for this assessment and is represented in Table 17-3.

17.3.27 For the purpose of this assessment temporary or short-term impacts are those which are limited to the construction period.

Table 17-3: Estimating the Significance of Potential Effects (taken from HD 45/09, Table A4.5)

		MAGNITUDE OF IMPACT			
		Negligible	Minor	Moderate	Major
IMPORTANCE OF ATTRIBUTE	Very High	Neutral	Moderate/Large	Large/Very Large	Very Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight/Moderate

17.3.28 Examples of impacts corresponding to the different levels of significance are illustrated in Table A4.6 of HD 45/09. An impact of Moderate, Large or Very Large significance is considered to be 'significant' in terms of the 2009 Regulations.

Water Framework Directive Assessment

17.3.29 A WFD Assessment has been undertaken to assess the Scheme against the key objectives of the WFD. The scope of this assessment has been agreed with the EA. The full assessment is provided in Appendix 17A.

17.4 Baseline Environment

17.4.1 A desk study has been undertaken, which comprises a review of various sources, in order to obtain information relating to the water environment assembled from other studies and designated and non-designated sites. Information sources which have informed the desk study review are:

- Environment Agency 'What's in My Backyard' (WIMBY) Online Mapper;
- Environment Agency 'Catchment Data Explorer' Online Mapper;
- British Geological Survey's Onshore GeoIndex Online Mapper;
- Ordnance Survey Opendata;
- Defra's online GIS portal - <http://www.magic.defra.gov.uk/>;
- Groundsure Report;
- Lake Lothing Third Crossing Geotechnical Feasibility Report, February 2016, SCC; and
- Consultation with Anglian Water.

17.4.2 Site visits have been undertaken to verify the desk study information and water quality sampling has been undertaken.

Designations

17.4.3 There are no water related designations within the study area, however, the Outer Thames Estuary SPA (qualifying feature - non-breeding red-throated divers) and candidate Southern North Sea cSAC (qualifying feature - harbour porpoise) are located approximately 1.3km downstream, within the 2km WFD Protected Areas Search Area.

Rainfall

17.4.4 East Anglia is one of the driest regions in the United Kingdom. The annual average rainfall from 1981 to 2010 from the Met Office weather station at Lowestoft is 619.9mm⁵⁹.

Surface Water

17.4.5 Lake Lothing is a saltwater lake, connected to the North Sea, allowing marine access to the upstream Oulton Broad, via the lock at Mutford Bridge, and the wider Broads National Park area to the west of Lowestoft.

17.4.6 Historically Lake Lothing was an enclosed inland lake, although in more recent times it has been physically adapted to create a link between the North Sea and the harbour of Lowestoft. Where the Scheme crosses Lake Lothing, it spans approximately 100m between the artificial banks existing on either side.

17.4.7 A watercourse known locally as the Kirkley Stream (see Figure 17.1) flows north to converge with Lake Lothing at approximately TM 5398 9269, downstream of the Scheme. This watercourse drains the south of Lowestoft and has an approximate catchment size of 11km². Between Kirkley Fen Park (TM 5373 9207) and the confluence with Lake Lothing, the lower course of this channel is culverted, representing approximately 500m of channel length. It is likely that there are additional, smaller local watercourses also culverted and flowing directly into Lake Lothing, such as that located to the west of the Scheme, which is an open watercourse for a short distance before discharging into the lake. The volume of water being discharged from these watercourses would be very small in comparison to the larger waterbody of Lake Lothing.

17.4.8 Approximately 500m to the west of the Scheme is Leathes Ham which is a small freshwater lake adjacent to Lake Lothing and is part of a Local Nature Reserve. It is assumed that Leathes Ham and Lake Lothing are not hydraulically with flow from Lake Lothing to Leathes Ham as Leathes Ham is reported to be a freshwater body which is located up-gradient of the Scheme. It is therefore not considered further in this assessment.

17.4.9 Whereas Lake Lothing is a heavily modified lake with a tidal regime, Oulton Broad is distinctly different in its composition due to the artificial barrier at Mutford Bridge. Beyond the study area Oulton Dyke links Oulton Broad to the River Waveney located

⁵⁹ Met Office UK Climate

to the west, with a number of smaller channels directly draining the local urban area into Oulton Broad. There is also an extensive network of artificial channels located west of Oulton Broad, draining the areas of White Cast Marshes, Share Marsh and Oulton Marsh. Oulton Broad is not considered further in this assessment due to the barrier at Mutford Bridge

17.4.10 Under the WFD, the EA has determined that Lake Lothing lies within the 'Bure & Waveney & Yare & Lothing' surface water body (GB510503410700), classified as a heavily modified, transitional water body. This estuarine water body is evaluated as having a current overall WFD status of 'Moderate', with this status due to ecological results; and a status of 'Good' for chemical results. Kirkley Stream is unclassified within the RBMP and therefore waterbody data is not available.

Groundwater

17.4.11 Groundwater flow within the study area occurs in the superficial deposits and bedrock. The aquifers in the vicinity of the Scheme are uniform in sensitivity as illustrated in the Groundsure Report in Appendix 12A.

17.4.12 Lake Lothing's floodplain is largely underlain with superficial alluvium deposits, although smaller areas of Happisburgh Glacigenic Formation sands are found locally, set further back from the banks of Lake Lothing. These superficial deposits are classified by the EA as Secondary A aquifers; permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

17.4.13 The bedrock geology is Crag Group, a suite of sands, gravels, silts and clays. The bedrock aquifers are classed as Principal aquifers; having layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. BGS Hydrogeological mapping (1:650k) records the rock as being Neogene to Quaternary rocks (undifferentiated), and the aquifer as being moderately productive with yields of up to 40 l/s. Further information is available in Chapter 12.

17.4.14 Under the WFD, the EA has determined the study area lies within the wider 'Broadland Rivers Chalk & Crag' groundwater body (GB40501G400300), classified as holding a 'Poor' status for both quantitative and chemical classifications based on the 2015 dataset. The main pressures were either from agricultural and rural land management or 'no sector responsible'. Levels of saline intrusion are recorded as 'Good'. This waterbody is linked to protected areas under the Drinking Water Directive and Nitrates Directive. It should be noted that this waterbody is large in extent and covers the Broads in addition to coastal regions.

Groundwater Vulnerability

17.4.15 The aquifer underlying the Scheme is designated as a principal bedrock aquifer with a high vulnerability ('Major Aquifer High' as defined by the EA), however considering the widespread areas of hard standing within the Order limits, rates of existing infiltration are likely to be reduced, and this is taken into account in the assessment.

Groundwater Flow

- 17.4.16** The source of local groundwater recharge is from rainfall. Due to the high permeability of the ground, groundwater recharge in the study area is considered to be relatively high although somewhat reduced by the impermeable surfaces, run-off and evaporation from the urban environment, further to review of aerial imagery.
- 17.4.17** Locally, shallow groundwater flows towards ditches and surface watercourses, acting as groundwater discharge locations. Regional groundwater flow is likely to occur in the deeper bedrock aquifers.

Groundwater Levels

- 17.4.18** Groundwater levels are generally very close to ground surface over much of the Scheme study area.
- 17.4.19** Historic boreholes were identified within the vicinity of the Scheme. Groundwater strikes were measured in 23 boreholes from one geotechnical investigation. The strikes occurred between 1.6m below ground level (bgl) and 10.2m bgl (1.8m above ordnance datum (AOD) and -7.2m AOD). Groundwater rises were generally limited to within 0.5m above the strike depth, with a maximum rise of 0.75m. The recording of the groundwater strike at -7.2m AOD is lower in elevation than the adjacent river level by approximately 7m. This is considered anomalous and not representative of the groundwater profile at the crossing location.
- 17.4.20** The GI undertaken for the benefit of the Piling Risk Assessment, the Geology Soils and Contamination Assessment and to inform the detailed design has similarly identified groundwater between 1.0m and 4.5m bgl.

Abstractions, Private Water Supplies and Discharges

- 17.4.21** A groundwater Source Protection Zone (SPZ) is centred on a large groundwater abstraction located at NGR 652350 294230, 1km north of Lake Lothing (Environment Agency, 2016). The SPZ does not extend as far as the Scheme. This is an active groundwater abstraction used as a source of process water. Within 500m of the Scheme 22 sewage, surface water or trade discharges have been recorded at Lake Lothing and one on Kirkley Stream. These are all shown on Figure 17.1.
- 17.4.22** Waveney District Council has confirmed that they do not hold data for recorded private water supplies within 1.5km of the centre of the Scheme (NGR 653898 292754). No potable water supplies or surface water abstractions have been identified in the study area.

Water Quality

- 17.4.23** No water quality monitoring stations are located within 2km of the Scheme. The WFD classification has a chemical status of 'Good' for Lake Lothing, and all the recorded substances independently also have a status of 'Good' for 2015 data. The importance of Lake Lothing in relation to water quality is therefore considered to be high.
- 17.4.24** To aid the understanding of baseline water quality conditions within the vicinity of the Scheme, four water quality samples were taken from Lake Lothing. The sampling regime was designed to provide an indication of water quality within the Order limits and upstream and downstream of the construction of the Scheme Bascule Bridge.

Table 17-4 details the locations in which water quality sampling was undertaken and these locations are identified on Figure 17.2.

Table 17-4: Water Quality Sample Locations

Monitoring ID	Date Taken	NGR	Description
WS1	19/04/2018	653706 292819	Upstream of Scheme
WS2	19/04/2018	653912 292806	Scheme north
WS3	19/04/2018	653894 292739	Scheme south
WS4	19/04/2018	654094 292727	Downstream of Scheme

17.4.25 Using professional judgement, the determinants were selected to provide measurements of general chemical and physico-chemical quality. The samples were collected from the surface of the lake at a depth of 0.0m to 0.2m, followed by analysis in a laboratory. The results of the sampling and comparison against Environmental Quality Standards (EQS) are presented in Appendix 12B: Interpretive Environmental Ground Investigation Report, Appendix F.

17.4.26 In relation to surface water pollution, attributable to routine highway run-off, the key determinants considered in the DMRB HAWRAT assessment are dissolved copper and dissolved zinc. The coastal EQS for zinc of 6.8 µg/l was exceeded at all sample locations; whereas copper did not exceed the respective EQS of 3.76 µg/l. Consultation with the Environment Agency recommended appropriate annual average concentrations of copper and zinc in a transitional waterbody of 5 µg/l and 40µg/l respectively in water of all levels of hardness. All the tested samples contained concentrations below these thresholds.

Existing Drainage Infrastructure

17.4.27 Anglian Water has been consulted regarding their drainage network plans where the Scheme integrates into the existing drainage network. This information is accommodated within the drainage design as detailed in Chapter 5 and the Drainage Strategy (Appendix 18B).

Geomorphology

17.4.28 The geomorphology of Lake Lothing is heavily modified and, where the Scheme crosses Lake Lothing, there are artificial banks on either side.

Summary of Features and Importance

17.4.29 Table 17-5 summarises the importance of water features identified within the Scheme study area and is based on applicable attributes as defined in Table A4.1, HD 45/09 and criteria set out in Table 17-1.

17.4.30 The biodiversity attributes in this table have been used to inform the WFD Assessment in Appendix 17A and the assessment upon biodiversity is included within that Appendix. The assessment in this chapter focuses on water quality, whilst aquatic ecology is discussed in Chapter 11.

Table 17-5: Importance of water features within the study area

Feature	Attribute	Comment	Importance
Lake Lothing	Water Quality	'Good' WFD chemical status	High
	Dilution and Removal of waste products	<p>Presence of surface water discharges and effluent discharges.</p> <p>Heavily modified channel with potential foul water and sewage discharges.</p> <p>Waterbody has a very large volume and therefore significant capacity for dilution of waste products.</p>	Low
	Biodiversity	<p>'Poor' WFD biological status due to angiosperm data. Otherwise statuses are either 'Good' or 'High' except for dissolved inorganic nitrogen which has a 'Moderate' status.</p> <p>Heavily modified port with maritime traffic.</p>	Medium
	Geomorphology	Heavily modified channel with artificial banks at the Scheme location.	Low
Kirkley Stream	Water Quality	Unclassified in the RBMP scheme, assume the same as Lake Lothing 'Good' WFD chemical status.	High
	Dilution and Removal of waste products	<p>Presence of surface water discharges and effluent discharges.</p> <p>Smaller watercourse with limited capacity for dilution.</p>	Medium
	Biodiversity	Culverted section in the vicinity of the Scheme and downstream section directly influenced by Lake Lothing which has 'Poor' biodiversity status. Potential for higher biodiversity is upstream of the site although there is minimal potential for impacts upstream.	Medium
Groundwater	Water Supply / quality	<p>Underlying geology is classified as a Principal and Secondary A aquifer however the site is not located within a Source Protection Zone. No other abstractions for potable use or otherwise have been identified within 500 m.</p> <p>The Groundwater waterbody has a 'Poor' WFD overall status.</p>	High

Feature	Attribute	Comment	Importance
	Conveyance of flow	Groundwater not anticipated to be providing base flow in the vicinity of the works.	Low
	Biodiversity	No groundwater dependent habitats due to urban environment.	Low

17.5 Predicted Impacts

17.5.1 The following predicted impacts take account of the embedded mitigation set out below with the exception of the assessment of surface water pollution related to routine run-off which follows standard DMRB methodology in assessing the impact in the absence of embedded mitigation.

Embedded Mitigation

17.5.2 Adopting the terminology for embedded mitigation defined in Chapter 6, embedded mitigation with regard to the Road Drainage and the Water Environment assessment comprises the following measures included in the Drainage Strategy (Appendix 18B):

- Provision of vegetated ponds which remove hydrocarbons, soluble metals, sediment and sediment-bound pollutants from road drainage discharges whilst attenuating flow;
- Other flow attenuation systems;
- Lined ponds to prevent historic ground contamination from polluting the water within the ponds;
- Oil interceptors included for all outfalls; and
- Three penstocks to cater for accidental spillage scenarios.

17.5.3 In addition, embedded mitigation includes standard good practice pollution prevention measures in construction. The interim CoCP requires that the Contractor must include within the full CoCP and implement standard good practice pollution prevention measures in construction. This must include, unless not relevant to the Contractor's construction methodology:

- Oil absorbent booms to be installed where necessary and appropriate and to be regularly inspected and maintained;
- Temporary cut-off drains to be used uphill and downhill of the working areas to prevent clean run-off entering and dirty water leaving the working area without appropriate treatment;
- Surface water drains to be protected to prevent the migration of soils/sediment into the drains / water bodies;
- Sediment-laden water generated on site to be appropriately treated before discharge. This will include use of one or more of the following; silt fences, silt traps, filter bunds, settlement ponds and/or proprietary units such as a 'siltbuster';

-
- Provision of temporary barriers (for example a straw bale wall lined with silt fencing; protected surface water drains);
 - Control and treatment measures to be regularly inspected to ensure they are working effectively;
 - Local weather forecasts to be monitored and works scheduled accordingly. In particular earthworks and in-lake works to not be programmed and to be stopped during storm events;
 - Emergency response plans to be developed and spill kits made available on site;
 - Stockpiling, oil storage and refuelling areas to be located at least 10m from watercourses identified in Figure 17.3, and at a greater distance where possible;
 - Fuels and potentially hazardous construction materials to be stored in bunds that have areas with external cut-off drainage; fuel to be stored in double skinned tanks with 110% capacity;
 - Fuelling and lubrication of construction vehicles and plant to generally be on hardstandings, where reasonably practical, with appropriate cut-off drainage and located away from the lake edge. In the event of plant breakdown drip trays to be used during any emergency maintenance and spill kits to be available on site;
 - Construction plant to be checked regularly for oil and fuel leaks;
 - Waste fuels and other fluid contaminants to be collected in suitable containers prior to removal from site to an approved processing facility and treated in accordance with the waste hierarchy;
 - Sewage generated from site welfare facilities to be disposed of appropriately. This may be by discharge to the foul sewer, subject to agreement, or by collection in septic tank for disposal off site; and

Construction: Erosion and Sedimentation Related Pollution

17.5.4 Silt and sediment-laden site run-off generated during construction activities, such as soil stripping and earthworks, can have a detrimental impact if allowed to enter watercourses untreated. Construction within Lake Lothing will mobilise river bed sediments. Fine sediments can increase water turbidity and smother stream beds, affecting water quality and causing harm to fish, aquatic invertebrates and plants by interfering with feeding, respiration and spawning. The effects of sediment release can extend considerable distances downstream and upstream in tidal waterbodies such as Lake Lothing.

17.5.5 The construction of the bridge piers within Lake Lothing (and to a lesser extent the fenders) has the potential to mobilise sediment and historic contaminants. Sediments in the vicinity of the bridge piers have a level of contamination consistent with regularly dredged sediments in Lake Lothing as discussed in Chapter 12. Two cofferdams (see Paragraph 5.6.21) will be used to isolate the pier construction area from the water environment. During installation of these features sediments will be mobilised to a limited extent, as mobilisation will only take place when the cofferdams are being driven in and on a relatively small surface area when compared to the extent of Lake

Lothing. Excavated sediments for the pier construction will be either be transported off-site or disposed of at sea, the latter would be subject to approval by the MMO through the operation of the Deemed Marine Licence (DML). There is no capital dredging associated with the construction of the bridge piers.

- 17.5.6 For the construction of the pontoon capital dredging will be required within a region of Lake Lothing which is not currently subject to maintenance dredging, although it is within the area for which ABP has a licence to dredge. This will mobilise previously undisturbed sediments; the level of contaminants associated with the sediment in the region of the pontoon is consistent with that of regularly dredged sediments. Removed sediment will be disposed of at sea subject to approval by the MMO through the operation of the DML.
- 17.5.7 In addition to construction within Lake Lothing, there is the potential for release of sediments from construction activities adjacent to Lake Lothing and Kirkley Stream via surface water drains.
- 17.5.8 The baseline condition at Lake Lothing is such that it experiences sediment mobilisation on a regular, twice yearly, basis due to the maintenance dredging activities that take place. Chapter 11: Nature Conservation provides detail on aquatic ecology and notes that Lake Lothing contains silty sediments with highly turbid water. This habitat supports an impoverished invertebrate community and low numbers of typical fish species. Other than a solitary eel, no migratory fish species were identified in the survey.
- 17.5.9 Considering the extent of Lake Lothing at this location, current baseline conditions and use of cofferdams, which will reduce the potential for sediment mobilisation, the potential effect on water quality from sediment mobilisation is anticipated to be temporary and of **minor** magnitude. This is considered to be of **slight adverse significance** for Lake Lothing which has **high** importance, due to its being of temporary duration and the existing level of baseline disturbance, high water turbidity and low sensitivity for aquatic ecology.
- 17.5.10 At Kirkley Stream there will be construction works directly above and adjacent to the culverted section of the stream. The works are not proposed to impact on the integrity of the culvert and therefore no direct impacts on this section of the watercourse are anticipated. As this section of Kirkley Stream is enclosed, there is no potential for contamination from overland flow, however there is the potential for discharges from surface water drainage, although embedded mitigation in the form of good practice construction measures secured through the CoCP would limit the potential impact from this. The potential effect on water quality is therefore anticipated to be temporary and of **minor** magnitude and considered to be of **slight adverse significance** for Kirkley Stream which has **high** importance, due to the limited potential for interaction.

Construction: Chemical and Hydrocarbon Pollution

- 17.5.11 Accidental spillages of potential pollutants such as oils, fuels, concrete, cement and sewage from staff welfare facilities can impact both groundwater and surface waters. Oils form a film on the water surface and can coat organisms, blocking respiration, photosynthesis and feeding. Biodegradation of oils in aquatic systems can lead to oxygen depletion; and many hydrocarbons are toxic, persistent and bio-accumulate in

the environment i.e. they build-up in the body tissue both directly and from feeding on other contaminated organisms. Cement in concrete is highly alkaline and can harm aquatic organisms if the pH of the receiving waters is affected.

- 17.5.12** Figure 17.3 illustrates the construction compound locations, development footprint and a 50m zone adjacent to surface waterbodies, which is considered to be best practice for consideration of risks to the waterbody. The risk of construction pollution is highest where the construction activities are taking place within Lake Lothing, adjacent to Lake Lothing and Kirkley Stream or in the vicinity of existing surface water drains. These water bodies are of high importance for water quality.
- 17.5.13** For construction adjacent to and within Lake Lothing and Kirkley Stream (**high** importance) there is the potential for accidental spillage. The magnitude of the effect is closely linked to the hazardous liquid material storage strategy employed at the site and good practice will be employed in terms of staff training, volumes of material stored, appropriate storage containers and refuelling procedures, secured through the interim CoCP and then through the full CoCP. Impacts on water quality are anticipated to be short-term, of **minor** magnitude and therefore considered to be of **slight adverse significance**, due to the good practice measures employed to minimise the likelihood of a spillage occurring, and also manage a spillage should it occur.
- 17.5.14** The potential for pollutants to infiltrate to groundwater aquifers in the event of an accidental spillage is at its highest during construction of earthworks due to the removal of existing hardstanding. As discussed in Paragraph 17.5.13, the magnitude of the effect is linked to the strategy for limiting liquid material storage at the site and good practice will be employed for training, storage and refuelling. Groundwater quality is of **high** importance and the area of the Order limits is urbanised with much of the local surface area comprising hardstanding which will limit infiltration rates. Impacts on groundwater quality are anticipated to be of **minor** magnitude, resulting in an effect of **slight adverse significance** for groundwater quality considering the reduced levels of infiltration and good practice being employed.
- 17.5.15** Piling activities associated with the construction of the bridge piers and pontoon will intrude into groundwater aquifers; which has the potential to create a preferential pathway for contamination if present. The Piling Risk Assessment concluded that the proposed pile design sufficiently mitigates pollution risks and that the risk level is Low or Very Low. Impacts on groundwater quality (**high** importance) are anticipated to be of **minor** magnitude, resulting in an effect of **slight adverse significance** for groundwater quality based on the findings of the Piling Risk Assessment and Chapter 12, which concludes that “*Potential risks to controlled waters are not considered likely to occur*”.

Operation: Surface Water Pollution Related to Routine Run-off

- 17.5.16** A broad range of potential pollutants, such as hydrocarbons i.e. fuel and lubricants, fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on and adjacent to road surfaces. These can subsequently be washed off the road during rainfall events, polluting the receiving waterbodies. Routine run-off from road drainage networks can result in both acute and chronic impacts on water quality and subsequently on the biodiversity of the receiving watercourses, due to both

soluble and sediment-bound pollutants.

17.5.17 All surface water drainage is being directed to the surface waters of Lake Lothing via the drainage proposals and the existing road drainage / sewer network, as described in the Drainage Strategy. Chapter 5 describes the current drainage design features which are also illustrated in Figures 5.3. Key features of the design include the following:

- Retention ponds will be constructed either side of the northern roundabout. Outfall to the existing drainage network will be via a flow control device and a penstock, and then an oil interceptor before formal discharge. The ponds will be lined to prevent historic ground contamination from polluting the water within the ponds. The ponds will offer physical treatment of surface water run-off through sediment settlement and biological treatment due to uptake through vegetation growth;
- A storage tank south of the crossing will collect surface water run-off and will include a catch pit to remove sediment prior to run-off entry into the tank. The water will discharge from the tank to an existing drainage network with appropriate flow control, an oil interceptor and a penstock installed; and
- Three other road drainage discharges to the existing road drainage network are proposed. They will discharge either directly, or via storage within oversized pipes and with flow control devices; the provision of oil interceptors has been included on all three and an additional penstock will be provided on the Riverside Road discharge.

17.5.18 The results of the HAWRAT assessment of surface water pollution from routine run-off are presented in Appendix 17B. The Scheme passed the HAWRAT Step 2 assessment taking into account pollutant concentrations after dilution and dispersion in the receiving watercourse, but without active, embedded mitigation. This follows HAWRAT standard methodology which excludes embedded mitigation at Step 2. Table 17-6 summarises the findings of the HAWRAT assessment for Scenario 2; which assumes that run-off from the entire impermeable area of the Scheme, including the bridge, roundabouts and associated roads, equating to a total of 32,641m² will be directly discharged to Lake Lothing.

Table 17-6: Summary of HAWRAT assessment of pollution risks to Lake Lothing

Input data		Short term pollutant impacts		Long term pollutant impacts	
Q95 (m ³ /s)	Impermeable road area drained (ha)	Acute impact assessment of copper	Acute impact assessment of zinc	Annual average concentration of copper (µg/l) due to road run-off	Annual average concentration of zinc (µg/l) due to road run-off
0.008	Total Network 3.2641	PASS	PASS	0.24	0.62

17.5.19 The HAWRAT assessment concludes that the acute concentration of pollutants generated by the Scheme would meet the acceptability criteria set by the DMRB methodology. Considering that the dilution potential within Lake Lothing will be significantly greater than the assumptions used within the assessment (see Appendix

17B), particularly due to tidal movement, the HAWRAT assessment concludes that the Scheme will not pose unacceptable short term pollution risks to the waterbody even without embedded mitigation.

17.5.20 The assessment of long term pollution impacts to the receiving water environment considers the annual average pollutant concentrations associated with the Scheme against the EQS that inform the WFD. As Lake Lothing is a transitional water body, the EQS values for dissolved copper and dissolved zinc are not strictly applicable. Consultation with the Environment Agency recommended appropriate annual average concentrations of copper and zinc in a transitional waterbody of 5 µg/l and 40µg/l, respectively, for all water hardness categories. The results of the HAWRAT assessment indicate annual average concentrations of copper and zinc at 0.24 µg/l and 0.62µg/l, respectively, for the Scheme as a whole, which are well below these threshold values. As the dilution potential within Lake Lothing will be significantly greater than the assumptions presented in Appendix 17B that were used within the assessment, the HAWRAT assessment indicates that the Scheme will not pose unacceptable long term pollution risk to the waterbody.

17.5.21 HAWRAT provides an assessment of sediment deposition associated with runoff from the road network. The results for the selected assessment parameters indicate that that there could be settlement of sediments in Lake Lothing as a result of the low flow velocity, but suggest that this is not extensive. As the navigation channel of the harbour is regularly dredged, the potential increase in sediment associated with the Scheme is not considered to result in a significant effect. The sediment influx to Lake Lothing is considered negligible in comparison to the baseline movements in this tidal waterbody and therefore it has not been included within the sediment transport model.

17.5.22 The Scheme passes the HAWRAT assessment in the absence of embedded mitigation; this equates to a **negligible** magnitude impact, and **neutral significance** for the potential for detrimental impacts on water quality from routine run-off. The design however does have embedded mitigation which would further reduce the level of pollutants entering the waterbody including sustainable drainage systems (SUDS) and treatment measures as discussed above and set out in the Drainage Strategy, notably ponds with flow control devices, oil interceptors on all outfalls and a sediment catch pit.

17.5.23 Direct impacts on water quality have the potential to have indirect effects on human health where the water is consumed or used for primary recreational purposes. As no surface or ground water abstractions for potable use have been identified within the study area, and recreational activities are non-contact (secondary) activities, detrimental impacts on human health are not considered likely.

Operation: Pollution Related to Accidental Spillages

17.5.24 On all operational roads there is a risk that road traffic accidents or vehicle fires may result in accidental spillage of potential pollutants on the road surface. These may then enter the road drainage network and subsequently be discharged to the water environment, causing an acute pollution event.

17.5.25 The results of the assessment of pollution from accidental spillage are presented in Appendix 17B, and a summary of the findings are provided in Paragraphs 17.5.26 to

17.5.29.

17.5.26 The DMRB recommends that an annual probability of a serious pollution incident occurring of less than 1% would be acceptable. The results of the assessment indicate an annual probability of 0.04%, which is well below this threshold and is prior to the inclusion of embedded mitigation which would further reduce the probability of a harmful event.

17.5.27 All surface water run-off from the Scheme will pass through an oil interceptor prior to discharge to the Anglian Water sewer network. Penstocks will be used where discharge from the Anglian Water network is in close proximity to Lake Lothing – particularly for the known outfall immediately to the south of the Scheme Bascule Bridge. Discharge on the northern side of Lake Lothing will also pass through a vegetated pond prior to discharge.

17.5.28 With the embedded mitigation taken into account, this reduces the risk of spillage by 50% and, in accordance with Table 8.1 of DMRB Volume 11, Part 10, Section 3 (Highways Agency, 2009), the annual probability of a serious pollution incident reduces to 0.02%. The impact on Lake Lothing is therefore of **negligible** magnitude and **neutral significance**.

17.5.29 As there are no drainage discharges to groundwater from the Scheme, nor any infiltration as part of the surface water drainage system, the risks to groundwater from accidental spillage are considered to be of **negligible** magnitude and **neutral significance**, on the basis that the spillage would be contained by the surface water drainage system.

Construction and Operation: Hydromorphological Changes

17.5.30 Channel modifications such as the construction of in-channel structures can result in changes to the geomorphological regime, such as erosion, deposition, channel migration and mobilisation of contaminants. A reduction in morphological diversity can subsequently impact on water quality and biodiversity.

17.5.31 The presence of two new piers in Lake Lothing, the pontoon, and to a lesser extent the fenders, will locally impact currents, however, the Sediment Transport Assessment (Appendix 17C) shows that there is a negligible change in the overall flow of sediment around Lake Lothing during the operational phase of the Scheme, and also beyond to the adjacent coast. Additionally, the harbour is heavily modified and is subject to a regular dredging regime for the navigation channel; approximately twice a year.

17.5.32 There will also be temporary structures on the bed of Lake Lothing during the construction phase associated with the temporary piers and cofferdams. The Sediment Transport Assessment reports that, due to the temporary, short term nature of the construction phase, effects would be negligible

17.5.33 Access to the new pontoon will be maintained through the use of maintenance dredging, which will be subject to the operation of the DML.

17.5.34 Considering the results of the Sediment Transport Assessment (Appendix 17C), the magnitude of the impact on the geomorphology of Lake Lothing would be **negligible**. As the water body is heavily modified it has a **low** importance resulting in a potential

significance of **neutral**.

Operation: Subsurface flows

17.5.35 It is likely that piles associated with the bridge piers will extend within the groundwater body. This may locally affect sub-surface flows within the aquifer. The piles are discrete intrusions, rather than a block foundation, which would have a reduced impact on the groundwater flows, water levels, and available yield. Additionally, there are no identified groundwater abstractions down hydraulic-gradient of the Scheme with the potential to be influenced by localised changes to groundwater flows. The magnitude of effect on sub-surface flows is therefore considered to be **negligible**, resulting in an impact of **neutral significance** on availability of groundwater to known abstractions.

Water Framework Directive Assessment

17.5.36 A WFD assessment is provided in Appendix 17A which comprises WFD Assessment data sheets for surface and groundwater bodies and a WFD Scoping sheet for activities in estuarine and coastal waters. The EA has commented on the WFD scoping and its comments have been incorporated into the WFD Scoping sheet included in Appendix 17A.

17.5.37 With the application of standard good practice and appropriate mitigation measures as secured through the Drainage Strategy and the interim CoCP, the assessment of the Scheme concludes that there is a high level of confidence that the following four key objectives of the WFD will not be adversely impacted by the Scheme:

1. To prevent deterioration in the ecological status of the water body;
2. To prevent the introduction of impediments to the attainment of Good WFD status for the water body;
3. To ensure that the attainment of the WFD objectives for the water body are not compromised; and
4. To ensure the achievement of the WFD objectives in other water bodies within the same catchment are not permanently excluded or compromised.

17.6 Mitigation

Further Mitigation (Construction Phase)

17.6.1 Mitigation beyond the embedded design commitments described above is outlined here and included in the interim Code of Construction Practice (CoCP) which accompanies this ES in Appendix 5A.

17.6.2 The installation of the cofferdams (see Figure 5.6 and Paragraph 5.6.21), and piles for the pontoon will mobilise sediments to a limited extent. Measures such as the use of a silt curtain will be implemented for the cofferdam installation periods to trap sediments. To reduce sediment input into the waterbody when seawater is removed from the cofferdam area, sediment filter systems will be required to be used to filter the pumped water, for example using proprietary units such as a 'siltbuster'; the precise method will be designed by the Contractor during the detailed design. The sediment will then be removed and evaluated for contamination prior to being either transported off-site or disposed of at sea as discussed above. The filter system will have screens/'fish friendly' pumps to prevent fish entering the pumped system; alternatively

an electrofishing exercise could be undertaken. Fish remaining within the cofferdam area will be isolated and returned to Lake Lothing. Chapter 11: Nature Conservation of this ES states that Lake Lothing contains silty sediments with highly turbid water, which support low numbers of typical fish species. Other than eel, no migratory fish species were shown to be present.

- 17.6.3** A programme of adaptive water quality monitoring on Lake Lothing, upstream and downstream of the working corridor, will be implemented throughout the construction phase, beginning at least 6 months prior to construction, in order to ascertain the impacts, if any, of construction on the Scheme. The monitoring parameters, frequency and locations will be agreed with the EA prior to construction works commencing.

Operational Management and Monitoring

- 17.6.4** Other permits will be sought under other regimes notably the Environmental Permitting Regulations for the ongoing operation and maintenance of the drainage systems and protection measures therein as is also discussed in the Consents and Agreements Position Statement (document reference 7.7).

17.7 Residual Effects and Conclusions

- 17.7.1** Table 17-7 summarises the findings of the assessment of potential significant impacts and resulting significance of effects from the construction and operation of the Scheme. The impact significance has been derived by combining the importance of the affected waterbodies and the magnitude of the impacts, taking into account mitigation in line with the guidance provided in HD 45/09 Table A4.5. The importance has been derived from the attributes affected by the potential impact; only attributes affected by the potential impact are included.
- 17.7.2** In some cases the significance shown in Table 17-3 is shown as being one of two alternatives. In these cases a single description of significance has been adopted based upon a reasoned professional judgement taking account of guidance provided in HD 45/09 Table A4.6 (qualifying conditions relating to the levels of significance).
- 17.7.3** None of the residual impacts are considered to be significant.

Table 17-7: Summary of Residual Effects

Potential Impact	Feature / Sensitive Receptor	Attribute	Importance	Potential Effect Pre-mitigation		Mitigation Examples (full detail in Section 17.6)	Residual Effect	
				Magnitude	Significance		Magnitude	Significance
Construction: Erosion and sedimentation related pollution Increased risk of sedimentation / mobilisation of contamination during construction	Lake Lothing	Water quality	High	Minor	Slight Adverse	Sediment traps including use of a silt curtain, filter systems ('fish friendly') for pumped water, cut-off drains and treatment of sediment laden water. Protection of surface water drains. Monitoring programme implemented	Minor	Slight Adverse
	Kirkley Stream	Water quality	High	Minor	Slight Adverse	Treatment of sediment laden water and protection of surface water drains.	Negligible	Neutral
Construction: Chemical and hydrocarbon pollution Construction: Increased risk of accidental spillage of pollutants such as oil, fuel and concrete during construction	Lake Lothing & Kirkley Stream	Water quality	High	Minor	Slight Adverse	None required	Minor	Slight Adverse
	Groundwater	Water quality / water supply	High	Minor	Slight Adverse	None required	Minor	Slight Adverse
Construction: Chemical and hydrocarbon pollution Contamination of groundwater by piling	Groundwater	Water quality / water supply	High	Minor	Slight Adverse	None required	Minor	Slight Adverse
Operation: Surface water pollution related to routine run-off	Lake Lothing	Water quality	High	Negligible	Neutral	None required	Negligible	Neutral

Potential Impact	Feature / Sensitive Receptor	Attribute	Importance	Potential Effect Pre-mitigation		Mitigation Examples (full detail in Section 17.6)	Residual Effect	
				Magnitude	Significance		Magnitude	Significance
Operation: Pollution related to accidental spillage	Lake Lothing	Water quality	High	Negligible	Neutral	None required	Negligible	Neutral
	Groundwater	Water quality / water supply	High	Negligible	Neutral	None required	Negligible	Neutral
Construction and Operation: Hydromorphological changes Changes in geomorphological regime such as erosion, deposition and channel migration due to in-channel constructions	Lake Lothing	Geomorphology	Low	Negligible	Neutral	None required	Negligible	Neutral
Operational: Subsurface flows Changes in groundwater flows due to the presence of piles for the bridge piers and pontoon.	Groundwater	Water supply	High	Negligible	Neutral	None required	Negligible	Neutral

18 Flood Risk

18.1 Scope of the Assessments

Introduction

18.1.1 This chapter addresses the likely significant effects of the Scheme on flooding and is supported by a Flood Risk Assessment (FRA) (Appendix 18A), the Drainage Strategy (Appendix 18B) and Figures 18.1 to 18.2.

18.1.2 The assessment has focused upon the assessment of flooding on both the Scheme and the surrounding area as a consequence of the Scheme. Full details of the assessment undertaken can be found in the FRA in Appendix 18A.

Study area

18.1.3 The study area for the assessment encompasses a large part of Lowestoft and is centred on Lake Lothing. Oulton Broad is at the western extent of the study area, the eastern extent is the North Sea immediately outside of the outer harbour at Lowestoft. The study area extends as far as Corton in the north and Kirkley in the south and is shown in Figure 2.1 of the FRA in Appendix 18A.

18.1.4 The study area has been agreed with the EA through a review of the model files (see Paragraph 18.3.4) pre-submission of the application.

18.2 Directives, Regulations and Relevant Policy

Directives

Floods Directive (2007/60/EC)

18.2.1 The Floods Directive makes provision for the assessment of flood risk, mapping its potential impact and planning measures to reduce potential and significant flood risk.

Regulations

18.2.2 The objectives of the Floods Directive discussed above that are relevant to this assessment are met through the following UK legislation:

- Highways Act 1980;
- The Water Resources Act 1991 as amended;
- Land Drainage Act 1994;
- Environment Act 1995;
- The Water Act 2003 as amended;
- Flood Risk Regulations (2009);
- The Environmental Permitting (England and Wales) Regulations 2016; and
- The Flood and Water Management Act 2010

18.2.3 Under the various acts and regulations listed above, consents and permits may be required from the Environment Agency, as discussed in the Consents and Agreements

Position Statement (document reference 7.7). From a flood risk perspective, the DCO includes a disapplication for the need for a flood risk activity permit; but the Environment Agency retains the ability to control the works through the Protective Provisions for their benefit included within the DCO.

National Planning Policy

- 18.2.4 The Scheme has been defined as a Nationally Significant Infrastructure Project (NSIP) (see Paragraph 1.2.1) and it has been agreed with the Environment Agency (EA) that it is 'safety critical infrastructure' for the purposes of paragraph 4.4.1 of the National Networks National Policy Statement (NNNPS).
- 18.2.5 The NNNPS recognises that as a result of climate change, the risk of flooding will increase within the lifetime of NSIPs. The NNNPS states that the FRA should be carried out with reference to the guidance from the National Planning Policy Framework (NPPF) and accompanying Planning Practice Guidance (PPG) document. The NPS for Ports (PNPS) provides guidance for assessing flood risk associated with development in ports and acknowledges that whilst development within ports is 'water-compatible' and therefore is permitted in high flood risk areas, it is still necessary to undertake a FRA in line with the NPPF.
- 18.2.6 In Paragraph 5.98 of the NNNPS it states: "Where flood risk is a factor in determining an application for development consent, the Secretary of State should be satisfied that, where relevant:
- *the application is supported by an appropriate FRA;*
 - *the Sequential Test (see the National Planning Policy Framework) has been applied as part of site selection and, if required, the Exception Test (see the National Planning Policy Framework)."*
- 18.2.7 The NNNPS requires applicants to provide sufficient evidence for the SoS to undertake the sequential and exception test. As shown on Figure 18.1 the Scheme lies within Flood Zone 2 and Flood Zone 3 which extends beyond the Order limits to the north and south of Lake Lothing and therefore it is not possible to avoid encroaching into Flood Zone 3 when delivering a third crossing across Lake Lothing and the sequential test is therefore deemed to have been passed. The Applicant therefore needs to apply the exception test.
- 18.2.8 The Paragraphs 99 to 108 of the NPPF outline the development requirements in terms of flood risk and the impact of climate change. The UK Government's Department for Communities and Local Government PPG ID7 (March 2014) for Flood Risk and Coastal Change provides additional guidance in the implementation of the NPPF in relation to development and flood risk.
- 18.2.9 NPPF requires developments to be "safe, without increasing flood risk elsewhere" and, where possible to "reduce flood risk overall". Priority is given to the use of Sustainable Drainage Systems (SuDS) within the NPPF.

Guidance

18.2.10 The following guidance documents have also been taken into account:

- Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 HD 45/09;

and

- CIRIA Report 753 SuDS Manual.

18.3 Methods of Assessment

Baseline Data Collection

18.3.1 Baseline data relating to flooding has involved the collation of the following:

- Collation and analysis of available data on flood risk;
- OS Mastermap covering Lowestoft;
- Bathymetric survey of Lake Lothing and the outer harbour (collected spring 2016);
- 0.5m resolution LiDAR flown in 2015;
- Environment Agency Extreme Sea Levels;
- Daily average water level data recorded in Lake Lothing and Oulton Broad (provided by the EA);
- Topographic data on the north and south quay of Lake Lothing (collected spring 2017 and summer 2016 respectively);
- Scheme design (see Chapter 5) ;
- As built construction drawings for the A47 Bascule Bridge and Mutford Bridge;
- Lowestoft tidal barrier - outer harbour water level modelling investigation⁶⁰;
- Lowestoft Tidal Defences Additional Modelling Studies⁶¹; and
- Lowestoft Flood Risk Management Strategy⁶².

18.3.2 The following documents have also been used to gather information for this assessment:

- Suffolk Coastal and Waveney District Strategic Flood Risk Assessment (SFRA), February 2008;
- Broadland Rivers Catchment Flood Management Plan (CFMP), December 2009;
- Suffolk Shoreline Management Plan 2 (SMP2) - Sub-cell 3c, January 2010;
- Suffolk Preliminary Flood Risk Assessment (PFRA), June 2011;
- Suffolk Flood Risk Management Strategy (FRMS), March 2016;
- Flood Risk Management Strategy Overview, March 2016;
- EA data and web based mapping; and

⁶⁰ Lowestoft tidal barrier - outer harbour water level modelling investigation – CH2M Hill 2016

⁶¹ Lowestoft Tidal Defences Additional Modelling Studies – CH2M Hill 2014

⁶² Lowestoft Flood Risk Management Strategy – CH2M Hill 2016

- Lowestoft Cumulative Land Raising Study, June 2008.

Flood risk assessment

18.3.3 A FRA was prepared with the following objectives:

- Considers the sequential and exception test in the context of the Scheme;
- Assess the risk to the Scheme from all potential sources of flooding (both during construction and operation);
- Establish the future flood risk to the Scheme;
- Assess the potential impacts of the Scheme on flood risk elsewhere (both during construction and operation);
- Determine appropriate mitigation measures to manage flooding issues during operation in a sustainable way; and
- Link to the drainage strategy for the Scheme that will address how any additional surface water runoff generated by the Scheme will be managed.

18.3.4 The main source of flooding to the Scheme is tidal, but other sources of flooding have been considered in the FRA. . An existing 1D-2D hydraulic model of Lake Lothing and the outer harbour plus part of Oulton Broad (developed by CH2M Hill as part of the Lowestoft Tidal Barrier project in 2014) was obtained for use in this assessment. The existing model was reviewed and it was deemed appropriate to develop a new 2D only model of Lake Lothing and the outer harbour for the purposes of the FRA.

18.3.5 The focus of this FRA is the local hydraulic effects of the Scheme, therefore there is a need to use the most recent and accurate data, particularly close to the Scheme site. The CH2M Hill model was developed for a different purpose and is still valid but it has been necessary to refine and incorporate more detail into the model to determine the impacts of the Scheme on the hydraulics within Lake Lothing.

18.3.6 A suite of sensitivity tests has been undertaken to determine the impact of a variety of parameters on the model results, including the roughness values representing land use within the model, fluvial inflows and tidal levels.

18.3.7 The model has been used to investigate three scenarios in the assessment of flooding:

- Baseline – to establish the existing flood risk to the existing area of the Scheme and Lowestoft as a whole;
- Construction phase – to establish the impacts of placing cofferdams within Lake Lothing on flooding elsewhere; and
- Scheme – to establish the impact of the Scheme during the operational phase on flooding elsewhere.

18.3.8 The water levels predicted by the model for the Scheme scenario have been compared to the predicted water levels for the baseline scenario, which will determine the impact of the Scheme on flood levels in Lowestoft.

18.3.9 Three flood return periods have been investigated using the flood model developed for

this assessment; these are:

- the 5% Annual Exceedance Probability (AEP) event;
- the 0.5% AEP event (tidal Flood Zone 3); and
- the 0.1% AEP event (tidal Flood Zone 2).

- 18.3.10** Model runs have been undertaken for each return period with and without climate change allowances applied to determine the present day (2017) flood risk in Lowestoft and predicted future flood risk. As the development is a NSIP the impact of, and resilience to, future flooding has been considered and mitigation against future flood risk elsewhere has been recommended as necessary. Climate change allowances have been applied based on the NN NPS. As the development is safety-critical, the UK Climate Projections (UKCP09) high emissions scenario for the 2080s at the 50% probability level will be used to inform the design and mitigation of the development, as agreed with the EA (FRA Appendix 18A).
- 18.3.11** The Scheme design has been assessed against the H++ estimates (high risk, low probability) for sea level rise to assess a credible maximum scenario. The EA have agreed that they do not expect the design or mitigation to be provided to this level but the development should be assessed against this scenario to understand the full picture of risk.
- 18.3.12** The need for flood mitigation is dependent on the magnitude of impact and the vulnerability of the receptor(s) that are affected by any increase in flood depth. Table 18-1 shows how a given increase in flood depth from the baseline scenario to the Scheme scenario will be classified in terms of impact.
- 18.3.13** The EA commented at scoping (ES Appendix 6B) that wave overtopping should also be considered within the model developed to assess flood risk as part of the FRA. Wave overtopping from the open coast has been considered but it was judged not to be critical in this assessment as the main flood risk to Lowestoft is tidal inundation.
- 18.3.14** This is due to the Scheme being approximately 1km from the coastal boundary, therefore wave overtopping will not have an impact on the development because at water levels below the coastal defences, the arrangement of the harbour entrance prevents significant transmission of waves into Lake Lothing. Should the defences be overtopped, wave action would have less of an impact as the sea water level will already be above the height of the defences. Wave overtopping has been judged as a small residual uncertainty and sensitivity testing of the tidal boundary (as identified in the Hydraulic Modelling Report, which is included in Annex B to the FRA) has shown that the peak tidal level has the greatest impact on the maximum flood levels predicted for each return period event - this would certainly have a greater impact on flood levels within Lowestoft close to the Scheme than wave overtopping. Following further liaison on this point the EA have accepted that wave overtopping does not need to be included in the FRA (Appendix 18A).
- 18.3.15** Table 18-2 compares the magnitude of impact with the flood risk vulnerability of receptors (taken from Table 2 within the NPPF PPG for flood risk and coastal change) to demonstrate when mitigation is required. The tables are valid up to and including the 0.5% AEP plus climate change event as the Scheme has to be designed and

mitigated up to this level in line with current Government guidance. The 0.1% AEP event has been considered separately in this assessment to provide a picture of the range of flood risk to Lowestoft with the Scheme in place. Although Table 18-2 is used as a guide to determine when mitigation is required; the need for mitigation is also determined using professional judgement based on the practicalities of what can be provided and how much benefit this will provide.

Table 18-1 – Classification of magnitude of Flooding Impact

Magnitude of Impact	Change in depth (m)
No change	0
Negligible	>0.0 – <=0.02
Moderate	>0.02 – <=0.3
Major	0.3+ <u>OR</u> Flooding in areas that were previously not flooding.

Table 18-2 – Significance of flood impact

Magnitude of Impact	Receptor Sensitivity				
	Water Compatible	Less Vulnerable	More Vulnerable	Highly Vulnerable	Essential infrastructure
No change	No Mitigation required	No Mitigation required	No Mitigation required	No Mitigation required	No Mitigation required
Negligible	No Mitigation required	No Mitigation required	No Mitigation required	Mitigation	Mitigation
Moderate	No Mitigation required	Mitigation	Mitigation	Mitigation	Mitigation
Major	No Mitigation required	Mitigation	Mitigation	Mitigation	Mitigation

18.4 Baseline Environment

18.4.1 The Scheme lies predominantly within floodplain cited as Flood Zone 3 (defined as land having a 1 in 100 or greater annual probability of river flooding (1%) or land having a 1 in 200 or greater annual probability of sea flooding (0.5%)), with this typically adjacent and relatively close to the banks of Lake Lothing and Oulton Broad, plus the area where Kirkley Stream is culverted. Flood Zone 3 is the highest risk zone defined by the EA.

18.4.2 Additional areas of land classified as being within Flood Zone 2 are also within the study area (defined as land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%) or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%)), primarily for the connection at Riverside Road, where the route connects into the existing road network.

-
- 18.4.3 Figure 18.1 shows the areas of Flood Zone 3 and 2 relative to the Scheme location.
- 18.4.4 The EA Flood Map for planning does not show any defences in Lowestoft. The quay walls of Lake Lothing are classified as informal defences and are generally at the same level as the ground behind them. The Lowestoft Flood Risk Management Strategy is ongoing, the aim of which is to reduce flood risk within Lowestoft by providing additional defences. The strategy may involve the construction of a tidal barrier across Lake Lothing, as discussed in Chapter 20. As the flood risk management strategy has not been implemented yet, potential future defences in Lowestoft have not been included in this assessment in order to represent the existing situation within Lowestoft. It may be that in future, the overall flood risk to Lowestoft is reduced based on the works undertaken as part of the Lowestoft Flood Risk Management Strategy.
- 18.4.5 The likely evolution of the baseline environment has been considered in this assessment by assessing the influence of climate change on flood risk within Lowestoft.
- 18.4.6 The EA Risk of Flooding from Surface Water Map was consulted to determine the baseline level of surface water flood risk at the Scheme site. To the south of Lake Lothing, there is minimal surface water flood risk and the majority of surface water flooding shown is classified as 'low' risk which means that in each year there is between a 0.1% and 1% chance of flooding occurring. There are two small areas where the risk of surface water flooding is classified as 'high' (each year this area has a greater than 3.3% chance of flooding) to the south of Lake Lothing; along a small reach of Durban Road near to the junction with Waveney Drive and along a short stretch of the A12 south west of the roundabout adjacent to Kirkley Ham. To the north of Lake Lothing a 'medium' surface water flood risk (each year this area has a chance of flooding between 1% and 3.33%) is shown along the East Suffolk railway line. The area between the East Suffolk railway line and Denmark Road is shown to be at 'high' risk of surface water flooding. Based on the information available the overall flood risk from surface water runoff to the Scheme is assessed as being high.
- 18.4.7 Flood risk from sewers within the Scheme boundary has been investigated and there are no recorded sewer flooding events in close proximity of the Scheme. The flood risk from existing sewers can be considered to be low based on the information available.
- 18.4.8 In relation to groundwater, the Scheme is located entirely in an area defined as 'Major Aquifer High' on the EA Groundwater Vulnerability Zones map. There are no historical records of groundwater flooding reported in the SFRA within the Scheme boundary. The site is predominantly an urban area with approximately 91% existing impermeable surface. Based on the available information, the flood risk from groundwater is considered to be low.
- 18.4.9 In respect of artificial sources, the Scheme is not located within the maximum extent area of any nearby reservoirs as shown on the EA web based mapping. The Scheme is not within an Internal Drainage Board (IDB) area and there are no pumping stations or canals nearby that have an impact on the Scheme. Based on the available information, the flood risk from artificial sources is considered to be low.

18.5 Predicted Impacts

Operational Phase

18.5.1 The FRA (Appendix 18A) predicts the impacts on tidal flood risk and surface water runoff of the Scheme. The major source of flood risk to the Scheme is tidal and this is the focus of the assessment but the impact of the Scheme on surface water runoff has also been considered as discussed below. Table 18-3, Table 18-4 and Table 18-5 show the tidal model results for the present day (2017), climate change (2117) and H++ scenarios respectively at a number of locations (P1 to P16) within Lake Lothing with these locations shown in Figure 18.2.

Present Day - 2017

18.5.2 The results in Table 18-3 show that within Lake Lothing the Scheme has a negligible impact on peak water levels for the present day scenario. There is no change in water levels predicted within Lake Lothing during the operational phase of the Scheme during the 5% AEP present day event. For the 0.5% AEP present day event, no increase in water levels within Lake Lothing is predicted and there is a negligible decrease in water levels predicted to the west of the Scheme. During the 0.1% AEP event, there is a negligible increase, as defined in Table 18-1 (up to 0.01m) in water levels on the eastern side of the Scheme Bascule Bridge and a moderate decrease in water levels on the western side (up to 0.03m). The increase in predicted water levels within Lake Lothing as a result of the Scheme can be attributed to afflux (a rise in water level on the upstream side of a bridge due to the constriction caused by the bridge structure) at the Scheme Bascule Bridge rather than the displacement of water by the bascule bridge piers in the channel.

Table 18-3 – Model results for the present day (2017) scenario

Present Day Point	Baseline (mAOD)			Difference (Scheme – Baseline (m))		
	5%	0.5%	0.1%	5%	0.5%	0.1%
P1	2.74	3.39	3.91	0.00	0.00	0.00
P2	2.74	3.39	3.90	0.00	0.00	0.00
P3	2.74	3.39	3.91	0.00	0.00	0.01
P4	2.74	3.39	3.91	0.00	0.00	0.00
P5	2.73	3.35	3.82	0.00	0.00	0.01
P6	2.73	3.33	3.77	0.00	0.00	0.00
P7	2.74	3.34	3.76	0.00	0.00	0.01
P8	2.74	3.34	3.76	0.00	0.00	0.01
P9	2.74	3.34	3.76	0.00	0.00	0.01
P10	2.74	3.34	3.76	0.00	0.00	0.01
P11	2.74	3.34	3.76	0.00	-0.02	-0.03
P12	2.74	3.34	3.76	0.00	-0.02	-0.03
P13	2.74	3.34	3.76	0.00	-0.02	-0.02
P14	2.74	3.34	3.76	0.00	-0.02	-0.03
P15	2.74	3.32	3.73	0.00	-0.02	-0.03

Present Day	Baseline (mAOD)			Difference (Scheme – Baseline (m))		
Point	5%	0.5%	0.1%	5%	0.5%	0.1%
P16	2.73	3.28	3.63	0.00	-0.02	-0.03

18.5.3 The impact of the Scheme on water levels on the floodplain has also been considered. For the 5% AEP present day event, there is no change in flood levels on the floodplain between the baseline and Scheme scenarios. For the 0.5% AEP present day event a negligible increase in water level (up to 0.01m) compared to the baseline is predicted on the floodplain to the east of the Scheme and there is a moderate decrease in water levels of up to 0.06m to the west of the Scheme. During the 0.1% AEP present day a negligible increase of up to 0.02m is predicted across the floodplain on the eastern side of the Scheme. There is a small area within the model results for this event where a moderate increase of 0.06m is predicted in the Scheme scenario compared to the baseline but this covers a small number of cells within the model and corresponds with a low point in the LiDAR within the carpark of Asda and Dunelm near the A12. There is no increase in flood extent predicted as a result of the Scheme for any of the scenarios modelled.

18.5.4 The bascule bridge deck of the Scheme is not predicted to flood during any of the present day scenarios modelled but flooding is predicted to other parts of the Scheme. The depth of flooding predicted on the approach roads to the Scheme Bascule Bridge has been considered to give an indication of the safety and operability of the new crossing during flood events. Negligible flooding is predicted to the approach roads to the Scheme Bascule Bridge during the 5% AEP present day scenario. During the 0.5% AEP present day event, flood depths of up to 0.93m are predicted on the northern approach road to the Scheme Bascule Bridge (a moderate reduction of 0.02m compared to the baseline scenario) and depths up to 0.13m are predicted on the southern approach road (same depth as predicted in the baseline scenario). During the 0.1% AEP present day event, flood depths of up to 1.35m are predicted on the northern approach road to the Scheme Bascule Bridge (a moderate reduction of 0.02m compared to the baseline scenario) and depths up to 0.56m are predicted on the southern approach road (same depth as predicted in the baseline scenario).

Climate Change 2140

18.5.5 Table 18-4 shows the peak water levels predicted by the model in the baseline and Scheme scenarios at the comparison points within Lake Lothing for the climate change events modelled. For both the 5% and 0.5% AEP climate change events, there is a negligible increase (up to 0.02m) in water levels predicted within Lake Lothing with the Scheme in place on the eastern side of the Scheme Bascule Bridge. A moderate decrease in water levels within Lake Lothing is predicted to the west of the Scheme for both the 5% and 0.5% AEP climate change events. The Scheme has a greater impact during the climate change events due to the higher tidal levels for these events compared to the present day events. The tidal levels during all of the climate change events are high enough for a small head loss to be generated across the bridge in the Scheme model. There is no increase in flood extent predicted as a result of the Scheme for any of the climate change scenarios modelled.

Table 18-4 – Model results for the climate change (2117) scenario

Climate Change Point	Baseline (mAOD)			Difference (Scheme – Baseline (m))		
	5%	0.5%	0.1%	5%	0.5%	0.1%
P1	4.27	4.93	5.45	0.00	0.00	0.00
P2	4.26	4.92	5.44	0.00	0.00	0.00
P3	4.27	4.93	5.45	0.00	0.00	0.00
P4	4.27	4.93	5.46	0.00	0.00	0.00
P5	4.16	4.75	5.25	0.01	0.01	0.01
P6	4.05	4.63	5.11	0.01	0.01	0.02
P7	4.03	4.56	5.01	0.01	0.02	0.02
P8	4.03	4.57	5.01	0.02	0.02	0.04
P9	4.03	4.57	5.01	0.01	0.02	0.03
P10	4.03	4.58	5.01	0.02	0.02	0.04
P11	4.03	4.57	5.01	-0.03	-0.04	-0.04
P12	4.03	4.58	5.01	-0.03	-0.04	-0.05
P13	4.03	4.57	5.01	-0.03	-0.04	-0.04
P14	4.03	4.57	5.01	-0.04	-0.06	-0.07
P15	3.99	4.52	4.95	-0.04	-0.05	-0.07
P16	3.84	4.27	4.58	-0.03	-0.04	-0.05

18.5.6 For the 5% AEP climate change event, water levels on the floodplain to the east of the Scheme are predicted to increase by up to 0.02m (negligible) in the Scheme scenario compared to the baseline scenario. To the west of the Scheme, decreases of up to 0.04m (moderate) are predicted compared to the baseline scenario. In the 0.5% AEP climate change event floodplain water levels are predicted to increase by up to 0.02m (negligible) to the east of the Scheme above the baseline scenario and water levels are predicted to decrease by up to 0.06m (moderate) to the west of the Scheme. The 0.1% AEP plus climate change events shows water level increases of up to 0.05m (moderate) on the floodplain in the Scheme scenario. Predicted water levels to the west of the Scheme decrease by up to 0.08m (moderate) during the 0.1% AEP Scheme scenario.

18.5.7 The bascule bridge deck of the Scheme is not predicted to flood during any of the climate change scenarios modelled but other parts of the Scheme are predicted to be at flood risk. The depth of flooding predicted on the approach roads to the Scheme Bascule Bridge has been considered to give an indication of the safety and operability of the new crossing during the climate change flood events. The depth of flooding predicted on the northern approach road during the 5% AEP climate change event is 1.61m (a moderate reduction of 0.03m compared to the baseline scenario) and a depth of 0.83m (a negligible increase of 0.01m compared to the baseline scenario) is predicted on the southern approach road. During the 0.5% AEP climate change event, the depth of flooding predicted on the northern approach road is 2.15m (a moderate

reduction of 0.04m compared to the baseline scenario) and on the southern approach road it is 1.36m (no change from the baseline scenario). The predicted flood depth during the 0.1% AEP climate change event on the northern approach road is 2.57m (a moderate reduction of 0.05m compared to the baseline scenario) and on the southern approach road the predicted flood depth during this event is 1.79m (no change from the baseline scenario).

H++ (UKCP09 high risk, low probability scenario)

18.5.8 Table 18-5 shows the peak water levels predicted by the model in the baseline and Scheme scenarios at the comparison points within Lake Lothing (Figure 18.2) for the H++ events modelled. The H++ events have been modelled to assess a credible maximum scenario and understand the safety and operability of the Scheme during an extreme flood event. As previously agreed with the EA design and mitigation for the Scheme will not be based on the H++ event results. The Scheme is predicted to have a greater impact on water levels within Lake Lothing during the H++ events due to increased tidal levels. A moderate increase in water levels in Lake Lothing with the Scheme in place is predicted for each event modelled. The maximum increase in water levels predicted within Lake Lothing is 0.14m during the 0.1% H++ event. There is no increase in flood extent predicted as a result of the Scheme for any of the scenarios modelled.

Table 18-5 – Model results for the H++ scenario

H++ Point	Baseline (mAOD)			Difference (Scheme – Baseline (m))		
	5%	0.5%	0.1%	5%	0.5%	0.1%
P1	5.83	6.51	7.06	0.00	0.00	0.01
P2	5.82	6.49	7.02	0.00	0.00	0.00
P3	5.83	6.52	7.06	0.00	0.00	0.00
P4	5.85	6.57	7.04	0.00	0.00	0.00
P5	5.67	6.32	6.85	0.01	0.01	0.02
P6	5.56	6.20	6.71	0.02	0.02	0.03
P7	5.40	5.96	6.40	0.03	0.04	0.06
P8	5.40	5.95	6.38	0.05	0.08	0.10
P9	5.40	5.95	6.38	0.04	0.06	0.08
P10	5.40	5.95	6.39	0.06	0.11	0.14
P11	5.40	5.95	6.38	-0.07	-0.06	-0.07
P12	5.40	5.95	6.38	-0.07	-0.06	-0.07
P13	5.40	5.95	6.38	-0.07	-0.05	-0.07
P14	5.40	5.94	6.37	-0.10	-0.11	-0.13
P15	5.33	5.85	6.25	-0.10	-0.10	-0.13
P16	4.85	5.22	5.49	-0.07	-0.07	-0.08

- 18.5.9** On the floodplain for the 5% AEP H++ event, water levels are predicted to increase up to 0.09m. This is a moderate increase in water level based on the criteria in Table 18-1 and there are areas where the water level has decreased by 0.1m to the west of the Scheme. The predicted increases in water level on the floodplain for the 0.5% AEP H++ event are moderate (up to 0.1m) and decreases of up to 0.1m are predicted to the west of the Scheme. The 0.1% AEP H++ event shows an increase of up to a 0.14m in predicted water depths on the floodplain, this is classified as a moderate change. There are decreases of up to 0.16m predicted to the west of the Scheme during the 0.1% AEP H++ event.
- 18.5.10** The bascule bridge deck of the Scheme is not predicted to flood during any of the H++ scenarios modelled. Flooding is predicted to other parts of the Scheme. On the approach road to the bridge to the south of Lake Lothing a water depth of 2.17m is predicted for the baseline and Scheme 5% AEP H++ scenarios. On the approach road to the north of Lake Lothing, a flood depth of 2.95m is predicted for the 5% AEP H++ scenario (a moderate reduction of 0.06m compared to the baseline scenario). For the 0.5% AEP H++ scenario, the predicted flood depth on the approach road to the south of Lake Lothing is 2.72m (a negligible 0.01m increase compared to the baseline scenario), to the north of Lake Lothing the predicted flood depth on the approach road is 3.49m (a moderate 0.07m reduction compared to the baseline scenario). The predicted flood depth on the approach road to the south of Lake Lothing during the 0.1% AEP H++ scenario is 3.16m (a negligible 0.01m increase compared to the baseline scenario) and on the approach road to the north, the predicted flood depth is 3.90 (a moderate 0.09m reduction compared to the baseline scenario).

Construction Impacts

- 18.5.11** During the construction phase of the Scheme, hydraulic modelling has shown that the maximum impact of the cofferdams in the 0.5% AEP climate change event is negligible (up to 0.02m increase in flood depth). The impact is in the channel close to the cofferdam and is caused by a localised decrease in velocity. The model has been carried out assuming a worst case scenario where both cofferdams are in place at the same time, and a maximum sized cofferdam has been simulated (see Figure 5.6). The results have shown the maximum change in water level is an increase of 0.09m in the 0.5% AEP H++ event as a result of a localised reduction in velocity. For more details of the modelling results see the FRA (Appendix 18A).
- 18.5.12** The assessment has shown that the Scheme is at risk of flooding during 5% AEP event and greater, and therefore there will also be a flood risk to the site during construction. Construction of the Scheme will be undertaken over an approximate period of two years as shown in Plate 5-2 with the construction of the piers within Lake Lothing programmed to last approximately ten months. During this time there is low likelihood of a significant flooding event, however it is prudent to consider the impacts of such an event.
- 18.5.13** Due to the relatively short lifespan of the construction phase, a flood management plan will be put in place for the site to minimise flood damage during large return period events. It is expected that in most instances there will be sufficient warning due to tide level predictions to implement the plan. This includes time for removal of plant and

equipment from the site to higher ground upon receiving a flood warning. This will limit damage and ensure that any hazardous materials with the potential to float will be moved.

- 18.5.14 A flood management plan will be prepared by the Contractor and incorporated within the full Code of Construction Practice (CoCP). The interim CoCP (Appendix 5A) identifies the requirements of this flood management plan.

Mitigation

- 18.5.15 Based on the results of the hydraulic modelling undertaken for the FRA, mitigation is not required in terms of tidal flooding for the Scheme as the impact on flooding is negligible up to and including the 0.5% AEP climate change event. It is noted that although Table 18-2 states that mitigation is required for a negligible increase in flood depth to highly vulnerable and essential infrastructure, using professional judgement, it is deemed impractical to provide mitigation for this in this scenario. In the baseline scenario for the 0.5% AEP climate change event flood depths on the floodplain are over 2m, therefore the negligible increase as a result of the Scheme does not alter the scale of risk during this event. As the flood risk to the site is tidal, the mitigation in order to prevent the negligible increase during the 0.5% AEP climate change event would be substantial and given the baseline scenario flood depths, receptors would still be at high risk of significant flooding even with the mitigation in place.

- 18.5.16 In order to avoid an increase in surface water runoff above the greenfield runoff rate from the Scheme site during the operational phase, embedded mitigation through the attenuation of surface water will be provided by a combination of buried tanks and ponds. In order to calculate the amount of attenuation required for surface water as part of the Scheme, a conservative approach has been taken where it has been assumed that the site is currently greenfield and the Scheme will result in a significant increase in hard surfaces. Using this method, it has been assumed that approximately 16,100m³ of storage is required to limit runoff from the site to the greenfield rate for the 1% AEP plus climate change allowance (upper end) event. A Drainage Strategy (see Appendix 18B) has been prepared for the Scheme that provides details of the attenuation required as part of the Scheme.

18.6 Conclusions and Effects

- 18.6.1 It has been agreed with the EA that the results of the hydraulic modelling for the present day and climate change events should be used to inform the design and any mitigation required for the Scheme. The H++ events have been simulated in order to assess the Scheme against a credible maximum scenario but it has likewise been agreed that the Scheme does not have to provide mitigation for the predicted impacts of these events.

- 18.6.2 The assessment of the construction phase has found that the impact of the worst case scenario on the water level is considered negligible (up to 0.02m increase in flood depth) in the 0.5% AEP climate change event. Embedded mitigation in the form of removable walls to the cofferdam will be employed that will sacrificially flood the cofferdam in the event of a flood event exceeding the height of the quay wall. This would lead to a negligible loss of storage within Lake Lothing during such an event.

- 18.6.3 The assessment has shown that the impact of the Scheme on flood water levels both

in Lake Lothing, and on the floodplain, for events up to and including the 0.5% AEP climate change event is negligible. Mitigation is not required in terms of tidal flooding for the Scheme as the impact on flooding is negligible up to and including the 0.5% AEP climate change event. A moderate increase (a maximum of 0.04m) in water levels is predicted for the 0.1% AEP climate change event. For each of the return periods modelled, a moderate increase is predicted for the H++ scenario. The increase in predicted water levels within Lake Lothing as a result of the Scheme can be attributed to afflux (a rise in water level on the upstream side of a bridge due to the constriction caused by the bridge structure) at the Scheme Bascule Bridge rather than the displacement of water by the bascule bridge piers in the channel. There is a corresponding reduction in water levels predicted for most events to the west of the Scheme Bascule Bridge.

- 18.6.4 The assessment has also shown that there is a negligible increase in flood depth on the approach roads in all events. It is important to note that the approach roads are flooded in events greater than 5% AEP. This is consistent with the baseline scenario and the current situation on the existing roads near the Lake, as such there is no change to flood risk. In order for the Scheme approach roads to connect to the existing roads the elevation is lower than the 0.5% AEP baseline flood level.
- 18.6.5 Embedded mitigation of surface water runoff is included as part of the Scheme in order to limit discharge from the Scheme site to the greenfield runoff rate. Embedded mitigation through the attenuation of surface water will be provided by a combination of buried tanks and ponds within the Scheme.
- 18.6.6 As the Scheme has been shown to have a negligible impact on flooding up to and including the 0.5% AEP plus climate change event, flood risk is deemed as not significant.

19 Traffic and Transport

19.1 Scope of the Assessments

Introduction

19.1.1 This chapter of the Environmental Statement assesses the likely significant effects of the Scheme with respect to traffic and transport in the operational phase of the Scheme in both the ‘opening year’ (2022) and in the ‘future year’ (2037). It is supported by the Transport Assessment (TA) (document reference 7.2) and it is also accompanied by Figures 19.1 to 19.16.

19.1.2 This chapter provides a quantitative assessment of operation of road junctions both with and without the Scheme as well as an assessment of the Effects on All Travellers during the operational phase of the Scheme, as set out in Volume 11 of Design Manual for Roads and Bridges (DMRB) and in Institute of Environmental Management (IEMA) guidance (the “IEMA Guidelines”) which includes the following assessments:

- Severance (including new pedestrian severance from community facilities and relief from severance for pedestrians);
- Driver stress and delay;
- Pedestrian and cyclist amenity, journey times and delay;
- Collisions and safety;
- Fear and intimidation; and
- Views from the road.

19.1.3 This chapter also describes the methods used to assess the effects; the baseline conditions currently existing in the study area; the mitigation measures required to prevent, reduce or offset any significant negative impacts; and the likely residual effects after these measures have been adopted.

19.1.4 This chapter should be read alongside Chapter 8: and Chapter 13: where the impacts from road traffic upon air quality, noise and vibration are assessed.

Study Area

19.1.5 The study area has been developed following review of where traffic is expected to change significantly during the operational phase of the Scheme. This could be through an increase in traffic flow, a decrease in traffic flow, or changes to the direction of flow of traffic. The study area is shown on Figure 19.1 and has been derived from SATURN (see Paragraph 19.3.4).

19.2 Directives, Statutes and Relevant Policy

Legislation

Countryside and Rights of Way Act (2000)

19.2.1 The CRoW Act (2000), amongst other ecological matters discussed in Chapter 11, provides for public access on foot to certain types of land and amends the law relating to public rights of way (PRoW).

The Wildlife and Countryside Act (1980)

19.2.2 Part III of the Wildlife and Countryside Act 1980 requires Local Authorities to produce a Definitive Map showing all PRow within their jurisdiction. The map has been used to identify PRow within the study area to be considered within the assessment.

The Highways Act (1980)

19.2.3 The Highways Act 1980 gives Local Authorities the necessary powers to apply to the Secretary of State to divert or stop up public footpaths or bridleways as necessary. This may be due to the PRow not being used or because it is expedient to divert the path. This may be the case for new highways that cross a PRow and diversion is required.

Public Rights of Way (Combined Orders) (England) Regulations (2008) / Public Rights of Way (Combined Orders) (England) Amendment

19.2.4 The above legislation has been updated by the Public Rights of Way (Combined Orders) (England) Regulations 2008 and Public Rights of Way (Combined Orders) (England) (Amendment) Regulations 2010. This Act provides access to all public rights of way, where some public rights of way are also open to horse riders, cyclists and motorists.

National Policy Statement for National Networks

19.2.5 The National Policy Statement for National Network (NNNPS), January 2015, sets out the need for, and Government policies to deliver, development of nationally significant infrastructure projects on the national road networks in England. The NNNPS works to complement the overall strategic aims of the National Planning Policy Framework (NPPF).

19.2.6 The Government, therefore, sets out its vision and strategic objectives for the national road network in the NPS, which states “The Government will deliver national networks that meet the country’s long term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- *Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs;*
- *Networks which support and improve journey quality, reliability and safety;*
- *Networks which support the delivery of environmental goals and the move to a low carbon economy; and*
- *Networks which join up our communities and link effectively to each other”.*

19.2.7 The NNNPS highlights the need for development of the national road network and delivers the above aims in the context of Government policy for economic performance, environment, safety, technology, sustainable transport, accessibility and journey reliability. The national road network connects towns, cities and regions and there is a critical need to address congestion issues to provide safe and resilient networks. The pressure on this network is predicted to increase as the long term drivers for demand to travel, GDP and population, are also forecast to increase.

National Policy Statement for Ports

19.2.8 The National Policy Statement for Ports requires a transport assessment to be included within the ES which should follow Department for Transport (DfT) guidance for transport assessment.

The National Infrastructure Plan

19.2.9 The National Infrastructure Plan was published in 2014 and is based on the principle that high quality infrastructure boosts productivity and competitiveness, allowing businesses to grow and enabling them to reach suppliers, deepen labour and product markets, collaborate and innovate, and attract inward investment.

19.2.10 Hence, the Plan recognises the role of Government in funding improvements to the Strategic Road Network (SRN) and aims to transform the nation's road network over the next 25 years. The Government provides financial support for road maintenance and renewal schemes, and supports investment in new local transport schemes through Growth Deals, allocating Local Growth Fund through Local Enterprise Partnerships.

19.2.11 This support was fulfilled in spring 2016, when the then Prime Minister pledged £73.39m of funding towards the construction of the Scheme.

19.3 Methods of Assessment

Technical Guidance Documents

19.3.1 The following guidance documents have been considered in this assessment:

- Department for Communities and Local Government (DCLG)/DfT Guidance on Transport Assessment (2007);
- DCLG National Planning Policy Framework (2012);
- DCLG National Planning Practice Guidance (2014);
- IEMA has prepared Guidelines for the Environmental Assessment of Road Traffic (Guidance Note 1); and
- DMRB Volume 11, Environmental Assessment.

Network / Junction Operation

19.3.2 The scope of the TA (document Reference 7.2), which assesses the impact of the Scheme on the capacity of highway infrastructure, has been agreed with Suffolk County Council (SCC).

19.3.3 Desk studies and site visits have been undertaken to identify key features of the existing road and pedestrian/cycle networks in the vicinity of the Scheme and to obtain data on existing collision rates and identify existing public transport services.

Strategic Traffic Model - SATURN

19.3.4 The reassignment of traffic onto the Scheme has been taken from the strategic model, which is a dynamic assignment model using data on route choice and driver behaviour built in SATURN (Simulation and Assignment of Traffic to Urban Road Networks). SATURN is a suite of flexible network analysis programs. As a 'conventional' traffic

assignment model, SATURN can deal with large conurbation, regional or even national model networks. The model redirects traffic to the fastest routes when congestion builds, thereby spreading traffic to quieter routes and away from heavily congested areas. This is a realistic traffic assignment methodology given that many drivers will reroute rather than stay within a queue.

19.3.5 The SATURN model is used to forecast future travel demand and traffic flows and has been constructed and validated in line with WebTAG criteria. WebTAG is national guidance for undertaking transport studies and required for all projects that require government approval. Use of the model within this ES Chapter and the TA is therefore considered valid and appropriate means to assess the impact on traffic.

19.3.6 The majority of data is available from the strategic SATURN model for the area with traffic surveys completed at key junctions and links surrounding the Scheme to supplement the model data available. The strategic model was used to support the Outline Business Case (document reference 7.4), which was scrutinised by the DfT prior to funding approval and Programme Entry status of the Scheme being confirmed.

Journey Time Assessments – VISSIM

19.3.7 A microsimulation model using VISSIM has been developed to represent the existing traffic conditions and to assess the potential impacts of the Scheme on the highway network in the locality of the Scheme.

19.3.8 A VISSIM model is able to more accurately model on-street behaviour and network capacity issues such as lane usage and exit blocking compared to conventional model analysis such as LINSIG, JUNCTIONS 8 and SATURN.

19.3.9 The Base year model has been developed from a VISSIM model originally produced on the basis of surveys from April 2015. The model has been updated using demand matrices (including traffic growth assumptions) from the 2016 Base SATURN model, and has been calibrated using Manual Classified Count (MCC) surveys on seventeen key junctions collected in April 2015.

Operational Assessments – JUNCTIONS8 and LINSIG

19.3.10 An assessment of the impact of the redistribution of traffic on local junctions has been completed using appropriate software (JUNCTIONS8 and LINSIG) at the individual junctions, to determine where any additional mitigation is required based on Ratio of Flow to Capacity (RFC) results (non-signalised junctions) / Practical Reserve Capacity (PRC) (signalised junctions), delays and expected queue lengths.

19.3.11 Following discussion and agreement with SCC, 22 junctions have been assessed within the TA (document reference 7.2) as follows and as shown on Figure 19.1.

- 1: A47 Yarmouth Road / A1117 Millennium Way;
- 2a: A47 Katwijk Way / A1144 St Peter's Street;
- 2b: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street;
- 3: A47 Waveney Road / Station Square / Commercial Road;
- 4: A12 Pier Terrace / B1532 London Road South;

-
- 5: A12 Belvedere Road / Mill Road / Kirkley Rise;
 - 6: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive;
 - 7: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run;
 - 8a: A12 Tom Crisp Way / Blackheath Road;
 - 8b: Kirkley Run / Blackheath Road / Long Road;
 - 8c: Blackheath Road / Carlton Road;
 - 9a: A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue;
 - 9b: A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road;
 - 10: A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road;
 - 11: A1117 Normanston Drive / B1375 Gorleston Road;
 - 12: Peto Way / Denmark Road / Barnards Way;
 - 13: Denmark Road / Rotterdam Road;
 - 14: A1117 Normanston Drive / A1117 Peto Way;
 - 15: A1144 Normanston Drive / Rotterdam Road;
 - 16: B1531 Waveney Drive / Riverside Road / Durban Road;
 - 17: New junction north of the Lake;
 - 18: New junction south of the Lake;
 - 19: Denmark Road / A47 Katwijk Way;
 - 20: B1531 Waveney Drive / Kimberley Road;
 - 21: A1117 Millennium Way / B1074 Somerleyton Road;
 - 22: B1531 Waveney Drive / Riverside Road; and
 23. Kirkley Run/Notley Road

19.3.12 The assessments include scenarios which take into account traffic growth associated with planned and committed development with the vicinity of the Scheme and across Lowestoft. Future traffic flows are forecast using appropriate DfT-approved software. All junctions have been subject to weekday AM and PM peak hour assessments. Following discussion with SCC, an assessment has been undertaken to determine the Saturday peak hour within Lowestoft using the 2015 traffic data. The traffic flows for the Saturday peak hour were then compared to the weekday peak hour flows to determine whether the weekday or weekend peak was the greater.

19.3.13 In the design of the capacity of junctions, designers seek to achieve an RFC below 0.85 (for non-signalised junctions) and 0.9 (for signalised junctions), the theoretical capacity of traffic passing through a junction being 1.0. This is reflected in Table 19-4 which assigns a 'high' magnitude of change for any junction with a RFC above 0.9. Table 19-4 also provides a summary of the significance of effects for each aspect of the assessment of impact upon junction capacity, based upon the relationship of the magnitude of impact of each assessment criteria to the assessed sensitivity of each receptor.

Link Operation

19.3.14 The predicted traffic impacts of the Scheme have been assessed on the following seventeen links which are expected to experience significant changes in traffic as a result of the Scheme, based on analysis of traffic flows derived from SATURN:

- A47 Bascule Bridge;
- A1117 Bridge Road (Mutford Bridge);
- The Scheme;
- B1531 Waveney Drive (Between Waveney Crescent);
- B1531 Victoria Road;
- A12 Tom Crisp Way;
- Kirkley Run;
- A1117 Normanston Drive (Between Peto Way and Gorleston Road);
- Peto Way (Between Scheme and Normanston Drive);
- Rotterdam Road (Between Denmark Road and Normanston Drive);
- A47 Battery Green Road;
- A47 Jubilee Way;
- A1144 St. Peter's Street;
- A47 Foxburrow Hill;
- A1117 Millennium Way (Between Park Meadows and Somerleyton Road);
- Denmark Road (Between Katwijk Way and Trafalgar Street); and
- A47 Katwijk Way.

19.3.15 The assessment also considers the impact of the operational phase of the Scheme against the following, in accordance with IEMA and DMRB Guidance:

- Severance (including new pedestrian severance from community facilities and relief from severance for pedestrians);
- Driver stress and delay;
- Pedestrian and cyclist amenity, journey times and delay;
- Collisions and safety;
- Fear and intimidation; and
- Views from the road.

Severance (including new pedestrian severance from community facilities and relief from severance for pedestrians)

19.3.16 Severance is the perceived division that can occur within a community (See community assets on Figure 19.3) when it becomes separated by a major traffic route. The assessment of severance pays full regards to specific local conditions, in particular the

location of pedestrian routes to key local facilities and whether crossing facilities are present. Factors that are considered in determining the existing level of severance are road width, traffic flow and composition, vehicle speed and the availability of pedestrian crossing facilities.

19.3.17 The IEMA Guidelines state that a 30%, 60% and 90% increase in traffic flows have a slight, moderate and substantial change in severance respectively. Severance can be associated with residents, local employees, motorists, cyclists or pedestrians.

New Severance

19.3.18 Pedestrian and cycle connectivity is important to enable journeys to be made on foot or by bicycle. Using DMRB criteria (DMRB Volume 11, Section 3, Part 8, Chapters 5, 6 and 8) new severance is described using a three-point scale: slight, moderate or severe, as shown below in Table 19-1.

Table 19-1 – DMRB Magnitude Criteria, New Severance

Magnitude of Impact	Criteria
Slight	<ul style="list-style-type: none"> • Pedestrian at-grade crossing (located at carriageway level) of a new road carrying below 8,000 vehicles per day (Average Annual Daily Traffic (AADT)); or • A new bridge will need to be climbed or a subway transversed; or • Pedestrian journeys increased by up to 250m.
Moderate	<ul style="list-style-type: none"> • Two or more of the hindrances set out under 'slight' applying to single trips; or • Pedestrian at-grade crossing of a new road carrying between 8,000-16,000 vehicles per day (AADT) in the opening year; or • Pedestrian journeys will be increased by 250-500m.
Severe	<ul style="list-style-type: none"> • Pedestrian at-grade crossing of a new road carrying over 16,000 vehicles per day (AADT) in the opening year; or • An increase in length of journeys of over 500m; or • Three or more of the hindrances set out under 'slight' or two or more set out under moderate

Relief from Existing Severance

19.3.19 The assessment considers the extent of relief that can be gained from a reduction in traffic on the existing road network in the opening year of the Scheme (2022) and in the future assessment year (2037).

19.3.20 Relief from existing severance is not considered significant where traffic flows are already relatively low, and DMRB guidelines do not apply when the AADT is less than 8,000 vehicles. Where traffic flows are greater than 8,000 AADT the criteria set out in the IEMA Guidelines have been used. These are as set out below:

- Change in traffic flow of less than 30% - Slight change in severance;
- Change in traffic flow of 30% - 60% - Moderate change in severance; and
- Change in traffic flow of over 60% - Substantial change in severance.

Driver Stress and Delay

19.3.21 Using criteria in DMRB Volume 11, Section 3, Part 9, Chapters 3 and 4, driver stress has three main components:

- frustration;

- fear of potential accidents; and
- uncertainty relating to the route being followed.

19.3.22 The assessment of driver stress has been based on the traffic and road conditions likely to be encountered and the certainty of the route for travellers.

19.3.23 Frustration can be caused by a driver's inability to drive at speed consistent with his or her wishes. Frustration increases as speed falls in relation to expectation and may be due to high flow levels, intersections, roadworks, or difficulties in overtaking.

19.3.24 The main factors leading to fear of potential accidents are the presence of other vehicles, inadequate sight distances, and the likelihood of pedestrians stepping into the road. Fear is highest when speeds, flows and the proportion of heavy goods vehicles (HGVs) are all high.

19.3.25 DMRB vol.11 section 3 Part 9 paragraph 4.4 states that "There is evidence that drivers make a compensatory reduction in their speed where conditions increase the risk of an accident."

19.3.26 Traffic delays to non-development traffic can occur:

- At the Scheme entry points where there will be additional turning movements;
- On approach to the Scheme where there may be additional flow; and
- At key junctions on the local highway network.

19.3.27 The Scheme is not a 'development' that will generate trips, but will instead create a reassignment of trips throughout the town. The impact of those reassigned trips has been considered to determine whether there is a beneficial or detrimental effect on driver stress and delay.

19.3.28 Time values for delay are based upon computer junction assessment programs: LINSIG for signalised junctions; JUNCTIONS8 for roundabouts and for priority junctions. JUNCTIONS8 has been utilised within the TA (document reference 7.2).

Pedestrian and Cyclist Amenity, Journey Times and Delay

19.3.29 The importance of walking and cycling in contributing towards sustainable travel patterns is outlined in the NPPF and the NNNPS, which places focus on the roles that walking and cycling can play as both the main modes of transport or as part of a longer journey by public transport. The IEMA Guidelines broadly defines amenity as "*the relative pleasantness of a journey, and is considered to be affected by traffic flows, traffic composition and pavement width/separation from traffic*".

19.3.30 An indicative threshold for changes in pedestrian amenity are where traffic flows are halved or doubled⁶³. The traffic flow reductions predicted by the SATURN model that are presented in the TA (document reference 7.2) are utilised to assess the changes in pedestrian amenity across all bridges⁶⁴ during the operational phase of the Scheme.

19.3.31 The IEMA Guidelines recommend that rather than relying on thresholds for pedestrian

⁶³ May, A.D., Turvey, I.G., Hopkinson, P.G.(1985) *Studies of Pedestrian Amenity*. Institute of Transport Studies, University of Leeds, Working Paper 204

⁶⁴ That is the Scheme Bascule Bridge, the A47 Bascule Bridge and Mutford Bridge

and cycle delay the assessor should use judgement to determine whether there will be a significant impact.

- 19.3.32** Increases in traffic levels as a consequence of a development are likely to lead to increased delay to pedestrians and cyclists wishing to cross roads. The degree of pedestrian and cycle delay therefore corresponds to the level of severance.
- 19.3.33** The assessment has involved identification of the existing network of PRow, other Non-motorised user (NMU) routes and the road network likely to be affected by the Scheme.
- 19.3.34** NMU routes which have been included in the assessment were identified from OS mapping. There are no PRow routes affected by the Scheme as identified from the SCC PRow definitive map (see Figure 19.2)
- 19.3.35** Diversion lengths for NMU routes have been assessed and are provided at Table 19-16. The change in journey distance for pedestrians between residential areas and key destinations on the north and south sides of Lake Lothing has been assessed.
- 19.3.36** Using guidance from DMRB Section 3, Part 8, Chapters 2 and 3 and professional judgement, changes to journey lengths have been calculated for road links where traffic flows on an existing road increase or decrease by 30% or more or where journeys are diverted. The impacts of the following changes will be identified and a descriptive assessment on the impacts to all users provided:
- journey routes;
 - journey lengths;
 - journey times; and
 - the potential number of people affected.
- 19.3.37** Impacts on amenity are assessed qualitatively by describing the perceived changes to the relative pleasantness of a journey. This is determined by the views afforded to travellers along an NMU route and any exposure to traffic which would potentially affect travellers in respect of fear and safety.
- 19.3.38** In accordance with the DMRB guidance in Volume 11, Section 3, Part 8, Chapter 4, the assessment undertaken is subjective, qualitative and based on the likely perception of change to the individual experience.

Collisions and Safety

- 19.3.39** The IEMA Guidelines state that an assessment of road safety on the highway network should be undertaken based on recent collision records. Personal Injury Collision (PIC) data has been obtained for the study area from STATS19 Road Safety Data for a five-year period to the end of December 2016 and is summarised in Paragraph 19.4.23 in the baseline conditions section of this ES chapter. Professional judgement is used to determine the significance of the Scheme on collisions and safety following detailed analysis undertaken as part of the Economics Report (document reference 7.3) using COBALT software (Cost Benefit of Accidents – Light Touch) which is a computer program developed by the DfT to undertake the analysis of the impact on accidents as part of economic appraisal for a road scheme.

Fear and Intimidation

19.3.40 Traffic may also increase fear and intimidation for pedestrians. This impact is dependent on the volume of traffic, its HGV composition, its proximity to pedestrians and/or lack of protection caused by factors such as narrow pavement widths.

19.3.41 Whilst this danger has been recognised as an important environmental impact for many years, there are no commonly agreed thresholds for estimating levels of danger, or fear and intimidation, from known traffic and physical conditions. The IEMA Guidelines therefore suggest thresholds based on 18-hour daily flow and vehicle speeds, as shown in Table 19-2.

Table 19-2 – Fear and Intimidation Thresholds for traffic

Degree of Hazard	Average traffic flow over 18-hour day (veh/hr)	Total 18-hour HGV flow	Average speed over 18-hour day (mph)
Extreme	1800+	3000+	20+
Great	1200-1800	2000-3000	15-20
Moderate	600-1200	1000-2000	10-15

Views from the Road

19.3.42 The assessment of views from the road has involved understanding how the extent to which travellers would be able to perceive the townscape will vary with the relative level of the road, surrounding topography and vegetation. ‘Travellers’ in this section can be defined as pedestrians, cyclists and vehicle drivers. The categories used in assessing this have been derived from DMRB Guidance and are as follows:

- minimum change to view as the road is slightly widened;
- no view - road in very deep cutting or contained by earth bunds, environmental barriers or adjacent structures;
- restricted view - road in frequent cuttings, or with deep cuttings across slopes, with frequent environmental barriers or adjacent structures blocking the view;
- intermittent view - road generally at grade but with shallow cuttings, environmental barriers or structures at intervals; and
- open view - road generally at grade or on embankment with views extending over the wider landscape or only restricted by existing landscape features.

19.3.43 In addition to the ability of the traveller to see the view, the assessment must take into consideration the route type, townscape character and the quality of the view experienced. Table 19-3 provides definition of the category of the view from the road for vehicle travellers.

Table 19-3 – DMRB Magnitude Criteria, Views from the Road

Magnitude of Impact	Criteria
High	Travellers are exposed to views of high quality townscape or an area of unique townscape character. Views may have features of particular interest or quality, or distinctive attractive features.

Medium	Travellers are exposed to views of moderate quality townscape, which may include views of some features of moderate interest
Low	Travellers are exposed to views of low quality townscape and/or unremarkable townscape. Views may include detractors or features which are inconsistent with an area of higher quality or character.

Significance of Effects

19.3.44 The IEMA Guidelines identify two broad rules-of-thumb to be used as a screening process in determining the scale and extent of the assessment:

- Rule 1 – include highway links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%); and
- Rule 2 – include any other specifically sensitive areas where traffic flows have increased by more than 10% (Sensitive areas may include accident black-spots, Conservation Areas, hospitals, links with high pedestrian flows etc. which have been identified using professional judgement)

19.3.45 The IEMA Guidelines go on to state that “Traffic forecasting is not an exact science and the accuracy of projections is open to debate. It is generally accepted that accuracies greater than 10% are not achievable. It should also be noted that the day-to-day variation of traffic on a road is frequently at least some + or -10%. At a basic level, it should therefore be assumed that projected changes in traffic of less than 10% create no discernible environmental impact.”

19.3.46 The IEMA Guidelines identify that the most discernible environmental impacts of traffic are noise, severance, pedestrian delay and intimidation and they provide additional information on how those impacts should be assessed. “*At low flows, increases in traffic of around 30% can double the delay experienced by pedestrians attempting to cross a road (DOT, 1983). Whether this is significant in absolute terms requires further consideration (see 3.19). Severance and intimidation are, however, much more sensitive to traffic flow and the Department of Transport, in its MEA, has assumed that 30%, 60% and 90% changes in traffic levels should be considered as ‘slight’, ‘moderate’ and ‘substantial’ impacts respectively.*”

19.3.47 In order to undertake a relative assessment of the increase in road traffic, the criteria outlined in Table 19-4 and Table 19-5 have been used to determine the magnitude of impact and receptor sensitivity respectively. However, professional judgement is also applied to the local characteristics, such as the volume of traffic, pavement widths and availability of crossing facilities.

Table 19-4: Magnitude of Traffic Impact Criteria (Beneficial and Adverse)

Change in Traffic Flow	Magnitude of Impact
Change in total traffic or HGV flows over 90%, or exceeding the road's traffic capacity or a junction with a predicted flow ratio greater than 0.9	Major
Change in total traffic or HGV flows of 60 - 90%	Moderate
Change in total traffic or HGV flows of 30 - 60%	Minor
Change in total traffic or HGV flows of less than 30%	Negligible

Table 19-5: Receptor Sensitivity Criteria

Receptor Sensitivity	Receptor Type
High	Receptors of greatest sensitivity to traffic flow: schools, colleges, playgrounds, accident black spots, retirement homes, urban/residential roads without footways that are used by pedestrians.
Medium	Traffic flow sensitive receptors including: congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, unsegregated cycle ways, community centre, parks, recreational facilities.
Low	Receptors with some sensitivity to traffic flow: places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision.
Very Low	Receptors with low sensitivity to traffic flow and those with sufficient distance from affected roads and junctions.

19.3.48 Table 19-6 provides a summary of the significance of effects adopted for each aspect of the assessment. This is based on the relationship of the magnitude of impact of each assessment criteria to the assessed sensitivity of each receptor. A major and moderate effect is seen as significant. A minor or negligible effect is seen as not significant.

Table 19-6 – DMRB Magnitude Criteria (incorporating IEMA impact ratings), Significance

Importance / sensitivity of resource of receptor	Magnitude of Impact (Adverse / Beneficial -/+)			
	Major	Moderate	Minor	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Very Low	Minor	Negligible	Negligible	Negligible

19.4 Baseline Environment

19.4.1 This section examines the existing transport conditions within the vicinity of the Scheme. The study area is shown in Figure 19.1.

Strategic Road Network

19.4.2 The SRN in England is managed by Highways England and within the study area includes the existing A47 Bascule Bridge, and the A47 to Great Yarmouth to the north of the A47 Bascule Bridge.

19.4.3 Between the A47 Bascule Bridge and Ipswich to the south, the A12 is managed by SCC. Access to the A12 from the Scheme is approximately 0.25km to the south-east of the Order limits, via the A12 Tom Crisp Way / Horn Hill Roundabout.

Local Highway Network

19.4.4 To the south of the Scheme is the B1531 Waveney Drive/ Victoria Road, which forms

the main east-west route on the south side of Lake Lothing. It is a wide single carriageway road, with good forward visibility and a 30mph speed limit.

19.4.5 The C909 Denmark Road runs along the northern boundary of the Scheme and forms the east-west route on the north side of Lake Lothing. It feeds into the C970 Peto Way at the North Quay Retail Park to the west, and the A47 to the east, adjacent to Lowestoft railway station. The carriageway is narrow where residential parking exists between Hervey Street and Trafalgar Street.

19.4.6 The A146 is a main distributor road in Oulton Broad which connects with numerous other 'A' and 'B' roads to provide access across Suffolk and Norfolk. The A146 is accessible from the Scheme via B1531 Waveney Drive / Victoria Road and is subject to a 30mph speed limit within the boundaries of Lowestoft.

19.4.7 The A1117 is a main distributor road that provides a direct connection between the A12 and A47. The A1117 is accessible from the Scheme via B1531 Waveney Drive / Victoria Road. It is subject to a 30mph speed limit from Mutford Bridge through to Peto Way, and thereafter 40mph until A47 Yarmouth Road.

Baseline Traffic Data

19.4.8 A summary of the existing, and historic, two-way traffic flows from DfT data sources in the study area is shown in Table 19-7.

Table 19-7 – Existing and Historic Two-way Traffic Flows in the Study Area

DfT Traffic Count Site	Average Annual Daily Traffic Flow					
	2011	2012	2013	2014	2015	2016
A1117 Bridge Road (S)	20,501	20,251	20,177	20,031	19,853	20,433
A1117 Bridge Road (N)	26,146	25,844	25,734	25,912	25,645	25,194
A1117 Normanston Drive	7,892	7,807	7,804	8,035	8,214	8,453
A1144 St Peter's Street	14,421	14,267	14,269	14,709	15,044	15,502
A47 Katwijk Way ⁶⁵	6,757	6,673	-	-	-	13,823
A12 Pier Terrace (Bascule Bridge)	15,794	15,609	16,728	17,228	17,613	16,969

Public Transport Network

19.4.9 Buses in Lowestoft are mainly operated by First Norfolk & Suffolk and Anglian Bus providing public transport in and around the town. The bus services cover the main corridors through the town, with all routes serving the town centre from outer lying areas. There is a bus interchange located approximately 1km east of the Order limits of the Scheme, at Lowestoft railway station. Lowestoft's main Bus Station is located on Gordon Road, approximately 1.5km from the Order limits of the Scheme.

19.4.10 The nearest bus stops to the Scheme are located on Denmark Road to the north, the B1531 Waveney Drive to the south and the A12 Horn Hill to the east. Bus Route 101 is the most frequent service along these roads, stopping at the B1531 Waveney Drive

⁶⁵ Data for 2011 and 2012 is *estimated* data from DfT. Data unavailable from DfT for 2013, 2014, 2015. Data for 2016 is *counted* by DfT.

bus stop approximately every 20 minutes, Monday to Friday.

19.4.11 Lowestoft railway station is a terminus on the East Suffolk Line, located approximately 1km east of the Order limits of the Scheme.

19.4.12 During the extended AM peak period (0700-1000), there are four rail services that depart from Lowestoft to Norwich, and two services departing for Ipswich. In the extended PM peak period (1600-1900), there are three services that depart to Norwich, and three departing for Ipswich. The approximate journey time on the stopping service between Lowestoft and Norwich is 45 minutes and 1 hour and 30 minutes between Lowestoft and Ipswich.

Pedestrian Network

19.4.13 There is a good provision of existing pedestrian routes in the proximity of the Scheme with continuous footways or wide shared use facilities on either side of the highways to the north (Denmark Road) and south of Lake Lothing (Riverside Road and B1531 Waveney Drive).

19.4.14 On the two existing crossing points over Lake Lothing, the A47 Bascule Bridge to the east and Mutford Bridge to the west, there are continuous footways on either side of the carriageway, with a shared cycle / footway on the eastern side of the A47 Bascule Bridge. The footways are relatively narrow and, particularly at the A47 Bascule Bridge, the provision is inadequate to cater for the high number of pedestrians in the summer months. In addition to this, there is a separate pedestrian and cycle bridge to the west of Mutford Bridge upon the lock between Oulton Broad and Lake Lothing.

19.4.15 However, Lake Lothing itself creates a severance issue for pedestrians with only the two crossing points at the east and west of the Lake.

19.4.16 Three PRoW are located within the 500m of the Order limits of the Scheme (see Figure 19.2). These are footpaths 021, 028 and 044.

Footpath 021

19.4.17 This footpath runs in an east-west direction north of Peto Way and provides access around Leathes Ham. A controlled signal allows for users to cross Peto Way and access Leathes Ham and a footbridge provides a crossing point over the East Suffolk line near the northern most point of Lake Lothing.

Footpaths 028 and 044

19.4.18 These two footpaths are located to the south east of the Order limits of the Scheme beyond the A12 Tom Crisp Way roundabout. They are considered together due to how they connect together and due to their short length.

19.4.19 Footpath 028, approximately 150m long, runs south from the A12 Tom Crisp Way roundabout that connects Horn Hill and Belvedere Road before it connects into Footpath 044. Footpath 044 runs between Mill Road and Salisbury Road for approximately 340m.

Other Pedestrian Routes

19.4.20 The area surrounding the Scheme, both north and south of Lake Lothing, are provided with a network of pedestrian footways alongside the highway. Pedestrian footways are

located on Denmark Road, Peto Way, Riverside Road and Waveney Drive as well as along other roads leading into Lowestoft town centre and through the surrounding residential areas.

Cycle Network

19.4.21 The cycle network within the study area includes sections of National Cycle Network Route 517 and the Regional Cycle Network route 30 (maintained by SCC), as well as other signposted on-road cycle routes, advisory cycling routes and some traffic free cycle routes. Similarly to pedestrians, Lake Lothing provides limited opportunities for cyclists to make north-south connections within the town. There is provision for cyclists crossing the Lake at the west of Lake Lothing in the form of a shared use pedestrian / cycle bridge across Mutford Lock (west of Mutford Bridge), and a shared use footway / cycleway on the eastern footway of Mutford Bridge. In contrast the A47 Bascule Bridge has no specific provision for cyclists and the three-lane tidal flow system means that the road lane widths are narrow and create a poor environment for cyclists.

Community Facilities

19.4.22 The movement of vehicles and NMUs to community facilities is presently severed by Lake Lothing and Figure 19.3 shows those community facilities surrounding Lake Lothing. These include religious buildings, medical and educational facilities.

Personal Injury Collisions

19.4.23 PIC data for the Lowestoft area was obtained from STATS19 Road Safety Data from the five-year period between July 2012 and August 2017. In total, there were 89 injury collisions across the junctions assessed within the TA (document reference 7.2). There were no fatal collisions, ten severe PICs and 79 slight PICs during the five year period. More detailed accident analysis can be found within Section 3 of the TA (document reference 7.2).

19.5 Predicted Impacts

Traffic Impacts

Construction Phase

19.5.1 As presented in Section 10 of the TA, the construction phase of the Scheme will generate a peak of 108 two-way traffic movements per day for the delivery of construction materials and hence includes Light Goods Vehicle and HGV movements. As shown in Figure 5.4, there are three construction compounds and therefore deliveries will be split between the north and the south of Lake Lothing. Construction of the Scheme is programmed to take approximately two years as shown in Plate 5-2.

19.5.2 Assuming 108 vehicles are split with 50% north and south of the Lake (accessing each compound in Figure 6.6), there could be 108 construction vehicle movements on the local highway network on either side of Lake Lothing per day.

19.5.3 A level of construction traffic movements of circa 108 per day on the local highway network does not require a detailed assessment as it will not constitute a change in traffic of greater than 30% on any link within the study area, as identified in Table 19-4, and therefore further assessment is scoped out of this assessment.

Operational Phase

19.5.4 This section considers the impact of the Scheme upon the future conditions of the local area during the operational phase. The change in traffic flows as a result of the introduction of the Scheme, and the associated reassignment of traffic are shown by comparing the Do Minimum (DM) (without Scheme) traffic flows with the Do Something (DS) (with Scheme traffic flows) in Table 19-8 and Table 19-9 upon the links identified in Paragraph 19.3.14.

Table 19-8 – 2022 and 2037 DM and DS Peak Hours Traffic Flows (AM and PM)

Road	2022 (Opening Year)				2037 (Design Year)			
	AM Peak (08:00-0900)		PM Peak (17:00-18:00)		AM Peak (08:00-0900)		PM Peak (17:00-18:00)	
	DM	DS	DM	DS	DM	DS	DM	DS
A47 Bascule Bridge	2,321	1,252	2,846	1,575	2,544	1,492	3,095	1,915
A1117 Bridge Road (Mutford Bridge)	2,369	1,598	2,691	1,981	2,706	1,851	3,000	2,227
The Scheme	N/A	2,271	N/A	2,460	N/A	2,568	N/A	2,729
B1531 Waveney Drive (Between Waveney Crescent)	656	1,107	732	1,303	809	1,364	791	1,563
B1531 Victoria Road	850	440	981	519	1,039	521	1,152	658
A12 Tom Crisp Way	1,496	2,132	1,426	2,113	1,596	2,282	1,567	2,250
Kirkley Run	288	322	455	414	342	388	519	452
A1117 Normanston Drive (Between Peto Way and Gorleston Road)	1,635	1,195	1,635	1,220	1,878	1,419	1,727	1,337
Peto Way (Between New bridge and Normanston Drive)	824	1,634	1,064	1,727	994	1,922	1,225	2,026
Rotterdam Road (Between Denmark Road and Normanston Drive)	225	497	259	607	249	539	304	614
A47 Battery Green Road	1,007	777	1,405	979	1,101	908	1,565	1,236
A47 Jubilee Way	774	663	1,001	840	790	711	1,188	990
A1144 St. Peter's Street	972	961	1,101	999	1,066	1,014	1,174	1,077
A47 Foxburrow Hill	1,554	1,531	1,866	1,865	1,826	1,839	2,214	2,224
A1117 Millennium Way (Between Park Meadows and Somerleyton Road)	1,077	1,332	1,133	1,220	1,290	1,502	1,235	1,275
Denmark Road (Between Katwijk Way and Trafalgar Street)	612	110	676	127	698	449	1,320	474

Road	2022 (Opening Year)				2037 (Design Year)			
	AM Peak (08:00-0900)		PM Peak (17:00-18:00)		AM Peak (08:00-0900)		PM Peak (17:00-18:00)	
	DM	DS	DM	DS	DM	DS	DM	DS
A47 Katwijk Way	368	367	236	284	398	381	261	311

Table 19-9 – 2022 and 2037 Percentage Change in Traffic Flow

Road	2022 (Opening Year)		2037 (Design Year)	
	AM Peak(08:00-0900)	PM Peak (17:00-18:00)	AM Peak (08:00-0900)	PM Peak (17:00-18:00)
A47 Bascule Bridge	-46%	-45%	-41%	-38%
A1117 Bridge Road (Mutford Bridge)	-33%	-26%	-32%	-26%
The Scheme	N/A	N/A	N/A	N/A
B1531 Waveney Drive (Between Waveney Crescent)	69%	78%	69%	98%
B1531 Victoria Road	-48%	-47%	-50%	-43%
A12 Tom Crisp Way	43%	48%	43%	44%
Kirkley Run	12%	-9%	13%	-13%
A1117 Normanston Drive (Between Peto Way and Gorleston Road)	-27%	-25%	-24%	-23%
Peto Way (Between New bridge and Normanston Drive)	98%	62%	93%	65%
Rotterdam Road (Between Denmark Road and Normanston Drive)	121%	134%	116%	102%
A47 Battery Green Road	-23%	-30%	-18%	-21%
A47 Jubilee Way	-14%	-16%	-10%	-17%
A1144 St. Peter's Street	-1%	-9%	-5%	-8%
A47 Foxburrow Hill	-1%	0%	1%	0%
A1117 Millennium Way (Between Park Meadows and Somerleyton Road)	24%	8%	16%	3%
Denmark Road (Between Katwijk Way and Trafalgar Street)	-82%	-81%	-36%	-64%
A47 Katwijk Way	0%	20%	-4%	19%

19.5.5 It should be noted that whilst Table 19-9 indicates that Rotterdam Road shall experience a significant increase in traffic flow as a result of the Scheme, this appears as a high proportion as a result of the very low existing flow on this link.

19.5.6 An assessment of junction capacities has been undertaken for junctions identified during the scoping process. The results comparing the DM and DS model scenarios is presented in more detail within the TA (document reference 7.2).

Junction Capacity Analysis

19.5.7 Operational modelling was undertaken for 23 junctions (see 19.3.10 and Figure 19.1) using JUNCTIONS8 and LINSIG software. In 2022 (the opening year), four junctions are forecast to operate over reserve capacities in the AM or PM peaks, two of which require improvements. In 2037, seven junctions operate over reserve capacity, however of those only four require improvements. The junctions that do not require improvements are forecast to see a reduction in the predicted capacities as a result of the Scheme even though they remain over capacity.

19.5.8 Using data from the ATC sites, the following four junctions have been identified as having a Saturday peak hour which is greater than the weekday PM peak hour. They have therefore been subject to an additional Saturday peak hour assessment:

- Junction 12 - Peto Way / Denmark Road / Barnards Way;
- Junction 13 - Denmark Road / Rotterdam Road;
- Junction 14 - A1117 Normanston Drive / A1117 Peto Way; and
- Junction 19 - Denmark Road / A47 Katwijk Way.

19.5.9 An overall summary of the junction operation assessment is included in Table 19-10 and Table 19-11 for 2022 and 2037 respectively, with the following colour classifications:

- Green – operating under an RFC of 0.85/85%;
- Orange – operating between an RFC of 0.85/85% and 1.00/100%; and
- Red – operating over an RFC of 1.00/100%.

Table 19-10: Summary of Junction Operation Assessments in 2022

Junction	AM Peak DM	AM Peak DS	PM Peak DM	PM Peak DS	Saturday DM	Saturday DS	Mitigation Required
1					-	-	No
2					-	-	No
3					-	-	No
4					-	-	No
5					-	-	No
6					-	-	No
7					-	-	Yes
8					-	-	No
9					-	-	No
10					-	-	No
11					-	-	No
12							No
13							No
14							Yes
15					-	-	No
16		-		-	-	-	No
17	-		-		-	-	Scheme North Rbt
18	-		-		-	-	Scheme South Rbt
19							No
20					-	-	No
21					-	-	No
22	-		-		-	-	Scheme Junction
23					-	-	No

Table 19-11: Summary of Junction Operation Assessments in 2037

Junction	AM Peak DM	AM Peak DS	PM Peak DM	PM Peak DS	Saturday DM	Saturday DS	Mitigation Required
1	Green	Green	Green	Green	-	-	No
2	Green	Green	Green	Green	-	-	No
3	Green	Green	Yellow	Green	-	-	No
4	Yellow	Green	Green	Green	-	-	No
5	Red	Green	Green	Green	-	-	No
6	Green	Green	Green	Yellow	-	-	No
7	Green	Yellow	Red	Red	-	-	Yes
8	Green	Green	Yellow	Red	-	-	Yes
9	Green	Green	Green	Green	-	-	No
10	Red	Green	Red	Green	-	-	No
11	Red	Green	Red	Red	-	-	No
12	Green	Green	Green	Yellow	Green	Yellow	No
13	Green	Green	Green	Green	Green	Green	No
14	Yellow	Yellow	Green	Green	Yellow	Red	Yes
15	Green	Green	Green	Green	-	-	No
16	Green	-	Yellow	-	-	-	No
17	-	Green	-	Green	-	-	Scheme North Rbt
18	-	Green	-	Yellow	-	-	Scheme South Rbt
19	Green	Green	Green	Green	Green	Green	No
20	Green	Green	Green	Green	-	-	No
21	Yellow	Red	Red	Red	-	-	Yes
22	-	Green	-	Green	-	-	Scheme Junction
23	Green	Green	Green	Green	-	-	No

19.5.10 The junction assessment results have been broken down into three categories:

- Junctions that operate within an RFC of 0.85/PRC of 0.90 in all scenarios;
- Junctions that are beneficially impacted by the Scheme; and
- Junctions that experience a major adverse impact as a result of the Scheme.

19.5.11 The junctions set out in Table 19-12 will experience a change in traffic flow during the operational stage of the Scheme, however they will continue to operate within an RFC of 0.85/PRC of 0.90 in all scenarios and therefore any impacts of the Scheme are not major, in line with the IEMA Guidelines set out in Table 19-4.

Table 19-12: Junctions which Operate within an RFC of 0.85/PRC of 0.90 with the Scheme in Place

Junction	Average change in flow	Magnitude of Impact
1: A47 Yarmouth Road / A1117 Millennium Way	6%	Negligible
2a: A47 Katwijk Way / A1144 St Peter's Street	-7%	Negligible
2b: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street	-10%	Negligible
6: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive	34%	Minor
8b: Kirkley Run / Blackheath Road / Long Road	22%	Negligible
8c: Blackheath Road / Carlton Road	22%	Negligible
9a: A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue	3%	Negligible
9b: A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road	-21%	Negligible
13: Denmark Road / Rotterdam Road	49%	Minor
15: A1144 Normanston Drive / Rotterdam Road	27%	Negligible
16: B1531 Waveney Drive / Riverside Road / Durban Road (DM)	190%	Major
18: New junction south of the Lake (Southern Roundabout) (DS)		
17: New junction north of the Lake (Northern Roundabout)	N/A – Scheme junction	
19: Denmark Road / A47 Katwijk Way	-72%	Negligible
20: B1531 Waveney Drive / Kimberley Road	45%	Minor
22: B1531 Waveney Drive / Riverside Road	N/A – Scheme junction	
23: Kirkley Run / Notley Road	130%	Major

19.5.12 There are two junctions which are the exception. Junction 16: B1531 Waveney Drive / Riverside Road / Durban Road which becomes Junction 18: New junction south of the Lake (Southern Roundabout), which sees a change in flow of 190%. Whilst the magnitude of this impact is deemed 'major', all approaches to the junction operate well below an RFC of 0.85 with the exception of Waveney Drive EB which operates at 0.87 in the 2037 DS PM Peak. The junction has been designed to generate the best capacity available given the land availability constraints within this area, and the slight exceedance of 0.85 has been demonstrated to equate to just one additional PCU on this approach, which is not considered to be a major impact.

19.5.13 Junction 23: Kirkley Run / Notley Road has an average increase in flow of 130%, however this appears as a high proportion as a result of the very low flow on this junction. The turning movements from and to Notley Road increase as a result of the closure of Durban Road to traffic, however the turning traffic flows remain at 60 vehicles per hour at the very most, with an average increase of around 25 vehicles per

hour. The junction operates well within capacity with the highest capacity of 0.24 in 2037 DS PM Peak.

19.5.14 The junctions set out in Table 19-15 will experience a reduction in flow during the operational phase of the Scheme when considered against the DM scenario, and therefore will experience a beneficial impact. The magnitude of the beneficial impact is shown for each junction.

Table 19-13: Junctions which are Beneficially Impacted by the Scheme

Junction	Average change in flow	Magnitude of Impact
3: A47 Waveney Road / Station Square / Commercial Road	-39%	Minor
4: A47 Pier Terrace / B1532 London Road South	-38%	Minor
5: A12 Belvedere Road / Mill Road / Kirkley Rise	-27%	Negligible
10: A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road	-27%	Negligible
11: A1117 Normanston Drive / B1375 Gorleston Road	-23%	Negligible

19.5.15 All other junctions with a major impact, i.e. an RFC which is increased and is over 0.85/PRC which is increased and is over 0.90, are discussed below.

7: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run

19.5.16 This junction operates below operational capacity in the base and DM scenarios, with the exception of B1531 Waveney Drive which exceeds this in the 2037 DM PM Peak. In line with the IEMA Guidelines set out in Table 19-4, as a result of the Scheme this junction sees an average increase in flow of 25% which is deemed a negligible impact; however, this impact causes a number of arms to exceed an RFC of 0.85. Due to this a mitigation package is set out within Section 9 of the TA.

19.5.17 It is proposed to introduce a two-phase improvement to the junction to include an advanced signal on Waveney Drive in 2022 secured through the DCO, with a further improvement to a fully signalised junction in 2037, if required following monitoring of traffic flows and junction capacity.

19.5.18 The improvements to this junction will improve the capacity results, however there will remain an impact on the junction which is classified as a major effect. This is as expected due to Waveney Drive/Victoria Road being so close to the Scheme, and also as a result of the proposed development at the Jeld Wen site adjacent to this junction which forms part of the regeneration of the local area.

8a: A12 Tom Crisp Way / Blackheath Road

19.5.19 This junction operates well within operational capacity in the AM Peak in all scenarios. In the PM Peak, a number of arms exceed operational capacity in 2037 DM. In line with the IEMA Guidelines, this junction sees an average increase in flow of 22% which is deemed a negligible impact; however, the additional traffic using the link to access/egress the new crossing causes a number of arms to exceed an RFC of 0.85,

and the junction operation is anticipated to marginally exceed absolute capacity in 2037 as a result of the Scheme.

19.5.20 It is proposed that Microprocessor Optimised Vehicle Actuation (MOVA) would be installed at the junction to improve the overall operation. MOVA is a method of signal operation which can respond to increased congestion on the network. Introducing MOVA at the A12 Tom Crisp / Blackheath Road junction would release additional capacity within the junction to accommodate growth to 2022 and beyond as a result of the reassignment of trips associated with the Scheme.

19.5.21 During periods of congestion, MOVA will assess which approaches are overloaded and determine a set of signal timings which will maximise the throughput of the junction under current conditions. Installation of MOVA at the junction has the potential to bring it under 90% operational capacity in the 2037 DS scenario. This will be monitored by the Applicant to determine whether any further measures are necessary. The impact on this junction following installation of MOVA will not be significant.

12: Peto Way / Denmark Road / Barnards Way

19.5.22 This junction operates within operational capacity in the base, DM and DS scenarios on a weekday. The results for the Saturday models show that the junction does come under some pressure as a result of high traffic demand for the North Quay Retail Park compared to a weekday, with the Scheme resulting in a 16% increase in flow (a negligible impact).

19.5.23 The queuing would be limited to the North Quay Retail Park arm of the junction, and would therefore be contained within the retail park and off the highway network. Given that the impact is related to a short shopping peak on a Saturday, and queues would be contained off-highway, the impact at this junction is considered to be not significant.

14: A1117 Normanston Drive / A1117 Peto Way

19.5.24 This junction operates within operational capacity in the base, DM and DS scenarios on a weekday and 2022 DM scenario on a Saturday. However, on a Saturday in the 2037 DM and the both DS scenarios, A1117 Normanston Drive/Peto Way exceeds the threshold of an RFC of 0.85. The Scheme results in a 29% increase in flow which is deemed a negligible impact, however Peto Way exceeds theoretical capacity in 2022 and 2037 DS Saturday peak.

19.5.25 Consequently, improvements are proposed to marginally increase the entry capacity of Peto Way through kerb widening, which brings the junction within 100% capacity in both the 2022 and 2037 DS scenarios. Given that the impact is greatest on a Saturday, and not on a weekday, it is considered that this does not constitute a significant effect.

21: A1117 Millennium Way / B1074 Somerleyton Road

19.5.26 The Somerleyton Road approach to the junction is indicated to exceed theoretical capacity in the AM Peak. This approach also exceeds operational capacity in the PM Peak of the base scenario. All other arms are indicated to operate well below capacity in both peak periods.

19.5.27 Whilst the Scheme is only shown to increase average flows by 9% (a negligible impact in line with IEMA Guidelines), the Scheme has a major negative impact on the

operation of the junction; in 2022 junction performance is predicted to decrease and further worsen in 2037. Due to this junction being forecast to operate in exceedance of capacity in 2037, a potential mitigation package is set out within Section 9 the TA (document reference 7.2) to provide an additional lane on the B1704 Somerleyton Road approach, which could be implemented if proven necessary after monitoring.

19.5.28 With the proposed improvements implemented, the junction is indicated to operate within theoretical capacity in the 2022 and 2037 DS scenarios, and with a reduced capacity compared to the DM scenario. As such, it is considered that the impact on this junction is significantly beneficial following the implementation of improvements.

Summary of Junction Capacity Analysis

19.5.29 The Scheme can be considered as embedded mitigation for existing traffic problems within Lowestoft as it will open up a third crossing of Lake Lothing, offering a wider variety of route choice and thereby reducing traffic on existing routes. The implementation of the Scheme will therefore reduce congestion in the town, provide greater journey time reliability for public transport, and increase connectivity for pedestrians and cyclists.

19.5.30 Nevertheless, a small number of junctions require some improvements to reduce the impact of the Scheme, generally on the main approaches to the Scheme where additional traffic is to be expected. Junction 7, Junction 8 and Junction 14 require improvements with the implementation of the Scheme in 2022, with Junction 7 and Junction 8 requiring further monitoring to 2037.

Severance (including new pedestrian severance from community facilities and relief from severance for pedestrians)

New Severance

19.5.31 The assessment upon New Severance considers impacts in the operational phase. A construction phase assessment is not relevant to the Scheme as the operational effects are realised at the point in the construction phase when the severance is created. There are no temporary severance effects created only during construction.

19.5.32 New severance, as assessed against DMRB criteria (see Table 19-1), is unlikely for the town of Lowestoft as a result of the Scheme. As discussed in Chapter 5, the Scheme incorporates measures to support pedestrians and cyclists to use the Scheme. Pedestrian journey routes with origins and destinations across the Lake are expected to reduce as a result of the Scheme, therefore there will be no increases in journey distances as set out in the criteria in Table 19-1 for an effect of new severance.

19.5.33 The inclusion of segregation of pedestrians/cyclists and vehicle traffic will likely encourage pedestrians/cyclists to use the Scheme and will not act as a hindrance or deterrent to journeys north and south of the lake.

19.5.34 Benefits are likely to be experienced by pedestrians and cyclists as a result of the Scheme as the Scheme will provide improved access to the north and south of Lake Lothing. This includes accessing community facilities, shops and schools. Additional crossings points have been proposed for locations on both the north and south of the lake which intend to further support access to facilities and amenities, as shown on the General Arrangement drawings, general accordance with which is secured through the

DCO.

19.5.35 Crossings points will be located on both the north and south side of Lake Lothing (see the General Arrangement Plans). The crossings on Waveney Drive and on the Scheme at the southern roundabout replace existing crossings in those locations. A new crossing will be located across the bell mouth of the New Access Road, which is expected to have an AADT of fewer than 8,000 vehicles per day and therefore a slight effect on new severance. New crossing points are proposed on Denmark Road and Peto Way to connect the new footpaths and cycleways with the existing pedestrian and cycle network. Denmark Road has an AADT of fewer than 8,000 vehicles per day, and will see a reduction in traffic and therefore a reduction in severance at the location of the new crossings.

19.5.36 Peto Way has an increase in AADT of 66% in the DS 2022 scenario (see Table 19-14), with a moderate adverse impact on new severance at the new crossing point in relation to the criteria in Table 19-1, however the crossing point will be connecting new footpaths/cycleways with the Scheme which will present an overall benefit to severance across the town through enhanced connectivity.

19.5.37 As a result of the improved connectivity for all modes, there will be no new severance created by the Scheme.

Relief from Existing Severance

19.5.38 A reduction in traffic congestion is likely to occur as a result of the Scheme in the opening year. The Scheme is likely to encourage journeys across Lake Lothing as the Scheme will alleviate traffic congestion and additional journey time associated with the current highway network in Lowestoft.

19.5.39 During the operational phase the Scheme will reduce congestion on the local network. In particular a benefit can be seen on Mutford Bridge and the A47 Bascule Bridge, which see an average reduction in traffic flows of 46% and 30% respectively in 2022, as shown in Table 19-9.

19.5.40 Traffic data simulating AADT flows in the DM and DS scenarios is shown in Table 19-14, thus allowing an assessment of whether the Scheme is providing relief from severance and the magnitude of such changes.

19.5.41 Table 19-14 shows AADT flows and percentage change in flow in the opening year and assigns a magnitude of change in accordance with the IEMA Guidelines set out in Paragraph 19.3.20. In accordance with the IEMA Guidelines, roads with a DM AADT of fewer than 8,000 vehicles are excluded from the assessment.

19.5.42 As shown in Table 19-14 a number of roads within the study area will see a decrease in traffic flow which generates slight benefits for severance, with A47 Bascule Bridge, A1117 Bridge Road and B1531 Victoria Road seeing a moderate benefit.

19.5.43 The increase in traffic on A12 Tom Crisp Way will have a moderate disbenefit, and B1531 Waveney Drive and Peto Way will experience a substantial disbenefit. The increases in traffic on A1117 Millennium Way are within the slight category of impact. All of these roads are on the direct approaches to the Scheme and it is therefore to be expected that traffic would increase on these links.

19.5.44 Using professional judgement, it is therefore considered that the overall effect on existing severance is beneficial and significant.

Table 19-14 – Relief from Existing Severance (AADT)

Road	DM 2022	DS 2022	% Change	Magnitude Change	DM 2037	DS 2037	% Change	Magnitude Change
A47 Bascule Bridge	29,843	16,795	-44%	Moderate benefit	32,815	20,615	-37%	Moderate benefit
A1117 Bridge Road (Mutford Bridge)	31,606	21,559	-32%	Moderate benefit	35,358	25,177	-29%	Slight benefit
New Bridge	N/A	29,223	N/A	N/A	N/A	33,406	N/A	N/A
B1531 Waveney Drive (Between Waveney Crescent)	8,180	14,267	74%	Substantial disbenefit	9,743	18,100	86%	Substantial disbenefit
B1531 Victoria Road	11,656	535	-54%	Moderate benefit	14,085	7,129	-49%	Moderate benefit
A12 Tom Crisp Way	16,409	25,044	53%	Moderate disbenefit	18,343	27,246	49%	Moderate disbenefit
Kirkley Run	4,069	3,594	N/A – Less than 8,000 veh.		4,780	4,415	N/A – Less than 8,000 veh.	
A1117 Normanston Drive (Between Peto Way and Gorleston Road)	21,017	15,011	-29%	Slight benefit	22,885	17,069	-25%	Slight benefit
Peto Way (Between New bridge and Normanston Drive)	12,564	20,809	66%	Substantial disbenefit	14,771	24,607	67%	Substantial disbenefit
Rotterdam Road (Between Denmark Road and Normanston Drive)	3,090	6,815	N/A – Less than 8,000 veh.		3,434	7,193	N/A – Less than 8,000 veh.	
A47 Battery Green Road	13,677	9,790	-28%	Slight benefit	15,536	12,253	-21%	Slight benefit
A47 Jubilee Way	10,553	9,240	-12%	Slight benefit	11,651	10,465	-10%	Slight benefit
A1144 St. Peter's Street	11,962	10,742	-10%	Slight benefit	12,831	11,825	-8%	Slight benefit
A47 Foxburrow Hill	19,613	18,991	-3%	Slight benefit	23,848	23,528	-1%	Slight benefit
A1117 Millennium Way (Between Park Meadows and Somerleyton Road)	12,477	14,661	18%	Slight disbenefit	14,048	15,728	12%	Slight disbenefit
Denmark Road (Between Katwijk Way and Trafalgar Street)	7,359	1,416	N/A – Less than 8,000 veh.		8,089	1,794	N/A – Less than 8,000 veh.	
A47 Katwijk Way	2,703	2,984	N/A – Less than 8,000 veh.		2,955	3,292	N/A – Less than 8,000 veh.	

Driver Stress and Delay

19.5.45 During the operational phase of the Scheme it is likely that levels of driver stress will be reduced. The three components of driver stress set out in DMRB are (see Paragraph 19.3.21):

- Frustration;
- fear of potential accidents; and
- uncertainty of the route being followed.

19.5.46 Frustration can occur when speed consistency is poor, and as speed falls. Transport modelling analysis of the Scheme is contained within the TA (document reference 7.2) and shows in Section 7.6 that across the study area speeds will increase by between 1.23 and 3.72mph, reducing frustration for drivers. Detail on journey time reliability is provided within the Economics Report (document reference 7.3) and shows that reliability will increase across the network. Increased journey time reliability infers increased speed consistency, thereby reducing frustration as a part of driver stress.

19.5.47 Fear of a potential accident relates to the presence of other vehicles, inadequate sight distances, and the likelihood of pedestrians stepping into the road. The design of the Scheme includes adequate sight lines at all new junctions, footways of widths that meet or exceed the required standards, and crossing points along the desire lines for pedestrians. Together these measures will not increase the fear of a potential accident compared to the DM scenario. The Scheme will also reduce congestion, spreading traffic over three bridges in the town rather than two, thereby reducing fear caused by the presence of vehicles.

19.5.48 Uncertainty for drivers of the route being followed will not increase compared to the DM scenario and is likely to reduce as a result of a comprehensive strategy of directional signage across the town following implementation of the Scheme secured through the DCO.

19.5.49 The delay to drivers as a result of the Scheme will reduce across the local and strategic networks overall. The delay along a number of key north-south and east-west movements is provided using VISSIM microsimulation modelling and the delay at junctions is assessed using JUNCTIONS8 and LINSIG software. The full results are detailed within Section 7 and Section 8 of the TA.

19.5.50 Using the analysis set out above along with professional judgement, it is therefore considered that there will be a significant beneficial impact upon driver stress and delay as a consequence of the Scheme.

Pedestrian and Cyclist Amenity, Journey Length and Delay

19.5.51 It is anticipated that the number of pedestrian and cycle journeys on the network in the vicinity of the Scheme will increase. Taking into account the new connection between the north and south of Lowestoft, the overall impact for pedestrians and cyclists is expected to be beneficial. There will be a benefit to the pedestrian and cycle environment around the A47 Bascule Bridge (where there is already a significant pedestrian presence) created by the reduction in vehicles as a result of the redistribution of traffic to the Scheme.

19.5.52 Census data has been analysed within the TA (see Section 11 of Application Document 7.2) to further understand the impact of the Scheme on pedestrians and cyclists. The Scheme has little to no impact on pedestrians or the potential for cycle trips to / from the Town Centre, given that the majority of pedestrians and cyclists would continue to use the A47 Bascule Bridge due to its proximity to the Town Centre. Figures 19.5 to 19.16 show the isochrones (i.e. the time taken) for journeys by cycle and by foot both with and without the Scheme.

19.5.53 The Scheme will, however, put an additional 2,884 people within walking distance and 6,942 people within cycling distance of the employment areas north of Lake Lothing. For the employment areas south of Lake Lothing, the Scheme will put an additional 2,580 pedestrians and 2,212 cyclists within walking/cycling distance. This analysis clearly highlights the improved pedestrian and cyclist connectivity and reduced severance as a result of the Scheme.

19.5.54 Analysis has also been completed within Section 11 of the TA and is summarised in Table 19-15 and Table 19-16. It is anticipated that there will be an additional 519 pedestrian trips and 214 cyclists' trips per day as a result of the Scheme.

Table 19-15 – Future pedestrian trips on the Scheme

Pedestrian use	Pedestrians
Existing pedestrian trips re-routing to the Scheme	4,207
New pedestrian trips using the Scheme	519
Totals	4,726

Table 19-16 – Future cyclist trips on the Scheme

Cycle use	Cyclists
Existing cyclists re-routing to the Scheme	1,206
New cyclists using the Scheme	214
Totals	1,420

19.5.55 The IEMA Guidelines define pedestrian amenity as the relative pleasantness of a journey and can include fear and intimidation if they are relevant. Amenity is influenced by traffic volumes and composition along with footway width and pedestrian activity. The IEMA Guidelines suggest tentative thresholds of significance would be where the traffic flow is halved or doubled (see 19.3.30).

19.5.56 The Scheme will positively impact the pleasantness of journeys on foot or by bicycle, by introducing a new crossing route over Lake Lothing with shared and segregated footway/cycleways, separated from vehicle traffic. The Scheme will reduce journey times for many users through more direct routings, and will encourage pedestrian and cycling trips where previously distances were too long to be considered.

19.5.57 Furthermore, the expected reduction in vehicle traffic on the A47 Bascule Bridge and Mutford Bridge will be beneficial for pedestrians and cyclists using these routes. The AADT traffic flow on A47 Bascule Bridge reduces by 44% in 2022 (37% in 2037) and on Mutford Bridge by 32% in 2022 (29% in 2017), these are substantial reductions in traffic that will increase the pleasantness and safety of the route for pedestrians and

cyclists. None of the road links experience a doubling of traffic flows and therefore the significance of the impact on pedestrian amenity is assessed to be negligible.

19.5.58 An analysis of pedestrian journey times between origins and destinations on the north and south sides of Lake Lothing is included in the TA, and in Table 19-17. The destinations were selected during the assessment as key trip attractions for local residents.

Table 19-17 – Pedestrian Distances to Key Destinations

Origin	Destination	Existing Route		Future Route		Reduction	
		Distance (km)	Time (mins)	Distance (km)	Time (mins)	Distance (km)	Time (mins)
Burnham Way (south of Lake Lothing)	North Quay Retail Park	3.5	44	1.9	24	1.7	20
	Lowestoft 6 th Form College	3.4	43	2.0	25	1.4	18
Rotterdam Road (north of Lake Lothing)	Waveney District Council	2.5	31	0.9	11	1.6	20
	Asda	2.0	25	1.2	15	0.8	10

19.5.59 As previously stated (Paragraph 19.3.34) there will be no changes and therefore no impact on the ProW network as a result of the Scheme.

19.5.60 The Scheme will generate increases and decreases in the number of vehicle movements on the local road network. In general, increases in traffic levels can lead to greater increases in delay to pedestrians seeking to cross roads. The IEMA Guidelines recommend that the effects on pedestrian delay are unlikely to be material, if a road has two-way traffic flow of less than 1,400 vehicles per hour.

19.5.61 As detailed in Table 19-8, only five roads within the study area will see an increase in traffic and have a flow of over 1,400 vehicles per hour. These are the Scheme, A12 Tom Crisp Way, Peto Way and Waveney Drive (2037 PM peak only), and A1117 Millennium Way (2037 AM Peak only). Pedestrian crossing points are included on the Scheme, Peto Way, Waveney Drive and A1117 Millennium Way. A12 Tom Crisp Way is a key local distributor link which is expected to carry a high level of traffic, with a shared footway/cycleway along the entire length and four toucan crossings. Using professional judgement, as advised by IEMA Guidelines, it is considered that there is not a significant impact on pedestrian delay.

19.5.62 During the operational phase of the Scheme there will be beneficial effects upon travellers as the Scheme provides an additional crossing point of Lake Lothing, reducing travelling time and reducing the length of some journeys where a more direct route is possible. The Scheme will bridge a gap in the local highway network of 600m which in reality requires a journey of 2.4km, reducing journey lengths by 1.8km for some users.

19.5.63 NMUs will benefit from better access to community facilities as a result of the Scheme (Figure 19.3). Access to Lowestoft hospital, retirement homes and religious facilities will be improved as the Scheme offers an alternative and in some cases more direct

route. Based upon the analysis set out above and application of professional judgement, it is considered that there will be a significant beneficial impact upon pedestrian and cyclist amenity, journey length and delay as a consequence of the Scheme.

Collisions and Safety

19.5.64 The TA (document reference 7.2) assesses the most up to date five-year collision records that are available, and a COBALT assessment was undertaken to assess the Scheme over a 60-year period (2022 to 2081) with an opening year of 2022 and design year of 2037.

19.5.65 The analysis estimates that 169 collisions will be saved over the 60-year appraisal period as a result of the Scheme, along with a saving of 294 casualties of varying levels of severity. The detail of the COBALT analysis is contained in the Economics Report (document reference 7.3) submitted with the DCO application.

19.5.66 Utilising the PIC analysis set out above and professional judgement, it is clear that there will be significant beneficial effects from the Scheme in relation to reduced collisions/enhanced safety around the network.

Fear and Intimidation

19.5.67 There will be an increase in traffic associated with the operational phase of the Scheme on a limited number of links with a number of roads within the town seeing a reduction in traffic, as shown in Table 19-18 along with the impact classification of the links in line with the IEMA Guidelines. Table 19-19 shows the change in the impact of fear and intimidation during the operational phase of the Scheme.

Table 19-18 – 2022 and 2037 DM and DS Peak Hours Traffic Flows (AM and PM) – Fear and Intimidation

Road	2022 (Opening Year)				2037 (Design Year)			
	AM Peak (08:00-0900)		PM Peak (17:00-18:00)		AM Peak (08:00-0900)		PM Peak (17:00-18:00)	
	DM	DS	DM	DS	DM	DS	DM	DS
A47 Bascule Bridge	2,321	1,252	2,846	1,575	2,544	1,492	3,095	1,915
A1117 Bridge Road (Mutford Bridge)	2,369	1,598	2,691	1,981	2,706	1,851	3,000	2,227
The Scheme	N/A	2,271	N/A	2,460	N/A	2,568	N/A	2,729
B1531 Waveney Drive (Between Waveney Crescent)	656	1,107	732	1,303	809	1,364	791	1,563
B1531 Victoria Road	850	440	981	519	1,039	521	1,152	658
A12 Tom Crisp Way	1,496	2,132	1,426	2,113	1,596	2,282	1,567	2,250
Kirkley Run	288	322	455	414	342	388	519	452
A1117 Normanston Drive (Between Peto Way and Gorleston Road)	1,635	1,195	1,635	1,220	1,878	1,419	1,727	1,337
Peto Way (Between New bridge and Normanston Drive)	824	1,634	1,064	1,727	994	1,922	1,225	2,026
Rotterdam Road (Between Denmark Road and Normanston Drive)	225	497	259	607	249	539	304	614
A47 Battery Green Road	1,007	777	1,405	979	1,101	908	1,565	1,236
A47 Jubilee Way	774	663	1,001	840	790	711	1,188	990
A1144 St. Peter's Street	972	961	1,101	999	1,066	1,014	1,174	1,077
A47 Foxburrow Hill	1,554	1,531	1,866	1,865	1,826	1,839	2,214	2,224
A1117 Millennium Way (Between Park Meadows and Somerleyton Road)	1,077	1,332	1,133	1,220	1,290	1,502	1,235	1,275
Denmark Road (Between Katwijk Way and Trafalgar Street)	612	110	676	127	698	449	1,320	474

Road	2022 (Opening Year)				2037 (Design Year)			
	AM Peak (08:00-0900)		PM Peak (17:00-18:00)		AM Peak (08:00-0900)		PM Peak (17:00-18:00)	
	DM	DS	DM	DS	DM	DS	DM	DS
A47 Katwijk Way	368	367	236	284	398	381	261	311

*Colour coding of impacts – red Extreme, orange Great, yellow Moderate, green Low

Table 19-19 – 2022 and 2037 Fear and Intimidation Changes in Impact

Road	2022 (Opening Year)	2037 (Design Year)	Pedestrian Protection Factors
A47 Bascule Bridge	Reduction	Reduction	-
A1117 Bridge Road (Mutford Bridge)	Reduction	No Change	-
The Scheme	N/A	N/A	0.5m safety strip between pedestrians and vehicles
B1531 Waveney Drive (Between Waveney Crescent)	Increase	Increase	
B1531 Victoria Road	Reduction	Reduction	-
A12 Tom Crisp Way	Increase	Increase	Existing shared use pedestrian/cycleway with 0.5m safety strip
Kirkley Run	No Change	No Change	-
A1117 Normanston Drive (Between Peto Way and Gorleston Road)	No Change	Reduction	-
Peto Way (Between New bridge and Normanston Drive)	Increase	Increase	New shared use pedestrian/cycleway with 0.5m safety strip
Rotterdam Road (Between Denmark Road and Normanston Drive)	Increase	Increase	Monitoring of traffic flows included within the Scheme.
A47 Battery Green Road	Reduction	No Change	-
A47 Jubilee Way	No Change	No Change	-
A1144 St. Peter's Street	No Change	No Change	-
A47 Foxburrow Hill	No Change	No Change	-
A1117 Millennium Way (Between Park Meadows and Somerleyton Road)	Increase	No Change	Shared use pedestrian/cycleway with 0.5m safety strip
Denmark Road (Between Katwijk Way and Trafalgar Street)	Reduction	Reduction	-
A47 Katwijk Way	No Change	No Change	-

**Colour coding of changes – red; increased, orange; no change, green; reduced*

19.5.68 Of the seventeen links assessed (with the Scheme excluded), as listed in paragraph 19.3.14, it can be seen from Table 19-19 that eleven links will see either no change or a reduction in fear and intimidation, and five will see an increase. In 2037, twelve links will see either no change or a reduction in fear and intimidation and four will see an increase.

19.5.69 However, as detailed in paragraph 19.3.40, fear and intimidation also needs to be assessed on the proximity of the link to pedestrians and/or lack of protection caused by factors such as narrow pavement widths.

19.5.70 The Scheme, A1117 Millennium Way, Peto Way and A12 Tom Crisp Way all have or will have separate shared use footway/cycleways with a 0.5m (minimum) safety strip protecting pedestrians from vehicles; therefore, only Waveney Drive will have an increase in fear and intimidation that is considered to be significant, with a change from moderate to great in 2022 PM peak and in 2037 in both peaks, as shown in Table

19-18. The increase in traffic flow on Waveney Drive is to be expected as it is the approach to the Scheme from the south of Lake Lothing, connecting with the southern roundabout.

19.5.71 With regard to traffic speed, all of the links assessed will include traffic over 20mph therefore all links will be classed as ‘extreme’ for fear and intimidation in both the DM and DS scenarios. With the classification of links unchanged between the DM and DS scenarios, it is considered that the influence of speeds as a result of the Scheme will not have a significant effect on fear and intimidation.

19.5.72 Based upon the analysis completed above and professional judgement, it is considered that the majority of links within the study area will experience significant beneficial effects in relation to fear and intimidation, with the exception of Waveney Drive which will see an adverse impact which is significant.

Views from the Road

19.5.73 The view from the road is likely to be limited to the Zone of Theoretical Visibility as identified in Figure 10.2 which shows the view of HGVs upon the Scheme (assuming the view is 4.5m above the bridge deck). It is noteworthy that this view will be an ‘open view’ as defined by the DMRB given that it will be a view restricted largely by existing landscape features rather than features of the Scheme. Further information is provided in Chapter 10.

19.5.74 Given the short time period that vehicles will be travelling on the Scheme it is unlikely that there will be opportunities for prolonged views, although cyclists and pedestrians will be able to appreciate the view of Lake Lothing for a greater duration.

19.5.75 The townscape character of Lake Lothing, as identified in Chapter 10, is of low sensitivity to change and using the criteria within Table 19-3, there will be a low magnitude of impact arising from the new views from the road that will be experienced, which does not constitute a significant effect.

19.6 Mitigation Measures

Mitigation Measures – Operational Phase

19.6.1 The impacts of the Scheme on the local highway network in the operational phase in terms of junction capacity are considered in detail within the TA (document reference 7.2).

19.6.2 A package of mitigation measures will be provided by the Scheme to ensure that junctions will operate within theoretical capacity in the future year with the Scheme operational. The junction improvements are shown in Table 19-20.

Table 19-20 – Improvement measures

Junction	Improvement measures
Junction 7 – B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run Mini Roundabout	<ul style="list-style-type: none"> • Advanced traffic signal on Waveney Drive arm in 2022 • Full signalisation in 2037 if proven necessary following monitoring.

Junction	Improvement measures
Junction 8a, 8b and 8c – A12 Tom Crisp Way / Blackheath Road signalised junction	<ul style="list-style-type: none"> Introduction of MOVA urban traffic control system in 2022, and further monitoring of junction performance following this.
Junction 14 – A1117 Normanston Drive / A1117 Peto Way roundabout	<ul style="list-style-type: none"> Minor geometric improvements to Peto Way to provide additional entry capacity.
Junction 21 – A1117 Millennium Way / B1074 Somerleyton Road Signalised Junction	<ul style="list-style-type: none"> Additional entry lane on Somerleyton Road in 2037, if proven necessary following monitoring.

19.6.3 Further information regarding the improvements to accommodate the operational phase of the development is provided in the Section 9 of the TA (document reference 7.2).

Summary of Residual effects

19.6.4 The changes in daily traffic during the construction and operational phase of the completed development is anticipated to be negligible where traffic increases on the highway network within the study area, and beneficial where traffic decreases, other than on the roads immediately surrounding the Scheme. After mitigation, including improvements to junction capacities, the Scheme will have a permanent significant beneficial effect on: severance (including new pedestrian severance from community facilities and relief from severance for pedestrians); driver stress and delay; pedestrian and cyclist amenity, journey times and delay; collisions and safety; and views from the road.

19.6.5 A summary of the Scheme impacts is contained in Table 19-21.

Table 19-21: Summary of Impacts

Topic	Effect	Sensitivity of Receptor	Magnitude of Impact	Nature	Significance
Post Construction	Severance	Medium	Major	Beneficial	Major
	Driver delay and stress	Medium	Moderate	Beneficial	Moderate
	Pedestrian and cycle amenity, journey length and delay	Medium	Minor	Beneficial	Minor
	Collisions and safety	Medium	Moderate	Beneficial	Moderate
	Fear and Intimidation	Medium	Moderate	Beneficial	Moderate
	View from the road	Low	Minor	Adverse	Minor

19.7 Summary, Conclusions and Effects

19.7.1 Lake Lothing and the East Suffolk Line sever the north and south communities of Lowestoft and severely restrict movement of general traffic, buses, pedestrian and cyclists. This severance generates longer, less direct, less efficient journeys, and due to the restricted number of crossing points for Lake Lothing (at Mutford Bridge and the

A47 Bascule Bridge), traffic becomes congested and queuing forms emanating from these 'pinch points'.

- 19.7.2 This traffic congestion and queueing is severely exacerbated by the opening of the bridges (the bridges open to allow both commercial port vessels and recreational vessels to pass), particularly if this coincides with the morning and evening peak periods of travel demand.
- 19.7.3 Apart from the transport problems caused by the constraints of Lake Lothing and the East Suffolk Line, other baseline transport conditions are adequate, with a reasonable provision of public transport, walking and cycling infrastructure and services.
- 19.7.4 The Scheme mitigates the effects of these pinch points on the network and constraints to north/south movements of traffic and people, particularly at the A47 Bascule Bridge, to reduce traffic congestion and severance, and to improve travel journey times on the strategic highway and local roads.
- 19.7.5 The impacts of the Scheme have been assessed within the TA (document reference 7.2). This includes analysis of the capacity and operation of a junctions across the town, which concluded that the Scheme has a significant positive effect on transport and the traffic operation of Lowestoft and the wider strategic highway network, improving operational performance (queueing, congestion, and journey times).
- 19.7.6 The capacity of existing junctions in the vicinity of the Scheme has been assessed to determine whether they can accommodate the increase in traffic associated with traffic re-routing to the Scheme. Amendments to layouts are proposed in the TA and included in the ES and secured through the DCO, where required, to reduce the impact of the Scheme. In addition, the northern and southern roundabouts have been designed to allow them to operate within an RFC of 0.85 where possible and practical to do so, both at the time of Scheme opening, and fifteen years after in the 'design year' in 2037.
- 19.7.7 Following the assessments of the Scheme, it is likely that the overall impact on: severance (including new pedestrian severance from community facilities and relief from severance for pedestrians); driver stress and delay; collisions and safety; and fear and intimidation will be significantly beneficial except on Waveney Drive where it will be significantly adverse. It is considered that there will be minor beneficial impact on pedestrian cycle amenity, journey length and delay, and a minor adverse impact on views from the road.

20 Cumulative Effects

20.1 Scope of the Assessments

Introduction

- 20.1.1 This chapter presents the findings of the Cumulative Effects Assessment (CEA) of the Scheme on the receiving environment during both the construction and operational phases. It is supported by Figure 20.1.
- 20.1.2 The focus of this CEA is to assess potential cumulative effects of the Scheme interacting with other developments as a result of multiple actions on receptors and resources over time which are generally additive or interactive. This assessment has been based upon Cumulative Effects Assessment Advice Note 17v4 (see 1.2.25).
- 20.1.3 Although the term cumulative is not defined in either the EIA Directive or the 2009 Regulations, the DMRB in Volume 11, Section 2, Part 5 identifies two types of cumulative impact:
- *the combined action of different environmental topic-specific impacts upon a single resource/receptor, which are termed ‘in combination’ effects (synergistic); and*
 - *the combined action of a number of different projects, cumulatively with the project being assessed, on a single resource/receptor, which are termed ‘cumulative’ effects (additive). This can include multiple impacts of the same or similar type from a number of projects upon the same receptor/resource.*
- 20.1.4 Cumulative impacts considered here can be defined as impacts resulting from incremental changes caused by other reasonably foreseeable projects together with the Scheme.
- 20.1.5 As requested by PINS, in Advice Note 17v4, assessments of interrelationships between topics (e.g. air quality and ecology) has been assessed as part of specialist topic chapters in the ES.

Study Area

- 20.1.6 The study area for the assessment has been determined following consideration of the likely significant effects that could reasonably arise from the projects that have been considered alongside the Scheme. The location of these projects is shown in Figure 20.1. Suffolk County Council and Waveney District Council, in their combined response to the Scoping Report, identified agreed that the approach to assessing cumulative impacts was appropriate. Since the Scoping Report was published, further information on the Great Yarmouth Third River Crossing (GYTRC) has been made public and this has been brought within the study area of the Scheme.

20.2 Directives, Regulations and Relevant Policy

EU EIA Directive

- 20.2.1 The EIA Regulations implement the EU Directive “*on the assessment of the effects of certain public and private projects on the environment*” (usually referred to as the EIA

Directive) for the Planning Act (2008) regime.

20.2.2 Schedule 3 paragraph 14 of the EIA Regulations, which refers to the selection criteria for screening Schedule 2 development, states that *'the characteristics of the development must be considered having regard, in particular, to... ..(b) the cumulation with other development'*.

20.2.3 In relation to inclusion within an ES, Schedule 4 of the EIA Regulations states that a description of likely significant effects *'should cover the direct effects and any....cumulative...positive and negative effects of the development'*.

National Policy Statement for National Networks

20.2.4 The National Policy Statement for National Networks (NNNPS) states that the SoS should take into account "potential adverse impacts, including any longer term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts". The Examining Authority should consider how significant cumulative effects and the interrelationships between effects might as a whole affect the environment, even though they may be considered on an individual basis with mitigation measures in place.

National Policy Statement for Ports


20.2.5 The National Policy Statement for Ports (PNPS) provides a framework for the decisions on proposals for new port development. It applies, wherever relevant, to associated development, such as road and rail links, for which consent is sought alongside that for the principal development.

20.2.6 The PNPS specifically identifies adverse cumulative impacts upon health as a topic for consideration with an ES, as well as the cumulative effects from flooding and the potential shortage of construction workers.

Planning Inspectorate Advice Note 17

20.2.7 This Advice Note identifies the nature of projects (referred to as 'other developments' in the Advice Note) that should be within a CEA. They include a tiered selection of projects which are shown in Table 20-1.

Table 20-1 – ‘Other Development’ for Inclusion in CEA

Tier 1	Under construction	Decreasing level of detail likely to be available 
	permitted application(s), whether under the PA2008 or other regimes, but not yet implemented;	
	submitted application(s) whether under the PA2008 or other regimes but not yet determined;	
Tier 2	Projects on the Planning Inspectorate’s Programme of Projects where a scoping report has been submitted.	
Tier 3	Projects on the Planning Inspectorate’s Programme of Projects where a scoping report has not been submitted.	
	Identified in the relevant Development Plan (and emerging Development Plans – with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited;	
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.	

20.2.8 Advice Note 17 also identifies that impacts may not be fully assessed due to a lack of information and in such a situation a pragmatic approach to what is feasible and reasonable should be undertaken.

20.3 Methods of Assessment

20.3.1 At the scoping stage a list of ‘other developments’ was collated based upon information available from WDC, SCC, PINS and the MMO. In accordance with Stage 1 of the CEA process set out in Advice Note 17, this list of proposed developments to be considered in the assessment of cumulative effects was compiled through searches of local authority planning portals for planning applications; a review of allocated and proposed sites in local plans; and direct consultation with local authorities whose areas are predicted potentially to be affected by the Scheme.

20.3.2 The response by the SoS within the Scoping Opinion (Appendix 6B) noted the selection of the six projects, did not identify any further projects for inclusion, although the SoS recommended that the list is updated as appropriate during the preparation of the application.

20.3.3 It is noteworthy that, since the scoping stage, the Riverside Road Local Development Order (LDO) has expired and therefore is not considered further in this assessment. The remaining five projects, as well as the GYRTC (see 20.1.6) outlined in the Baseline

Environment (Section 20.4) therefore form the basis of the CEA.

The CEA Process

20.3.4 Advice Note 17v4 sets out a four stage approach to present the outcomes of the CEA. Table 20-2 below illustrates these four stages.

Table 20-2 – The CEA Stages

CEA Stage	Main Activities
Stage 1 – Establishing a Zone of Influence (Zoi) for the Scheme and identifying a long list of 'other development',	Identifying a long list of 'other development' that is proposed in the vicinity of the Scheme.
Stage 2 – Identify a shortlist of 'other development'.	Identifying the nature of the 'other development' and assessing whether there is the potential for significant cumulative effects.
Stage 3 – Information gathering	Collation of information on the 'other development' identified at Stage 2
Stage 4 – Assessment	Review each of the 'other developments' in turn to assess whether cumulative effects may arise. Mitigation measures should be identified in relation to adverse cumulative effects.

20.3.5 Rejected planning applications that are not subject to appeal were not considered as their implementation is not considered to be reasonably foreseeable.

20.3.6 The assessment considers the capacity of environmental resource and receptors to accommodate changes that are likely to occur. This includes the duration, extent, type (additive or synergistic), frequency, value and resilience of the receptor and likely mitigation.

20.3.7 When considered in isolation environmental effects of a single resource or receptor may not be significant. However when individual effects are considered in combination the resulting cumulative effect may be significant.

Significance of Effects

20.3.8 The significance of the effect is formulated as a function of the receptors or a resources' environmental value (or sensitivity) and the magnitude of the project impact. Advice Note 17v4 states "*The significance criteria used to assess likely cumulative effects should consider the capacity of environmental resources and receptors to accommodate changes that are likely to occur. The terminology used to determine significance should be explicit and ensure a clear understanding of the outcome of the CEA.*"

20.3.9 Significance of effect has been identified using the criteria within the DMRB

20.3.10 In line with the DMRB, the following have been considered in determining the significance of cumulative effects;

- Which receptors/resources are affected;
- How will the activity or activities affect the condition of the receptor/resource;
- What are the probabilities of such effects occurring; and

- What ability does the receptor/resource have to absorb further effects before change becomes irreversible?

Study Area

20.3.11 Advice Note 17v4 states that the “*scale and nature of NSIPs will typically dictate a broad and temporal zone of influence (ZOI) for an NSIP*”. For individual environmental topics the ZOI is defined by relevant institutional guidelines which are discussed within each respective chapter. However, in determining a ZOI for ‘other developments’ that could give rise to cumulative effects when interacting with the Scheme it will be necessary to consider each development on a case-by case basis. A desk study was completed to examine and record developments that as a result of their *scale and nature* or *temporal scope* may cause a cumulative effect with the Scheme.

20.3.12 It is of note that cumulative assessment is intrinsically integrated within the operational phase assessment of road traffic noise, air quality and traffic and transport. This is due to these assessments incorporating both an opening year (2022) and a design year (2037) assessment which incorporates the change and growth in traffic due to developments that may be constructed within that 15 year timescale.

20.3.13 Operational traffic impacts are therefore not included within this cumulative assessment because they have already been incorporated within Chapters 8, 13 and 19.

20.3.14 Considerations for temporal scope have included construction, operation and decommissioning programs to establish whether there is overlap and any potential for interaction.

20.3.15 The scale and nature of developments identified within the ZOI is included where it is considered that interactions between developments and the Scheme could result in a cumulative effect.

Synergistic Assessment Methodology

20.3.16 An assessment of synergistic (in-combination) environmental impacts of the Scheme (for example, changes in air quality, road traffic noise and visual impact) on sensitive receptors has been undertaken. The assessment of synergistic effects ensures that the ES is not a series of separate assessments collated into one document, but rather a comprehensive assessment drawing together the environmental effects.

20.3.17 The significance of the synergistic effects has been determined by considering the following factors:

- Which receptors are affected; and
- How the Scheme affects the condition of the receptor.

Temporal scale

20.3.18 The assessment of synergistic effects considers likely significant effects of:

- the change in noise and air quality at ecologically designated sites;
- the effect of noise upon tranquillity at The Broads National Park; and
- the effect of noise upon the setting of designated heritage assets.

Receptors

20.3.19 The receptors considered in the ES have been sub-divided into the following groups:

- human – residents, including sensitive receptors and vulnerable groups;
- ecological receptors – protected species and existing habitats, including water bodies; and
- heritage assets.

20.3.20 Within these broad groups, individual receptors or groups of receptors that are adversely affected by the proposals have been considered. The potential effects acting upon these receptors are changes in noise, air quality, visual intrusion and traffic. The assessment considers significant adverse residual effects, after mitigation has been taken into account. Receptors that are significantly adversely affected by two or more residual effects have been identified and the range of effects likely to impact upon specific groups of receptors is demonstrated in Table 20-3.

Table 20-3 – Interaction between topics on receptor groups

Receptors	Air Quality	Noise and Vibration	Visual Intrusion (including light)	Approach to assessment of interactions
Human	Y	Y	Y	Covered in this chapter.
Ecological Receptors	Y	Y	N	All of these effects and interactions are dealt with in Chapter 11 Ecology and are therefore not considered here
Landscape designations	N	Y	N	Covered in Chapter 10 Townscape and Visual Impacts.
Heritage Assets	Y	Y	Y	All of these effects and interactions are covered in Chapter 9 Cultural Heritage and are therefore not considered here

20.3.21 Further assessment of the synergistic effects on human (residential) receptors has been undertaken and is discussed in this chapter. The synergistic effects on residents have been assessed in relation to air quality, noise and visual impact.

20.3.22 Whilst water quality may have an impact on human receptors' health when combined with air pollution and/or noise; it is not considered in the synergistic effects assessment, as appropriate mitigation measures have been incorporated in the Scheme design and construction methodology to reduce impacts on groundwater and surface water quality, as described in Chapter 12 Geology and Soils, Chapter 17 Road Drainage and Water Environment, and Chapter 18 Flood Risk.

20.3.23 The threshold criteria defined in Table 20-4 have been used to identify those residential receptors which may experience synergistic effects from air quality, visual and noise impacts. Significance descriptors are derived from the residual impact assessments in the relevant topic chapters, (taking into consideration mitigation measures that have

been identified in those chapters, albeit the visual mitigation, where present, will take some time to mature).

20.3.24 Residential receptors with an assessment score above these criteria thresholds for two or more impacts have been taken forward in the assessment of synergistic effects.

Table 20-4 – Significance criteria thresholds for synergistic effects assessment

	Air Quality	Noise	Visual Intrusion
Threshold for consideration in synergistic effects assessment (significance of residual effects criteria)	Residential receptors which experience a small, medium or large magnitude of change in relation to construction and operational dust emissions or changes above the air quality objective from vehicle emissions	Residential receptors which experience minor, moderate or large adverse residual effect during construction and/or at opening	Residential receptors which experience a slight, moderate adverse or large adverse residual visual effect during construction, and/or at opening.

20.4 Baseline Environment

20.4.1 Six projects form the basis of this cumulative assessment are shown in Figure 20.1 providing perspective on their geographical position in relation to one another and to the Scheme. These projects are as follows:

- East Anglia Array;
- Sizewell C New Nuclear Power Station;
- Sanyo Development Site;
- Brooke Peninsula and Jeld Wen Development;
- Lowestoft Tidal Barrier; and
- GYRTC.

20.4.2 In November 2016, the Secretary of State issued a Scoping Opinion for the proposed Norfolk Vanguard Offshore Windfarm. That report notes that offshore construction is not proposed to commence until 2023, although landfall ducts could be installed from 2022, however this connection is to Necton, some 70km northwest of Lowestoft. In June 2017, the Secretary of State issued a Scoping Opinion for the proposed Norfolk Boreas Offshore Windfarm. That report notes that offshore and onshore construction is not proposed to commence until 2024, and therefore will not coincide with the Scheme and is not considered further in this assessment.

20.4.3 The East Anglia Array is a wind farm development that consists of four phases, although it is noteworthy that two of these phases are proposed to be combined into a single DCO submission.

- East Anglia ONE received development consent in August 2017. Construction of this project is not expected to overlap significantly with the Scheme as construction of the onshore elements commenced in May 2017, the offshore

works are due to commence in August 2018, first power achieved in 2019 and full operation during 2020⁶⁶;

- East Anglia THREE received development consent in August 2017. The Environmental Statement submitted with the application states that “Construction of the proposed East Anglia THREE project...would commence between 2020 and 2025; and
- A scoping opinion for East Anglia TWO and East Anglia ONE NORTH was issued by the Secretary of State in December 2017. The Scoping Opinion for both projects notes that “*Onshore construction works are anticipated to take approximately 18 to 24 months*”. However, no details on the dates of the construction programme for either project are yet available although a combined PEIR for both East Anglia TWO and East Anglia ONE North is proposed for late 2018 with submission of the East Anglia TWO DCO in 2019 and East Anglia ONE NORTH DCO in 2020.

20.4.4 The scope of the cumulative assessment therefore includes the East Anglia THREE proposed project because East Anglia TWO and East Anglia ONE North are envisaged to be still undergoing consultation at the time that the construction phase of the Scheme commences.

20.4.5 While the programme for Sizewell C is to be confirmed, the Stage 2 consultation undertaken in November 2016 – February 2017 suggested a peak (or middle) construction year of 2024 for the 7-9 year construction period. However, with another stage of consultation still anticipated for this project, it is uncertain at this stage what construction activities will be undertaken during the construction of the project. It has therefore been assumed for the purposes of this cumulative assessment that construction of Sizewell C will commence during the first year of the construction of the Scheme and therefore construction intensity of Sizewell C concurrent to the Scheme is likely to be limited.

20.4.6 Sanyo Development Site and Brooke Peninsula and Jen Weld both have planning permission and the latter has involved submitting reserved matters applications and discharge of condition applications in early 2018. At the time of publishing this ES, a reserved matters application had been submitted for Phase 1 of the project which covers a limited number of homes (70 in total) at the Waveney Drive entrance to the project.

20.4.7 The proposed Lowestoft Tidal Barrier is a flood defence scheme that is being proposed as part of the Lowestoft Flood Risk Management Project. The PEIR for the proposed project was published in November 2017 as part of a programme of obtaining approval for the works through a Town and Country Planning Act application for the terrestrial based flood wall elements, and a Transport and Works Orders Act (TWAO) application for the elements affecting navigation. Subject to approvals, the project aims for completion in 2020/21⁶⁷.

⁶⁶ Information from Scottish Power Renewables website

⁶⁷Lowestoft Flood Risk Management Project

-
- 20.4.8 The GYRTC is a proposed bridge over the River Yare in Great Yarmouth that will open to allow continued vessel movements to the Port of Great Yarmouth and the Broads National Park. The proposed project has been designated as a NISP and a scoping opinion for the GYRTC was published in May 2018.
- 20.4.9 Table 20-5 below provides available information that has been sourced on the six projects and identifies whether it is appropriate to progress the assessment to stages 3 and 4 (as outlined in Table 20-2). To inform the assessment the table includes information on the following, which is recommended in CEA Advice Note 17v4:
- Project type;
 - Description of project;
 - Distance from the Scheme; and
 - Likely cumulative impacts.
- 20.4.10 Information collated in Table 20-5 below was extracted from a multitude of sources including, *inter alia*: Scoping Reports, PEIRs Environmental Statements, Environmental Reports, Consultation Reports and Sustainability Appraisals.
- 20.4.11 The environmental aspects considered in Table 20-5 below have been limited to the potential cumulative impacts associated with employment, traffic and construction impacts upon air quality and noise. All other environmental aspects have been excluded from the assessment as the size and temporal scope of the Scheme or project was deemed to have limited or no interactions with environmental aspects of other developments.
- 20.4.12 The assessment of operational traffic has been excluded from this CEA because operational traffic from the Tidal Barrier, the East Anglia THREE and Sizewell C projects is unlikely to affect the highway network adversely in the study area for the Scheme, given the nature of those developments and their distance from the Scheme. As stated in Paragraph 20.3.12 The traffic model that the operational air quality, noise, traffic and water environment assessments has been based upon (and considered in chapters 8, 13, 19 and 17 respectively) includes proposed developments including the Sanyo and Brooke Yachts and Jeld Wen development and hence cumulative effects arising from these projects have already been considered in this ES.
- 20.4.13 Each of the six projects was taken forward into assessment stages 3 and 4 as each is considered to be large enough or in close enough proximity to have the potential to cause cumulative impacts.

Table 20-5 – Information sourced to date on the projects

Application Reference	Applicant for 'other development' and brief description	Distance from Scheme	Status	Potential significant effect?	Progress to Stage 3/4?
East Anglia THREE	East Anglia THREE comprises up to 172 turbines generating up to 1200MW to be built in up to two phases.	70km east to offshore windfarm, 55km south to landfall at Bawdsey	Development Consent granted on 7 August 2017	Employment, construction traffic (if Port of Lowestoft is used)	Yes
Sizewell C New Nuclear Power Station	EDF Energy proposes to build, operate and decommission a new nuclear power station comprising two UK European Pressurised Reactors in Sizewell, Suffolk The proposed development is expected to have an electrical capacity of approximately 3,260 megawatts (MW) when operational	Approx. 30 km	Pre-application stage	Employment, construction traffic (if Port of Lowestoft is used)	Yes
Sanyo Site (DC/15/2004/R G3)	Outline application for up to 252 residential units and associated infrastructure. The site is located adjacent to Brooke Peninsula and Jeld Weld site.	Less than 1km	Application granted 22 January 2016 with reserved matters approved in May 2018 for Phase 1 of the development.	Employment, townscape and construction effects on traffic, air quality and noise	Yes
Brooke Peninsula and Jen Weld Development (DC/13/3482/OUT)	Planning application for the demolition of the existing industrial units and residential-led mixed use redevelopment for residential use (use class C3) of up to 850 dwellings or 950,000 sqft (whichever is the greater), up to 1774sqm commercial (use classes A1-A5), marina building (sui generis), 1.5 form entry primary school, together with associated infrastructure including a new spine road access and open space (as amended)	Less than 1km	Application granted 17 August 2015 with a reserved matters application submitted on the 23 of April 2018 for 70 dwellings.	Employment, townscape and construction effects on ecology, traffic, air quality and noise	Yes

Application Reference	Applicant for 'other development' and brief description	Distance from Scheme	Status	Potential significant effect?	Progress to Stage 3/4?
Lowestoft Tidal Barrier	The Lowestoft Tidal Barrier is a proposed flood defence project that is being promoted in two stages under a Town and Country Act Application for terrestrial based elements and a Transport and Works Act application for the tidal barrier within the entrance to Lake Lothing.	Less than 1km	Pre-application stage. Consultation on the proposed scope of the EIA is currently being undertaken via the request for formal scoping opinions Subject to the scoping opinions and planned stakeholder consultation, work on the EIA as proposed within The projects' PEIR was published November 2017, in preparation for the submission of consent applications in Autumn 2018. The development is currently at the funding stage with an application made to the Flood Defence Grant in Aid (FDGiA)	Construction traffic, ecology and private assets (Port of Lowestoft) and construction effects on air quality and noise.	Yes
Great Yarmouth Third River Crossing	The proposed GYTRC is an opening bridge scheme that is being proposed by Norfolk County Council. The aim of the project is to overcome the problems of poor access to the peninsula of Great Yarmouth, and the congestion that this causes. The project is intended to improve connectivity and resilience substantially for all port activities and	Approximately 13km	Pre-application stage. Consultation on the proposed scope of the EIA has been undertaken and the EIA scoping opinion was published in May 2018. Consultation is programmed to be undertaken in the summer	Construction employment and Construction traffic	Yes

Application Reference	Applicant for 'other development' and brief description	Distance from Scheme	Status	Potential significant effect?	Progress to Stage 3/4?
	facilitate the growth of the Great Yarmouth Enterprise Zone which covers the port and part of the Great Yarmouth peninsula.		of 2018. This will be supported by a PEIR. Submission of the DCO application is programmed for spring 2019.		

20.5 Predicted Impacts

Cumulative Impacts

- 20.5.1 The assessment of cumulative impacts is reliant on the availability of information relating to the identified projects and the assessment is therefore based upon the degree of information that is available at the time of the DCO application for the Scheme.
- 20.5.2 Should any number of projects be constructed concurrently impacts of traffic and transport have the potential to create traffic and there could also be employment impacts. For example, during construction phases projects are likely to increase the amount of traffic on the local road network, something which may cause a significant environmental effect. In terms of employment, different projects being constructed simultaneously, or which have similar construction programs, may place strain on the availability of skilled workforce, especially if developments require a workforce with similar skill sets.
- 20.5.3 Presented within Table 20-6 below is the assessment of cumulative effects.

Table 20-6 – Assessment of Cumulative Effects

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
East Anglia ONE and East Anglia THREE	Employment	<p>With regard to East Anglia ONE, construction will be largely complete during the start of construction of the Scheme and therefore peak employment demand will not coincide.</p> <p>East Anglia THREE Limited estimates 285 construction workers will be required to construct the onshore cable route, and that between 356 and 870 jobs associated with the offshore construction would be realised at the regional level.</p>	<p>The East Anglia ONE development required the production of a Skills Strategy in association with the local planning authorities, the objectives of which were to:</p> <ul style="list-style-type: none"> • To utilise existing parent company skills programmes where and when possible and appropriate; • To make best use of existing local and national education and skills infrastructures and add value to these where appropriate; • To promote employment and re-skilling opportunities in the communities most closely associated with the development of EA ONE; and • To ensure the necessary balance of demand and supply of skills to support the delivery of EA ONE and leave a legacy. <p>It was considered by the Secretary of State no additional mitigation beyond this was required to address the effects of the East Anglia THREE development additional to East Anglia One.</p>	<p>Not significant. The nature of construction of the East Anglia THREE project and the Scheme are unlikely to require a similar skill set of a significant number of construction workers at the same time. The scale of employment generated by the Scheme is much less than that associated with the East Anglia THREE project.</p>

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
	Traffic	<p>Additional construction traffic within the Scheme's study area</p> <p>Due to the nature of the NSIP, operational traffic impacts are not considered to be significant.</p>	<p>Traffic Management Plan – albeit construction traffic routes are focussed around the cable corridor, some 55km to the south and not within the Study area for the Scheme shown in Figure 19.1.</p> <p>Travel Plan – Requirement 28 of the DCO provides for a Port Travel Plan to be agreed with the relevant planning authority after consultation with the relevant highway authority once the main port for the construction and operation of the windfarm is confirmed</p>	<p>Not significant. The nature of construction related traffic movements associated with the proposed project are included in the project's traffic management plan and are unlikely to result in significant movements through the study area for the Scheme (given that the project identifies the A12 as its strategic access route) and as identified in Chapter 19, the construction traffic associated with the Scheme is not a significant effect. Traffic impacts associated with the project are adequately controlled by that DCO.</p>
	Ecology	<p>The East Anglia ONE HRA Report has assessed the impact of the project upon the Outer Thames Estuary SPA and the Alde-Ore SPA, amongst others that are out with the scope of assessment for the Scheme.</p>	<p>No mitigation is proposed by the project Applicant in connection with these two SPAs.</p>	<p>Not significant. The Scheme has identified in the HRA (document reference 6.5) that there would be no significant effects upon the Outer Thames Estuary SPA or the Alde-Ore SPA although the contractor of the Scheme will undertake specific measures during construction to control pollution within runoff. As the East Anglia ONE HRA report has not identified pollution during construction as a significant effect, and given the distance between the project and the Scheme and as the construction</p>

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
				<p>timescales are not aligned there will be no cumulative effect.</p> <p>With regard to the Alde-Ore SPA the Scheme HRA did not identify this as a site suitable for consideration at stage 2 of the HRA process and the East Anglia ONE project has considered that there will be no effect of the project upon the lesser black-backed gull and herring gull. Given that negligible impacts upon birds have been identified in Chapter 11 arising from the Scheme, there will be no cumulative effect</p>
Sizewell C New Nuclear Power Station	Employment	It is likely that approximately 5,600 people will be required during the peak construction of the Scheme, with the gravity model assuming a proportion of those would come from the Scheme socio-economic study area (Lowestoft & Great Yarmouth).	EDF proposes to produce an Economic Strategy & Skills Education and Employment Strategy to mitigate the effects of and exploit the opportunities provided by the Sizewell C development.	Not significant as the nature of construction of the proposed Sizewell C New Nuclear Power Station and the Scheme are unlikely to require a similar skill set and number of construction workers at the same time given the staggered programmes. The mitigation proposed by that project should address the effects associated with it. The total number of people estimated to be employed by the project at peak construction is also almost 50 times greater than the Scheme.

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
	Traffic – construction	Traffic information provided at EDF's Stage 2 consultation indicated an assumption that 15% of HGV traffic arriving at the Sizewell C construction site would arrive from the north. A Park and Ride site is proposed at Darsham (on the A12 between Sizewell and Lowestoft) with 1,000 spaces to provide capacity for construction workers arriving along the A12 corridor, north of Darsham	<p>No mitigation is proposed for the volume of HGV movements on the A12 north, consequently it is assumed that there are no impacts requiring mitigation on this route.</p> <p>A direct bus is proposed from Lowestoft to site to mitigate the traffic movements associated with construction worker traffic.</p> <p>It is anticipated that a Traffic Management Plan and Travel Plan would be produced as part of the application</p>	Not significant. Although the scale of the Sizewell C project is substantial, it is unlikely that construction traffic associated with the Scheme will interact significantly with construction traffic associated with Sizewell C, based on the current understanding of likely routeing and timing. As discussed in Chapter 19, the construction traffic from the Scheme has been scoped out of the assessment given the numbers of HGVs that will access the Scheme and as concurrent peak construction between this project and the Scheme is unlikely to coincide, this will not result in a significant effect.
	Ecology	The HRA evidence plan that has accompanied the consultation for this project has identified that Alde-Ore SPA, and the Outer Thames Estuary SPA are the Natura 2000 sites that have been considered for both the Scheme and the Sizewell C project.	No mitigation is presently proposed at the project's pre-submission stage	Not significant. The HRA for the Scheme has not identified any adverse effects upon any of the species for which the Alde-Ore SPA or the Outer Thames Estuary SPA and it is unlikely that concurrent construction will lead to cumulative effects due to the distance between the Scheme and this project.

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
Sanyo Development Site DC/15/2004/R G3, Outline Application permitted 22 January 2016	Employment	No information regarding construction dates or the number of construction workers is available. There is the potential to create a cumulative effect with regard to recruiting construction employees	N/A – none proposed by Applicant.	Not significant. No further information is available on construction employment, although it is unlikely that construction workers of a similar skill set would be required concurrently in numbers that would be significantly adverse to the labour market.
	Traffic	Potential traffic issues during construction phases, more information will become available once optioneering phase for reserved matters approvals have been completed and further reports are released. At the time of assessment no further information is available.	The project Applicant will restrict HGV movements to hours that would not cause " <i>undue disturbance to the local area</i> ".	Not Significant. The assessment for the Scheme has identified that there are no likely significant effects from construction related traffic and the timescale for development of the project and the Scheme are unlikely to require peak movements at the same time.
	Construction; Air quality and noise	Potential for construction dust from both the Scheme and this project to result in a cumulative effect upon properties to the south, particularly along Waveney Drive.	The project air quality assessment identifies that construction related air quality emissions are acceptable with best practice mitigation proposals. No assessment of construction noise has been undertaken by the Applicant.	Not significant. With the limited information on the projects' construction programme, it is considered unlikely that the nature of both construction operations, even if run concurrently, would cause a significant effect, given that both projects would utilise best practice mitigation measures.

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
	Ecology	The Sanyo development site did not include an assessment upon designated sites in its application although the HRA for the Scheme does consider the cumulative effect with the project.	N/A	The HRA Report (document reference 6.5) does not identify any in-combination effect between the Scheme and the project. Given the phased development of the project, adverse cumulative impacts upon any Natura 2000 site is very unlikely.
Brooke Peninsula and Jen Weld Development (DC/13/3482/OUT)	Employment	No information regarding construction dates or the number of construction workers is available. There is the potential to create a cumulative effect with regard to recruiting construction employees, although as only Phase 1 is presently been considered as a reserved matters application, a relatively low number of construction workers is likely to be required.	N/A as the project's Applicant in their Environmental Statement identifies beneficial effects upon employment and that 119 FTE construction jobs will be created.	Not significant. Whilst the project and the Scheme may be constructed concurrently, the phased approach to the development of the project is unlikely to result in a significant impact upon construction employment in combination with the Scheme.
	Traffic	Potential traffic issues during construction phases, more information will become available once optioneering phase for reserved matters approvals have been completed and further reports	In the Applicant's ES it is stated that during the construction phase delivery traffic will travel via designated routes agreed with SCC and this will be managed through a site access strategy agreed with SCC in advance prior to each phase of the works.	Not significant. Access to the Scheme will be to both the north and south of Lake Lothing and therefore only access to the compound on the south quay (see Figure 5.4) would be likely to use Waveney Drive which will be the access for the project. As the number of construction

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
		are released. At the time of assessment no further information is available.		vehicles needed for the Scheme is relatively low, the addition of further HGVs constructing Phase 1 of the project is unlikely to be significant based upon the limited information that is available.
	Construction; Air quality and noise	Potential for construction dust from both the Scheme and the project to result in a cumulative effect upon properties to the south, particularly along Waveney Drive.	<p>The Applicant has identified mitigation measures for air quality during construction that will reduce effects to no greater than slight adverse at the nearest residential receptor.</p> <p>With regard to noise, a construction management plan will keep noise during construction to those considered acceptable by Waveney District Council.</p>	<p>Not significant. The Air Quality assessment (Chapter 8) has identified that construction dust will have adverse, but not significant, effects upon those receptors closest to the Scheme. As the nearest receptors to this project are approximately half a kilometre from the Order limits of the Scheme, it is unlikely that construction air quality will lead to a cumulative effect, particularly as both projects will use best practice mitigation measures.</p> <p>Not significant. Noise during construction is unlikely to be a significant effect given the distance between the project and the Order limits of the Scheme.</p>

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
	Ecology	Potential for significant effects upon designated sites.	A HRA Screening Report in support of the Brooke Yachts and Jeld Wen application concluded that there was no need for mitigation to remove significant effects upon designated sites	Not significant. The HRA Report (document reference 6.5) and the assessment within Chapter 11 has identified that the Scheme will not have an adverse impact upon any European designated site. Chapter 11 identifies a significant effect upon Kirkley Ham CWS although as stated in Paragraph 20.4.12, the impact of the project's traffic is already included within the operational traffic assessments and therefore there will be no additional cumulative effect between the Scheme and this project.
Lowestoft Tidal Barrier	Employment	<p>Subject to receipt of funding and approvals, it is anticipated that the barrier will take approximately 15-20 months to construct. This programme assumes limited and a maximum of a four hour closure of the Navigation Channel to maintain ABP's marine operations.</p> <p>The target completion of construction of the tidal defences is 2020 to align with the Flood and Coastal Risk Management (FCRM) six year programme and WDC's business</p>	No information is provided by the proposed project's Applicant	Not significant based upon the labour market pool that is likely to be required.

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
		plan. No information regarding the number of construction workers is available and there is the potential to create a cumulative effect with regard to recruiting construction employees.		
	Construction Dust and Noise	Construction dust has been scoped out of the Applicants' assessment, although construction noise has been scoped in due to the proximity of residential properties.	Not known at this stage	Not significant. It is considered unlikely, given the nature of the construction, and the distance between the project and the Order limits of the Scheme, that the respective study areas for the construction noise assessment will overlap. As stated in Chapter 6, the assessment of construction traffic noise has been scoped from the assessment due to the effects of construction traffic being insignificant.
	Ecology	As raised in the Scoping Opinion, the impact upon the CWS at the Outer Harbour should be considered in cumulation between the Scheme and the project	The project's PEIR has scoped out further assessment upon Kittiwakes in the CWS because potential disturbance is not considered to be significant.	Not significant. The assessment in Chapter 11 has identified that there are no significant effects upon the CWS and that birds will not be adversely affected by the Scheme. With regard to designated Natura 2000 sites, the HRA Report for the Scheme (see document reference 6.5) identifies no significant effects

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
				<p>with the Scheme and the Tidal Barrier in combination.</p> <p>In cumulative terms there is no significant effect from the Scheme and the project together.</p>
	Private Assets	ABP has suggested there may be cumulative effects on the operation of the Port if the construction programmes align.	Where possible, channel closures will be limited to a maximum of four hours.	<p>As noted in Chapter 15, slight adverse effects on the Port are associated with Scheme's construction when the Navigation Channel is closed during the installation of the Scheme Bascule Bridge. During the operational phase, of the Tidal Barrier a closure of the entrance to Lake Lothing will only be during a flood event and hence operational impacts are not likely to further adversely affect the Port.</p> <p>The Sediment Transport Assessment (Appendix 17C) has identified that the Scheme will have a negligible effect upon the sediment flow within Lake Lothing. It is therefore concluded that there will be no significant effect upon sediment deposition in combination with the Tidal Barrier project.</p>

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
	Impediment to marine traffic	The construction of the project in the navigation channel has the potential to impact upon users of the Port.	Where possible, channel closures will be limited to a maximum of four hours.	<p>Not significant. During the construction phase the closure of the Navigation Channel within the Order limits of the Scheme will be for a single period likely to be three weeks in length. Construction of the Tidal Barrier project will require channel closures in four hour windows, although how many is uncertain and for what duration of the total project programme. Users of Lake Lothing, for both commercial and recreational purposes will not be significantly affected because the impact will be caused by the delay in entering Lake Lothing rather than the closure further west.</p> <p>During the operational phase, of the Tidal Barrier a closure of the entrance to Lake Lothing will only be during a flood event and hence this is an unlikely time when recreational vessels will be using Lake Lothing.</p>
	Flood Risk	The Tidal Barrier by its very nature will reduce the flood risk off site.	N/A	Not significant. The Scheme does not have a significant effect upon flooding (and its assessment has not assumed the presence of the Tidal Barrier), although it is likely that should the Tidal Barrier project be constructed, that the conclusions within the Flood Risk Assessment

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
				(see Chapter 18 and Appendix 18A) will change due to the inherent purpose of the Tidal Barrier.
Great Yarmouth Third River Crossing	Employment	<p>Subject to receipt of approval, it is anticipated that the bridge will take approximately 33 months to construct.</p> <p>Construction is scheduled to commence in May 2020, with the bridge due to open January 2023. This will overlap with the construction period for the Scheme which is scheduled between Autumn 2019 and Spring 2022 as shown in Plate 5-2.</p> <p>No information regarding the number of construction workers is currently available for the GYTRC. Nevertheless, it is recognised that there is an overlap in the construction programmes for the</p>	No mitigation currently proposed	Not significant. Both the project and the Scheme will require a similar skillset for portions of the construction programmes and it is likely, given their similar nature, that the number of construction workers will be similar. However, the Scheme and this project are unlikely to have peak construction requirements at the same time.

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
		project and the Scheme, which has the potential to result in a cumulative effect with regard to the recruitment of construction employees.		
	Construction Traffic	<p>The overlap of construction programmes for the Scheme and the GYTRC presents the potential for traffic impacts during construction phases.</p> <p>No information on the type or number of construction vehicles required for the GYTRC is currently available. More information will become available as the EIA progresses.</p>	<p>The requirement for mitigation is not known at this stage.</p> <p>A Construction Traffic Management Plan has been requested in the Scoping Opinion for the project.</p>	Not significant. Given the 13km distance between the project and the Scheme, it is unlikely that construction traffic associated with the Scheme will interact significantly with that of the project. As discussed in Chapter 19, the construction traffic from the Scheme is not likely to result in a significant effect.
	Ecology	The information available on the GYTRC does not provide any assessment of impact upon Natura 2000 sites although the assessment for the Scheme has not identified	N/A	Not significant. The Scheme's HRA Report does not identify any likely significant effects upon the integrity of any Natura 2000 site and assuming that the GYTRC project will have similar measures to the Scheme during construction to

Application Reference	Potential cumulative impact of 'other development'	Assessment of cumulative effect with NSIP	Mitigation proposed by the identified project's Applicant	Assessment of residual Cumulative Effect
		any significant effects in the HRA Report (document reference 6.5).		manage pollution and runoff, there will be no cumulative effect.

*Synergistic Impacts**Construction*

- 20.5.4 During the construction phase, the multiple impacts experienced by receptors would be temporary in nature, and potentially intermittent, within the approximate two year construction period. Although construction activities such as piling may cause noise disturbance, the noisiest activities would be infrequent. Synergistic effects would be experienced periodically by receptors at different times during the construction phase and would cease at the end of the construction period.
- 20.5.5 The residual effects of construction traffic are considered to be negligible, as concluded in Chapter 19 Traffic and Transport.
- 20.5.6 The human (residential receptors) that may experience synergistic effects during construction are located close to the Order limits, and to the construction works for all aspects of the Scheme.
- 20.5.7 As described in Chapter 8 Air Quality there is the potential for impacts from construction dust to occur at sensitive receptors (residential properties) located close to the proposals. However, strict environmental controls will be implemented as outlined in the interim CoCP to avoid potentially significant temporary air quality effects in these cases. These mitigation measures are anticipated to ensure that construction related dust impacts are not significant.
- 20.5.8 The assessment of construction activities has highlighted that significant adverse impacts are predicted during worst case conditions, when plant is operating in close proximity to NSRs. However, through the adoption of Best Practicable Means (BPM) and a 2.4m high hoarding around noise generating activities and other mitigation measures recommended in the ES, it will be possible to reduce noise levels such that during the majority of the construction phase the effects would be minor, but with some chance of significant adverse effects, albeit that these would be temporary and short-term.
- 20.5.9 With the inclusion of the mitigation measures, it is anticipated that for the majority of time, effects in terms of vibration arising during the construction works will be insignificant for the nearest NSRs. However, occasional significant adverse effects could not be entirely discounted during some activities when works are at their closest to nearby sensitive receptors
- 20.5.10 Where appropriate the Contractor will obtain consents from the relevant local authority under Section 61 of the Control of Pollution Act 1974 (which will include noise and vibration limits where relevant) for the proposed construction works. Any Section 61 consent that is obtained may contain site specific management and mitigation requirements for noise and vibration.
- 20.5.11 Chapter 10: Townscape and Visual Impact assesses the significance of visual effects during the construction phase for visual receptors in the vicinity of the proposals. The effects vary depending on location and therefore the view of the Scheme under construction. However, some viewpoints which incorporate current or future residential receptors are expected to experience moderate adverse effects as a result of a combination of open and direct views of construction activity, associated clutter and

plant (including lifting equipment) and occurring in relatively close proximity and within views of Lake Lothing, whilst others will experience slight adverse effects.

20.5.12 In summary, townscape and visual effects during the construction phase at specific receptor points are considered to be of moderate adverse significance. However, even though visual effects during the construction phase at specific receptors are considered to be moderate adverse, the assessment of noise levels at residential receptors during construction has not identified any long term significant effects, and the air quality assessment concludes that the effect on receptors will be not significant.

20.5.13 Therefore, there are no predicted significant synergistic effects during the construction of the properties on residential receptors.

Operation

20.5.14 The human receptors that may experience synergistic effects during operation are those that are closest to the Order limits upon Waveney Drive and Rotterdam Road.

20.5.15 The assessment of operational traffic emissions in Chapter 8 has found no new exceedances of the air quality objectives, and identifies that although there are some changes of annual mean concentration of particular particulates at specific locations, the majority of these changes are classes as imperceptible or small, with a relatively low number corresponding to a medium and large concentration. Overall, the assessment concludes that the local air quality impacts of the Scheme would not constitute a significant environmental effect.

20.5.16 The assessment in Chapter 13 Noise and Vibration shows significant noise impacts arising from increased external road noise at nearby residential receptors to the Scheme arising from increased traffic flows, and no mitigation measures are suitable for use given the constraints of the Scheme. Although some properties may be eligible for insulation under the Noise Insulation Regulations, this affects internal noise levels only.

20.5.17 As outlined in Chapter 10 Townscape and Visual Impact, whilst the identified viewpoints are not anticipated to be subject to significant adverse effects, two viewpoints that incorporate residential receptors will be subject to a slight adverse effect arising as a result of changes in the foreground associated with the tie in with the existing road network. Remaining viewpoints which include residential receptors are anticipated to be subject to neutral or slight beneficial operational effects.

20.5.18 It is therefore considered that synergistic effects of noise without further mitigation and a slight adverse loss of visual amenity to properties closest to the Scheme would result and could be of moderate significance to those receptors, and therefore significant.

20.6 Conclusions and Effects

20.6.1 This CEA finds that significant adverse cumulative effects between the Scheme and other projects are not predicted.

20.6.2 The assessment has also identified that significant synergistic effects will result for properties closest to the Scheme as a result of the increase in noise and loss of visual amenity.

This page is intentionally left blank

Glossary of Terms

Term	Definition
abutment	A point where two structures meet, which support or anchor the end of a structure, viaduct or bridge.
air quality management area	If a local authority identifies any locations within its boundaries where the air quality objectives are not likely to be achieved, it must declare the area as an air quality management area. The local authority is subsequently required to put together a local air quality action plan.
air quality objective	Objectives are policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set out in the UK government's Air Quality Strategy for the key air pollutants.
amenity	The benefits of enjoyment and well-being which are gained from a resource in line with its intended function. Amenity may be affected by a combination of factors such as: sound, noise and vibration; dust/air quality; traffic/congestion; and visual impacts.
Appropriate Assessment	An assessment (required under regulation 48 of the Conservation (Natural Habitats, &c.) Regulations 1994) of the effects of a plan or project on the Natura 2000 network of European sites of nature conservation significance. The assessment focuses on the plan or project's implications for the site and any potential adverse impacts on its integrity.
aquifer	A geological formation that is sufficiently porous and permeable as to store and yield a significant quantity of water to a borehole, well or spring.
ARCADY	Assessment of Roundabout Capacity and Delay - ARCADY is used for predicting capacities, queues, delays (both queueing and geometric) and accident risk at roundabouts.
arcGIS	Computer software based geographic information system used for: creating maps; analysing information that has been mapped; and managing and compiling geographic data.
borehole	A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground.
built heritage	A structure or building of historic value. These structures are visible above ground level.
climate change	This refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which persist for an extended period, typically decades or longer.
climate change adaptation	A change in natural or human systems in response to the impacts of climate change. These changes moderate harm or exploit beneficial opportunities and can be in response to actual or expected impacts.
climate change mitigation	Describes action to reduce the likelihood of an event occurring or reduce the impact if it does occur. This can include reducing the causes of climate change (e.g. emission of greenhouse gases); as well as reducing future risks associated with climate change.
conservation area	An area designated under section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990 as being of special architectural or historic interest and with a character or appearance which is desirable to preserve or enhance.
controlled waters	Rivers, streams, estuaries, lakes, canals, ditches, ponds and groundwater as far out as the UK territorial limit. The statutory

Term	Definition
	definition is provided in section 104(1) of the Water Resources Act 1991 and section 30A(d) of the Control of Pollution Act 1974.
county wildlife site	A site of important nature conservation value within a county context, but which is not protected under the Wildlife and Countryside Act 1981.
decibel(s) A-weighted	The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'.
decibel(s) or dB	Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal, Pa). Because of this wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audibility of sound covers a range of approximately 0-140 dB.
Department for Environment, Food and Rural Affairs	Government department responsible for policy and regulations on environmental, food and rural affairs in the UK. The department's priorities are to grow the rural economy, improve the environment and safeguard animal and plant health.
delay (pedestrians)	Change in the 'person-minutes' of the journey times of pedestrians and other non-motorised travellers.
delay (traffic)	An increase in journey time for drivers and passengers due to increased congestion.
dene	A low sandhill by the sea
Department for Communities and Local Government	Government department for communities and local government (including planning) in England. DCLG is now known as The Ministry of Housing, Communities and Local Government, however legacy DCLG documents will be referred to as DCLG, consistent with the document references.
Department for Transport	Government department responsible for transport issues in the UK (where not devolved).
Designated Site	Sites which have special status as protected areas because of their natural and cultural importance. Protection means that these places: have clear boundaries e.g. AQMAs, RAMSAR, AONB.
design development	Process in which technical specialists (engineers and environmentalists) refine the design for the various elements of the Scheme.
Design Manual for Roads and Bridges	Provides information about the design, assessment and operation of highways infrastructure projects, including bridge projects.
development consent order	Planning permission given by the Secretary of State under the Planning Act 2008 for nationally significant infrastructure projects.
development plan document	Documentation which seeks to guide development and planning in a local authority area for a set period of time.
diffusion tube	Diffusion tubes (samplers) are passive devices used in air quality monitoring to measure weekly or monthly average pollutant concentrations.
dredging	The removal of sediment and debris from the bottom of lakes, rivers, harbours, and other water bodies.
earthworks	The removal or placement of soils and rocks such as in cuttings, embankments and environmental mitigation, including the in-situ improvement of soils/rocks to achieve the desired properties.

Term	Definition
ecological status	The state of a water body, derived from a number of factors, including: the abundance of aquatic flora and fauna, nutrient availability, salinity, temperature and chemical pollution levels.
economically active	People who are either in employment or unemployed who are available for employment.
ecosystem	Biological community of interacting organisms (e.g. plants and animals) and their environment.
embankment	Artificially raised ground, commonly made of earth material, such as stone, on which the highway sits.
Environment Agency	Non-departmental public body established to protect and enhance the natural environment in England. Responsibilities include: water quality and resources, flooding and coastal risk management and contaminated land. In Ipswich specifically, they are the developer of the Ipswich FRMS Tidal Barrier Scheme.
environmental impact assessment	A process to systematically assess the potential environmental effects of proposed development. An environmental impact assessment is a legal requirement for certain public and private projects in European Union countries under Directive 2014/52/EU.
environmental statement	A suite of documents providing the necessary environmental information in respect of an environmental impact assessment undertaken for a proposed development. It must include all information that is reasonably required to assess the likely significant environmental effects.
equivalent continuous sound pressure level or LpAeq,T	An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value.
erosion	Process by which particles are removed by the action of wind, flowing water or waves.
flood defence	Infrastructure used to protect an area against floods, such as floodwalls and embankments.
flood risk assessment	An assessment of the risk of flooding from all flooding sources (including fluvial, tidal, surface water and groundwater) and the identification of flood mitigation measures.
flood zones 1, 2 and 3	A flood zone area classification system devised by the Environment Agency: Flood Zone 1: land outside the floodplain. There is little or no risk of flooding in this zone; Flood Zone 2: the area of the floodplain where there is a low to medium flood risk; and Flood Zone 3: the area of the floodplain where there is a high risk of flooding.
floodplain	Land adjacent to a watercourse over which water flows or would flow in times of flood, but for defences in place.
grade II listed building	Nationally important buildings that are of special interest.
grade II* listed building	A listed building of particular importance, of more than special interest.
greenhouse gases	Atmospheric gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapour that absorb and emit infrared radiation emitted by the Earth's surface, the atmosphere and clouds.

Term	Definition
groundwater	All water which is below the surface of the ground and within the permanently saturated zone.
groundwater body	A distinct volume of groundwater within an aquifer.
groundwater source protection zone	Areas defined by the Environment Agency which show the risk from contamination/pollution to groundwater that is extracted for drinking water.
heavy metals	A loosely defined term which refers to a group of metal and metalloids, many of which can be toxic to some degree.
heritage asset	A building, monument, site, place, area or landscape of historic value.
Highways England	A government-owned company with responsibility for managing the Strategic Road Network in England.
Historic England	Executive non-departmental public body created under section 32 of the National Heritage Act 1983 to: secure the preservation of ancient monuments and historic buildings situated in England; promote the preservation and enhancement of the character and appearance of conservation areas situated in England; and promote the public's enjoyment of, and advance their knowledge of, ancient monuments and historic buildings situated in England and their preservation.
Historic Environment Record	A record of all known archaeological finds and features and historic buildings and historic /landscape features, relating to all periods from the earliest human activity to the present day; maintained by each county and unitary authority in the United Kingdom.
hydrogeology	The nature, distribution and movement of groundwater in soils and rocks, including in aquifers.
in-combination effects	In-combination effects arise where receptors are affected by a combination of a number of environmental effects (for example, from sound, noise and vibration; dust and air quality) from the same project.
LINSIG	A software tool for modelling traffic signals and their effect on traffic capacities and queuing.
local planning authority	The local authority or council that is empowered by law to exercise planning functions. The Scheme lies within the jurisdiction of Waveney District Council and Suffolk County Council.
Lowestoft Future Townscape	A theoretical scenario, including the construction and operation of known developments that has been considered in the Townscape and Visual Impacts assessment in Chapter 10.
made ground	Land where natural and undisturbed soils have largely been replaced by man-made or artificial materials. It may be composed of a variety of materials including imported natural soils and rocks with or without residues of industrial processes (such as ash) or demolition material (such as crushed brick or concrete).
main river	A river maintained directly by the Environment Agency. Lake Lothing is a main river.
Manual for Streets guidance	Guidance on how to design, construct, adopt and maintain new and existing residential streets.
Marine Management Organisation	An executive non-departmental public body that licenses and regulates marine activities in England and Wales.

Term	Definition
materials management plan	A mechanism by which those who are developing a site can comply with Environment Agency regulations for excavated ground materials.
National Cycle Network	A series of safe, traffic-free paths and quiet on-road cycling and walking routes that connect to major towns and cities.
National Planning Policy Framework	Framework setting out the government's planning policies for England.
National Policy Statement for National Networks	This statement is part of the planning system established under the 2008 Act to deal with nationally significant infrastructure proposals. It sets out the need for the development of NSIPs on the national road and rail networks in England.
National Policy Statement for Ports	This statement is part of the planning system established under the 2008 Act to deal with nationally significant infrastructure proposals. It provides the framework for decisions on proposals for new port development.
nationally significant infrastructure project	A project considered to be nationally significant, requiring development consent under the Planning Act 2008. The Competent Authority for an NSIP in the transport sector is the Secretary of State for Transport.
Natural England	Executive non-departmental public body constituted under the Natural Environment and Rural Communities Act 2006 (section 2(1)) to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development.
New Anglia Local Enterprise Partnership	A group of business leaders from the public, private and education sectors striving for economic growth in Norfolk and Suffolk. They also produced the Economic Strategy for the region, published in November 2017.
nitrogen dioxide	A gas produced when fuels are burned and which is often present in motor vehicle and boiler exhaust fumes. It is an irritant to the respiratory system.
PARAMICS	3D traffic simulator consisting of a suite of software tools for the simulation of traffic conditions at the individual vehicle level.
particulate matter	Discrete particles in ambient air, with diameters ranging between nanometres (billionths of a metre) to micrometres (millionths of a metre).
photomontage	Inserting a visualisation of the Scheme onto a photograph for the purposes of creating an illustrative representation of potential changes to existing views.
piling	Driving and embedding piles of wood, concrete or steel deep into the ground, to support buildings/structures at the foundation level.
Planning Inspectorate	Deals with planning appeals, national infrastructure planning applications, examinations or local plans and other planning-related and specialist casework in England and Wales.
PM ₁₀	PM ₁₀ is any particulate matter with an aerodynamic diameter equal to or less than 10 micrometres.
PM _{2.5}	PM _{2.5} is any particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometres.
Preliminary Environment Information Report	The report provides sufficient preliminary information to enable consultees to develop an informed view of the Scheme.
principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage and transmission. They may support water

Term	Definition
	supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifers.
Order limits	The maximum extent of land within which the Scheme may take place
Ramsar site	Wetland sites that are of international importance, as designated under Article 2(1) of the Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar (Iran), 2 February 1971. UN Treaty Series No. 14583.
receptor	A component of the natural or built environment (such as a human being, water, air, a building or a plant) affected by an impact of the construction and/or operation of a proposed development.
Reference Design	The design proposals for the Scheme that comprises the DCO application. The Reference Design has been developed to a concept stage that is appropriate to prove both engineering and construction feasibility and to inform the assessment within the Environmental Statement.
remediation	The process of removing a pollution linkage (i.e. by removing one or more of the elements in a source-pathway-receptor linkage) in contaminated land in order to render an acceptable risk. Usually this involves a degree of removal of contaminants and/ or blockage of pathways.
river basin management plan	Plans developed under the EU Water Framework Directive setting out environmental objectives for all groundwater and surface water bodies and protected areas within a river basin district.
runoff	The flow of water over the ground surface.
scoping (EIA)	An initial stage in the environmental impact assessment process to determine the nature and potential scale of environmental effects arising as a result of a proposed development, and an assessment of what further studies are required to establish their potential environmental impacts and effects.
setting (cultural heritage)	The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive, negative or neutral contribution to the significance of an asset and may affect the ability to appreciate it.
severance	Used to refer to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance in this environmental statement does not necessarily imply a route is closed to access.
site of special scientific interest	Area of land notified by Natural England under section 28 of the Wildlife and Countryside Act 1981 as being of special interest due to its flora, fauna or geological or physiological features.
sound power level	A measurement of the total acoustic power it radiates. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.
sound pressure level	The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being

Term	Definition
	just detectable. A change of 10dB is subjectively twice, or half, as loud.
statutory consultee	Organisations and bodies, defined by statute, which must be consulted on relevant planning matters.
Strategic Flood Risk Assessment	A study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk.
Strategic Road Network	Motorways and major trunk roads in England.
surface water	Waters including rivers, lakes, loughs, reservoirs, canals, streams, ditches, coastal waters and estuaries.
sustainable drainage systems	Measures designed to control surface runoff close to its source, including management practices and control measures such as storage tanks, basins, swales, ponds and lakes. Sustainable drainage systems allow a gradual release of water and thereby reduce the potential for downstream flooding.
sustainable transport	This refers to any type of transport that has lower impacts on the environment and is more fuel efficient than traditional travel by single occupancy private motor vehicle. This includes walking, cycling, public transport and car sharing.
townscape character area	Areas of townscape that have a broadly consistent pattern of topography, land use and vegetation cover.
trial pit	An excavation typically up to 2m deep and 1m wide to investigate ground conditions.
visual receptor	People who may have a view of the Scheme during construction or operation.