Norfolk County Council

Norwich Western Link Project

Document NCC/NWL/OBCADD/001: Addendum to June 2021 Outline Business Case

Author: Norfolk County Council

Document Reference: NCC/NWL/OBCADD/001

Version Number: V.03

Date: 21 September 2022

CONTENTS

TABLES

FIGURES

GLOSSARY OF ABBREVIATIONS AND DEFINED TERMS

Acronym	**Meaning**
AMCB	Analysis of Monetised Costs and Benefits
AST	Appraisal Summary Table
BCR	Benefit Cost Ratio
DfT	Department for Transport
NCC	Norfolk County Council
NWL	Norwich Western Link
OBC	Outline Business Case
QRA	Quantified Risk Assessment
TAG	Transport Analysis Guidance
TEE	Transport Economic Efficiency
VfM	Value for Money

1 INTRODUCTION

1.1 Background

1.1.1 The Outline Business Case (OBC) for Norwich Western Link (NWL) was submitted to the Department for Transport (DfT) in June 2021.

1.1.2 Since this submission a contract between Norfolk County Council (NCC) and Ferrovial Construction (UK) Limited has been executed in July 2021, which has 3 stages:

- Stage 1 – design and support through the statutory approvals process;
- Stage 2 – construction;
- Stage 3 – initial maintenance, particularly in relation to the environmental measures.

1.1.3 The preferred route for the NWL was agreed by the County Council's Cabinet in July 2019 and the award of the contract has allowed the Council to work with Ferrovial Construction to further develop the design proposals.

1.2 This Addendum

1.2.1 As a result of the ongoing design development work, and the subsequent updates to the programme, budget forecast and risk register, this addendum provides an update to the OBC originally submitted in June 2021. Table 1-1 below provides a summary of the updates provided.

Table 1-1 Contents of this addendum

Chapter	Title	Description
2.0	Update to the Strategic Case	Provides an update to the Strategic Case provided in the June 2021 OBC
3.0	Update to the Economic Case	Provides an update to the Economic Case provided in the June 2021 OBC

Chapter	Title	Description
4.0	Update to the Financial Case	Provides an update to the Financial Case provided in the June 2021 OBC
5.0	Update to the Commercial Case	Confirms that no update to the Commercial Case provided in the June 2021 OBC is required
6.0	Update to the Management Case	Provides an update to the Management Case provided in the June 2021 OBC

2 UPDATE TO THE STRATEGIC CASE

2.1 Introduction

2.1.1 The Strategic Case, as set out in Chapter 2 of the June 2021 OBC, demonstrated that the NWL is needed for Norfolk. It detailed how the scheme fits into a wider strategy for development, and demonstrates that it aligns with national, regional and local strategic policy objectives. In particular Section 2.12 outlined the process undertaken to identifying the route option to take forward for further development and design.

2.2 Update to Strategic Case

2.2.1 As part of the ongoing scheme development work since June 2021 surveys were commissioned to inform the scheme design. These surveys included ground investigation surveys, topographical surveys, utility apparatus surveys, drainage surveys, ecological surveys, and vehicle surveys.

2.2.2 In the summer of 2021, a suite of further bat surveys was carried out to support the understanding of bat activity. Following analysis of the data obtained from these surveys, it was determined that there is a roost location used by a maternity colony of barbastelle bats (that has a significant level of environmental protection) within woodland near to part of the proposed road alignment.

2.2.3 Therefore, as part of the ongoing design development, work has been undertaken to assess, refine and develop the relevant length of the route alignment, and to assess the need for mitigation to minimise the impact of the scheme on the relevant area of woodland.

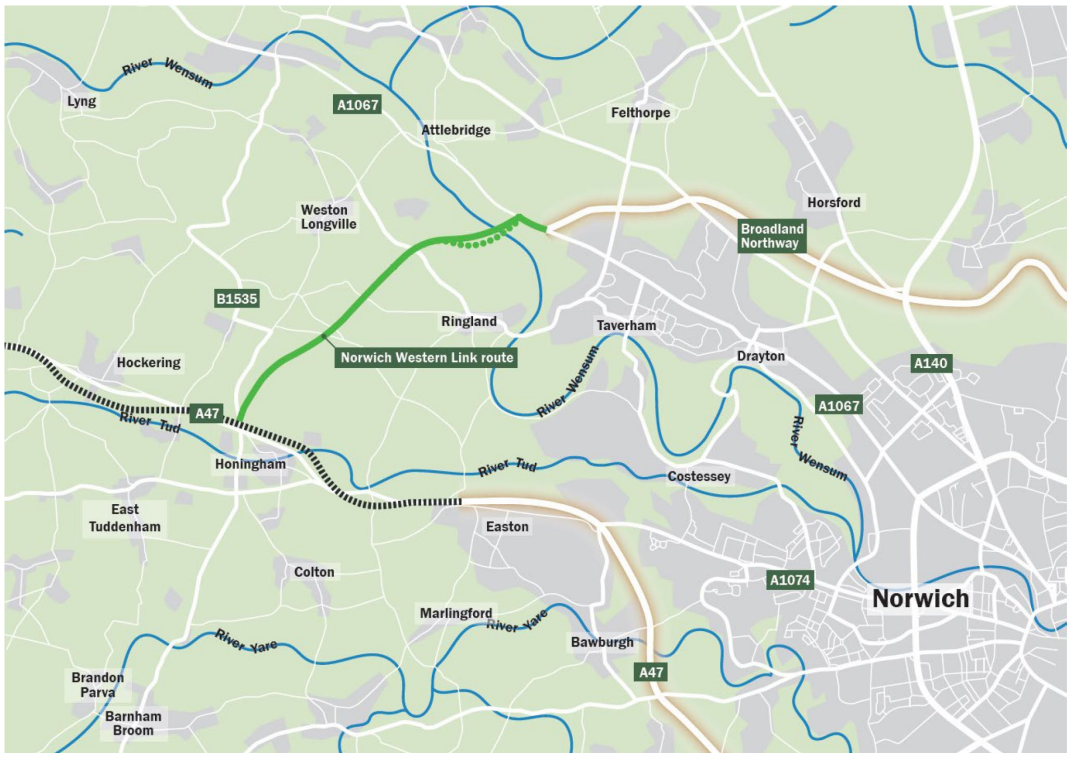
2.2.4 Taking account of known constraints and features, a number of ways to refine the route within the chosen route corridor were considered. This process has involved consideration of ecological factors (including specifically to bats), other environmental factors, costs and engineering factors. The results have

been set out in an Alignment Refinement Appraisal Report, which identified the best performing and most suitable option to take forward.

2.2.5 At its meeting of 4 July 2022, the County Council's Cabinet received an update report that outlined the results of the alignment refinement appraisal work undertaken on the NWL. The report to Cabinet included the Alignment Refinement Appraisal Report and also provided an update to the programme, budget forecast and project risks as a result of this work.

2.2.6 An indication of the scope of the refinement to the alignment is shown as the dotted line on Figure 1-1 below.

Figure 1-1 Scope of the alignment refinement



3 UPDATE TO THE ECONOMIC CASE

3.1 Introduction

3.1.1 Chapter 3 of the June 2021 OBC presented the Economic Case for the NWL scheme and appraised the proposed scheme to identify its economic impacts, and the resulting Value for Money (VfM).

3.1.2 Along with a Core Growth scenario, a sensitivity appraisal scenario was also presented within the Outline Business Case (OBC) in June 2021 which considered:

- revised economic and population projections issued by the Office for Budget Responsibility in March 2020;
- impact of COVID-19 on economic growth.

3.1.3 In July 2021 there were changes to DfT Transport Analysis Guidance (TAG) which updated the DfT TAG Data Book and removed specific mention of sensitivity testing. The impact of this change to DfT TAG meant that the Core Growth (Sensitivity) scenario became the Core Scenario.

3.1.4 Following the review of the OBC (June 2021) and the EAR (May 2021) by the DfT and after further discussions a Core Growth (Alternative Methodology) scenario was produced.

3.2 Update to Economic Case

3.2.1 The update to the Economic Case, detailing the outcome of the above scenarios, is contained in Appendix A. This is accompanied by the following updated documents:

- The updated breakdown of costs presented in the Economic Case in Appendix A, align with the breakdown required for the DfT Cost Pro-forma, which is provided in Appendix B;

- The updated Public Accounts Table for both the Core Growth (Alternative Methodology) and Core Growth (Sensitivity) scenarios, and in the format required by DfT, is provided in Appendix C. The apportionment of costs between local and central government is discussed in the update to the Financial Case (Appendix A);
- The updated Analysis of Monetised Costs and Benefits (AMCB) Tables for both the Core Growth (Alternative Methodology) and Core Growth (Sensitivity) scenarios are provided in Appendix D;
- The Appraisal Summary Tables (AST) for both the Core Growth (Alternative Methodology) and Core Growth (Sensitivity) scenarios are provided in Appendix E;
- An updated Economic Efficiency of the Transport System Tables for both the Core Growth (Alternative Methodology) and Core Growth (Sensitivity) scenarios are provided in Appendix F.

3.2.2 This OBC Addendum also includes a targeted update to the Environmental Impact Report to reflect the alignment refinement and an updated Biodiversity Worksheet. This is contained in Appendix G.

3.2.3 The updated BCR, using the Core Growth (Sensitivity) scenario is identified as 2.47. Using the Core Growth (Alternative Methodology) scenario, the BCR is identified as 2.17.

3.2.4 This gives the Adjusted BCR within a range from 2.17 to 2.47 based on the latest assumed overall budget position. This is still considered to be in the 'high' value for money category (BCR between 2.0 and 4.0) according to DfT criteria for a transport infrastructure project.

4 UPDATE TO THE FINANCIAL CASE

4.1 Introduction

4.1.1 Chapter 4 of the June 2021 OBC provide the Financial Case for the NWL and identified the cost of delivering the scheme as £198,387 million at out-turn prices from a price base of 2020. This chapter provides an update to the Financial Case.

4.1.2 The scheme risks identified within the OBC Risk Register have been actively managed, updated and reported to the Project Board on a monthly basis. In addition, a further Quantified Risk Assessment (QRA) has been undertaken as a result of the completed design development work described in Section 2.0.

4.1.3 The scheme risks will continue to be managed in line with the risk management strategy set out in Section 6.9 of the June 2021 OBC.

4.2 Update to Financial Case

4.2.1 The updated Financial Case for the scheme is contained in Appendix A of this document.

4.2.2 The updated base scheme costs are £168.747million. The scheme costs include a risk allowance taken from the latest Quantitative Risk Assessment. The updated total scheme costs, including risk and inflation, are £251.033million.

4.2.3 Funding is sought via the Large Local Majors programme through the National Roads Fund. Central government/DfT funding of £213.378million (85%) is sought to deliver the scheme, with the majority of the funds being spent during the financial years 2023-2026. A local contribution of £37.655million (15%) of the scheme implementation costs is required.

5 UPDATE TO THE COMMERCIAL CASE

5.1 Introduction

5.1.1 Chapter 5 of the June 2021 OBC provided the Commercial Case for the NWL and outlined the commercial viability of the proposed scheme and the procurement strategy used to engage the market. It also outlined the approach to risk allocation and transfer, contract and implementation timescales, and the approach to managing of the contract.

5.2 Update to Commercial Case

5.2.1 The Commercial Case remains unchanged from that submitted in the June 2021 OBC submission.

6 UPDATE TO THE MANAGEMENT CASE

6.1 Introduction

6.1.1 Chapter 6 of the June 2021 OBC provided the Management Case for the NWL and set out the processes and controls in place to manage the implementation of the scheme, and track and realise future benefits. It demonstrated the way in which the scheme will be delivered in accordance with best practice, project planning, governance structure, risk management, communications and stakeholder management, benefits realisation and assurance.

6.1.2 This chapter provides the following updates to the June 2021 OBC Management Case:

- The programme for delivery;
- The scheme risk register.

6.2 Update to Management Case

Update to Programme

6.2.1 Table 6.4 of the June 2021 OBC provided details of the construction programme. The programme has been reviewed and the scheme milestones are contained in Appendix H.

6.2.2 The updated key delivery milestones are shown in Table 6.1 below.

Table 6-1 Update to key delivery milestones

Milestones	Current Estimate
Large Local Majors (LLM) approval to progress to the next stage of development	Completed
OJEU notice (start of procurement process)	Completed
Design and Build Contractor appointment	Completed
Formal Pre-application Public Consultation	August 2022

Milestones	Current Estimate
Planning Application submission	April 2023
Completion of design stage of Design and Build Contract (Stage 1)	October 2023
Public Inquiry (if required)	November 2023
Confirmation of all statutory orders and consents	August 2024
Full Business Case (FBC) submission	August 2024
Start of construction work	Late 2024
Road open	Late 2026

6.2.3 As a result of this updated programme, Table 6.2 below provides the updated assurance and approval milestones.

Table 6-2 Update to assurance and approvals milestones

Milestones	Current Estimate
NCC Cabinet approval to submit Outline Business Case	Completed
NCC Cabinet approval to appoint Design and Build Contractor	Completed
NCC Cabinet authority to conduct Pre-Application Consultation	Completed
DfT OBC Approval (anticipated)	November 2022
NCC Cabinet authority to submit Planning Application	March 2023
NCC approval to submit Full Business Case	August 2024
DfT Full Business Case decision (anticipated)	November 2024

Update to Risk Management Strategy

6.2.4 Sections 6.9 of the June 2021 OBC detailed the risk management strategy for the NWL.

6.2.5 A Risk Register was initially developed in June 2018 to consider risks associated with the scheme. It is a live document and is updated monthly as the project progresses with new risks added when identified and progress on existing risks provided, as well as marking some as closed when appropriate. The Risk Register is reported to Project Board for challenge / review.

6.2.6 The latest Risk Register is contained in Appendix I.

APPENDIX A – Update to the Economic and Financial Case

Norfolk County Council

NORWICH WESTERN LINK

OBC Addendum - Update to the Economic Case and Financial Case

SEPTEMBER 2022

PUBLIC

Norfolk County Council

NORWICH WESTERN LINK

OBC Addendum - Update to the Economic Case and Financial Case

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70041922

DATE: SEPTEMBER 2022

Norfolk County Council

NORWICH WESTERN LINK

OBC Addendum - Update to the Economic Case and Financial Case

WSP

Matrix House
Basing View
Basingstoke, Hampshire
RG21 4FF

Phone: +44 1256 318 800

Fax: +44 1256 318 700

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Final	Updated for DfT comments	Updated Table 2-21	
Date	17 June 2022	31 July 2022	20 September 2022	
Prepared by	Lisa Agnew / Craig Drennan	Lisa Agnew / Craig Drennan	Lisa Agnew / Craig Drennan	
Signature				
Checked by	Various	Various	Various	
Signature				
Authorised by	Craig Drennan	Craig Drennan	Craig Drennan	
Signature				
Project number	70041922	70041922	70041922	
Report number				
File reference	\\uk.wspgroup.com\central data\Projects\700419xx\70041922 - Norwich Western Link\02 WIP\TP Transport planning\03 Document\OBC\OBC addendum scheme costs\OBC Addendum - Final\OBC Addendum Appendix A - NWL OBC Addendum report_200922.docx			

CONTENTS

TABLES

1 INTRODUCTION

1.1 BACKGROUND

1.1.1. This addendum report provides updated Economic Case and Financial Case for the Norwich Western Link (NWL) following cost increases forecast for the scheme due to an alignment refinement. It provides updated Economic Case information following:

- Changes to DfT Guidance
- Changes to scheme cost
- Change to methodology.

1.1.2. Along with a Core Growth scenario a Core Growth (Sensitivity Appraisal) scenario was also presented within the Outline Business Case (OBC) in June 2021 which considered:

- revised economic and population projections issued by the Office for Budget Responsibility in March 2020
- impact of COVID-19 on economic growth.

1.1.3. In July 2021 there were changes to Department for Transport (DfT) Transport Analysis Guidance which updated the DfT Transport Analysis Guidance Data Book and removed specific mention of sensitivity testing. The impact of this change to DfT Transport Analysis Guidance meant that the sensitivity appraisal scenario became the Core Scenario.

1.1.4. The increased scheme costs have been identified since the submission of the OBC in June 2021. These updated costs take account of an alignment refinement along with changes in materials and inflation levels since the OBC (June 2021) submission.

1.1.5. Following the review of the OBC (June 2021) and the EAR (May 2021) by the DfT and after further discussions a Core Growth (Alternative Methodology) scenario was produced.

1.1.6. The outcome of all the above has been included within this OBC Addendum.

2 ECONOMIC CASE

2.1 COSTS

2.1.1. The cost of the proposed scheme has been estimated at 2020 prices, as set out in the Financial Case. It includes all costs associated with scheme preparation and construction, including land costs.

2.1.2. The costs have been calculated in line with DfT Transport Analysis Guidance Unit A1.2 (Scheme Costs, May 2022), which uses the following methodology:

- Estimation of a base cost estimate
- Incorporation of a real cost increases
- Application of risk-cost adjustment
- Application of optimism bias-cost adjustment
- Rebase cost to Department base year
- Discount cost to Department base year
- Convert costs to market prices.

2.1.3. Costs have been estimated under two broad headings:

- Investment costs (scheme preparation and construction)
- Maintenance and renewal costs.

2.1.4. The breakdown of costs presented above, align with the breakdown required for the Department for Transport Cost Pro-forma.

ESTIMATION OF BASE COST ESTIMATES

2.1.5. The initial capital cost estimate of the scheme is **£168.747 million** in 2020 Q3 prices as shown in Table 2-1. This includes costs for construction, statutory undertakers work, land and other costs such as professional fees.

2.1.6. In line with DfT Transport Analysis Guidance Unit A1.2 (Scheme Costs, May 2022), sunk costs have not been included in the following tables as these are costs that represent expenditure prior to the economic appraisal and cannot be retrieved apart from land costs.

Table 2-1: Investment Costs (£000s) at 2020 Q3 prices

Investment costs	Total Cost	Cost excluding Sunk Costs
Construction cost	111,928,362	111,869,027
Statutory undertakers	732,210	732,210
Professional fees	39,037,987	30,082,182
Land	17,048,657	17,048,657
Total	**168,747,216**	**159,732,076**

2.1.7. This base cost estimate does not take account of real increases in costs and must therefore be adjusted to provide real costs that account for the effects of inflation.

SCHEME MAINTENANCE AND RENEWAL COSTS

2.1.8. The whole life costs of the scheme have also been estimated. A breakdown of the estimated capital renewal, annual maintenance and operation costs is presented in Table 2-2.

Table 2-2: Breakdown of capital maintenance, renewal and operating costs

Year after opening	Costs (£m) at base price 2020 Q3	Costs (£m) adjusted for inflation
Total (60 years)	30.070	63.614

INFLATION ADJUSTMENT

2.1.9. The inflation rates used on the scheme costs are set out in Table 2-3. The total inflation figure is £44.919m.

Table 2-3: Inflation Rates

Inflation Rates:	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
Fees						
▪ Staff		2.77%	5.63%	8.56%	11.57%	14.66%
▪ Consultancy (Environmental and Planning)	5.38%	7.93%	10.55%	13.22%	15.97%	18.77%
▪ Consultancy (Commercial)	2.87%	5.82%	8.85%	11.97%	15.18%	18.48%
Utilities	11.57%	14.66%	17.84%	21.11%	24.47%	27.93%
Land	2.77%	5.63%	8.56%	11.57%	14.66%	17.84%
Construction						
Stage One Work	7.34%	10.31%	13.36%	16.50%	19.72%	23.03%
Stage Two Work	18.75%	19.78%	21.77%	24.11%	27.19%	29.01%

INCORPORATION OF REAL COST INCREASES

2.1.10. The first step of cost adjustment is to incorporate real cost increases. A real cost adjustment is calculated by inflating base costs by the construction cost index to bring them to their nominal values, and then dividing by the rate of general inflation to give their 'real' value. Using the real cost adjustment to multiply by the initial base estimate derives a 'real' capital cost estimate as shown in Table 2-4.

Table 2-4: Real adjusted Costs (£m)

Items	2020	2021	2022	2023	2024	2025	2026	Total
Scheme Base Cost including inflation	2.535	9.666	15.119	8.636	27.415	87.419	53.861	204.651
Real Adjustment Factor	1	1.01	1.04	1.07	1.08	1.10	1.13	
Investment Cost w/Real adjustment	2.535	9.587	14.475	8.084	25.390	79.273	47.496	186.840

CONSIDERATION OF OPTIMISM BIAS COST ADJUSTMENT

2.1.11. In accordance with the updated DfT Transport Analysis Guidance Unit A1.2 (Scheme Costs, May 2022), an exercise has been undertaken to establish whether optimism should be applied to the base costs in line with the project stage i.e., Stage 2 (Outline Business Case) and the type of scheme i.e., road scheme, or whether risk-cost adjustment should be applied instead.

2.1.12. This exercise has been undertaken to comply with the following paragraph extracted from DfT Transport Analysis Guidance Unit A1.2 (Scheme Costs, May 2022):

> *"Scheme promoters may then choose to present either the QRA cost estimate or the optimism-bias-adjusted cost estimate in their appraisal and Benefit Cost Ratio (BCR). However, given Reference Class Forecasting (RCF) represents a less bespoke but more overarching (top-down) measure of risk, one would typically expect the OB estimate to be a) higher than the QRA estimate, and b) in the majority of cases, the estimate that is chosen to be reported in appraisal in order to fully reflect the potential risks of the project in question."*

2.1.13. The recommended optimism bias uplifts for each stage of a transport project and type of scheme for Local Authority projects are set out in Table 2-5.

Table 2-5: Recommended optimism bias uplifts (Source: TAG Unit A1.2, Scheme Costs, May 2022)

Category	Types of projects	Stage 1 Strategic Outline Business Case	Stage 2 Outline Business Case	Stage 3 Full Business Case
Road	Motorway, Trunk roads, Local roads	46%	23%	20%

2.1.14. Using an optimism bias adjustment of 23% applied to scheme base cost including inflation i.e., £204.651m would generate an uplift of **£47.069m**. Applying the optimism bias adjustment of 23% to the Investment Cost w/Real adjustment value i.e., £186.840m would generate an uplift of **£42.973m**.

2.1.15. The alternative risk cost-adjustment, which is the weighted average of all outcomes and probabilities from the Quantified Risk Assessment (QRA) of scheme investment costs, was also calculated and valued at **£37.366m** in 2020 Q3 prices. The risk element is 22.1% of the total cost i.e., £168.747m.

2.1.16. Given that the value of Optimism Bias is greater than the QRA value, the Optimism Bias value of **£47.069m** rather than the QRA value has been used within the appraisal for robustness. The Optimism Bias uplift of **£47.069m** has been applied to the total real costs as shown in Table 2-6.

Table 2-6: Costs (£m) adjusted for Optimism Bias

Item	2020	2021	2022	2023	2024	2025	2026	Total
Total real costs (without OB)	2.535	9.587	14.475	8.084	25.390	79.273	47.496	186.840
Optimism bias (23%): total	0.583	2.224	3.477	1.986	6.305	20.106	12.388	47.069
Total risk adjusted costs with real cost adjustment	3.118	11.811	17.952	10.070	31.695	99.379	59.884	233.909

REBASE COST TO DFT BASE YEAR

2.1.17. For appraisal purposes, all costs should be presented in the DfT's base year, 2010. Costs are deflated to the correct price base by multiplying them by the ratio of the inflation index in the desired base year to the inflation index in the year currently being used. Costs have been adjusted to 2010 prices using DfT Transport Analysis Guidance Data Book (v1.17) values as shown in Table 2-7.

Table 2-7: Rebased Costs (£m) to 2010 Prices

Item	2020	2021	2022	2023	2024	2025	2026	Total
Public investment costs with Optimism Bias	3.118	11.811	17.952	10.070	31.695	99.379	59.884	233.909
GDP deflator factor	0.8031	0.8031	0.8031	0.8031	0.8031	0.8031	0.8031	
Public investment costs with deflation	2.504	9.485	14.417	8.087	25.454	79.811	48.093	187.851

DISCOUNT COST TO DFT BASE YEAR

2.1.18. For the purposes of the Economic Appraisal, all the costs have been adjusted to 2010 prices using DfT Transport Analysis Guidance Data Book values as set out in the annual parameters table as shown in Table 2-8.

2.1.19. A discount factor based on the HM Treasury "Green Book" is applied, to adjust costs occurring in different periods to a standard base year of 2010. An annual discount rate of 3.5% was applied for the first 30 years and 3% for years 31 to 60. This reflects the lower weighting placed on costs (and benefits) incurred at a future date compared to those incurred in the present.

Table 2-8: Scheme Costs Discounted to 2010 Present Value

Item	2020	2021	2022	2023	2024	2025	2026	Total
Public investment costs with deflation	2.504	9.485	14.417	8.087	25.454	79.811	48.093	187.851
Discount factor	0.7089	0.6849	0.6618	0.6394	0.6178	0.5969	0.5767	
Public investment costs with deflation & discounting	1.775	6.496	9.541	5.171	15.725	47.639	27.735	114.082

CONVERT COSTS TO MARKET PRICES

2.1.20. The last stage in preparing costs for appraisal is to convert them from the factor cost to the market price unit of account. This is done by using the indirect tax correction factor of 1.190, as per the DfT Transport Analysis Guidance Data Book.

2.1.21. In line with T DfT Transport Analysis Guidance Unit A1.2 (Scheme Costs, May 2022), the Present Value of Costs (PVC) only includes investment and operating costs incurred by the public sector. Private sector contributions to the scheme costs are not included in the PVC but are recorded as negative values in the Transport Economic Efficiency (TEE) table and Present Value of Benefits (PVB).

2.1.22. The Present Value of Costs (PVC) is presented in Table 2-9.

Table 2-9: Present Value of Costs (£m)

Risk adjusted costs in £	Scheme Preparation and Construction Cost	Maintenance, Renewal and Operation (60 yrs)	Total
Public Sector risk adjusted costs	186.840	28.064	214.904
Public investment costs with Optimism Bias	233.909	28.064	261.973
Public investment costs with deflation & discounting	114.082	5.948	120.03
PVC with Market Price Adjustment - Public sector costs only	135.758	7.078	142.836

2.1.23. The total discounted Present Value of Costs (PVC) is **£135.758m** without maintenance costs and **£142.836m** including maintenance costs.

2.2 PUBLIC ACCOUNTS TABLES

2.2.1. The Public Accounts (PA) Table has been produced in the format required by DfT. The apportionment of costs between local and central government is discussed in the Financial Case.

2.3 APPRAISAL OF SCHEME IMPACTS

2.3.1. The appraisal of the scheme impacts has considered:

- Changes to DfT Transport Analysis Guidance
- Changes to scheme cost
- Change to methodology.

2.3.2. The impact of these changes is considered in the following sections.

2.4 JUNE 2021 OBC SUBMISSION

2.4.1. The Initial Benefit Cost Ratio (BCR) has been calculated for the scheme with the revised costs as shown in Table 2-10.

Table 2-10: Analysis of Monetised Costs and Benefits – Initial (£m)

	Scenarios			
	Core Growth (TUBA 1.9.14)	**Low Growth (TUBA 1.9.14)**	**High Growth (TUBA 1.9.14)**	**Core Growth (Sensitivity Appraisal) (TUBA 1.9.14)**
Noise	£0.038	-	-	-
Air Quality	£0.072	-	-	-
Greenhouse Gases (Environmental assessment)	£19.475	£17.445	-	-
Physical Activity	£8.876	£8.876	£8.876	£8.876
Accidents/Safety	£18.582	£12.793	£12.778	£11.496
Economic Efficiency: Consumer Users (Commuting)	£58.488	£52.234	£84.319	£43.158
Economic Efficiency: Consumer Users (Other)	£167.804	£142.272	£208.363	£140.112
Economic Efficiency: Business Users and Providers	£88.569	£70.836	£116.071	£69.491
Wider Public Finances (Indirect Taxes)	-£53.272	-£46.916	-£59.742	-£39.398
Initial Present Value of Benefits (PVB)	**£308.632**	**£257.540**	**£370.665**	**£233.735**
Present Value of Costs (PVC)	**£142.836**	**£142.836**	**£142.836**	**£142.836**
Net Present Value (NPV)	£165.796	£114.704	£227.829	£90.899
Initial Benefit Cost Ratio (BCR)	**2.16**	**1.80**	**2.60**	**1.64**

Note: £m 2010 prices, discounted to 2010.

Note: This is not a direct comparison as only the Core Growth scenario includes impacts for Noise, Air Quality and Greenhouse Gases. The Low Growth scenario includes Greenhouse Gases impacts.

2.4.2. The monetised benefits for the scheme range from £233.735m for the Core Growth (Sensitivity Appraisal) scenario to £370.665m for the High Growth scenario. Based on the scheme impacts and costs the scheme has an initial Value for Money (VfM) category of High i.e., BCR of 2.16 for the Core Growth scenario.

2.4.3. The other scenarios sit within the Medium to High VfM category as shown in Table 2-10.

2.4.4. DfT Transport Analysis Guidance recommends that this Initial BCR be modified to include additional elements to create an Adjusted BCR. This Adjusted BCR includes monetised impacts from Level 2 benefits i.e., Reliability and Wider Economic Impacts as shown in Table 2-11.

Table 2-11: Analysis of Monetised Costs and Benefits (£M) – Adjusted

	Core Growth (TUBA 1.9.14)	Core Growth (Sensitivity Appraisal) (TUBA 1.9.14)
Initial Present Value of Benefits (PVB)	£308.632	£233.735
Reliability	£26.291	£90.692
Output Change	£7.881	
Agglomeration	£89.257	
Labour Supply	£0.330	
Adjusted Present Value of Benefits (PVB)	**£432.391**	**£324.427**
Present Value of Costs (PVC)	**£142.836**	**£142.836**
Net Present Value (NPV)	£289.555	£181.591
Adjusted Benefit Cost Ratio (BCR)	**3.03**	**2.27**

2.4.5. Following the inclusion of wider economic impacts in the appraisal the Adjusted BCR increases to **3.03** for the Core Growth scenario and **2.27** for the Core Growth (Sensitivity Appraisal) and remains in the **High** VfM category.

2.4.6. Following the submission of the OBC (June 2021) and the EAR (May 2021) DfT guidance was updated i.e., July 2021. This updated the DfT Transport Analysis Guidance Data Book and removed specific mention of sensitivity testing. Effectively the Core Growth (Sensitivity Appraisal) scenario became the Core Growth scenario i.e., Initial PVB decreased from £308.632m to £233.735m as shown in Table 2-11.

2.4.7. An updated version of TUBA i.e., 1.9.17 was released in November 2021 with the results shown in Table 2-12. This shows that the Initial PVB increases to £262.570m with an increase in the Initial BCR to 1.84.

Table 2-12: Analysis of Monetised Costs and Benefits – Initial (£m)

	Core Growth (Sensitivity Appraisal) (TUBA 1.9.17)
Noise	-
Air Quality	-
Greenhouse Gases (Environmental assessment)	-
Physical Activity	£8.876
Accidents/Safety	£11.496
Economic Efficiency: Consumer Users (Commuting)	£52.612
Economic Efficiency: Consumer Users (Other)	£159.535
Economic Efficiency: Business Users and Providers	£73.736
Wider Public Finances (Indirect Taxes)	-£43.685
Initial Present Value of Benefits (PVB)	**£262.570**
Present Value of Costs (PVC)	**£142.836**
Net Present Value (NPV)	£119.734
Initial Benefit Cost Ratio (BCR)	**1.84**

Note: £m 2010 prices, discounted to 2010

2.4.8. Table 2-13 shows that the Adjusted PVB is £353.262m with an Adjusted BCR of 2.47.

Table 2-13: Analysis of Monetised Costs and Benefits (£M) – Adjusted

	Core Growth (Sensitivity Appraisal) (TUBA 1.9.17)
Initial Present Value of Benefits (PVB)	**£262.570**
Reliability	£90.692
Output Change	
Agglomeration	
Labour Supply	
Adjusted Present Value of Benefits (PVB)	**£353.262**
Present Value of Costs (PVC)	**£142.836**
Net Present Value (NPV)	£210.426
Adjusted Benefit Cost Ratio (BCR)	**2.47**

2.5 CORE GROWTH (ALTERNATIVE METHODOLOGY)

2.5.1. Following the review of the OBC (June 2021) and the EAR (May 2021) by the DfT and after discussions with them a Core Growth (Alternative Methodology) scenario was produced.

2.5.2. This was in response to the scheme economics output results producing a higher than expected Vehicle Operating Costs (VoC) value which the DfT questioned as this has not been evident in other scheme assessments.

2.5.3. When the NWL is included within the transport model vehicles are rerouted to the NWL as you would expect with the introduction of new infrastructure. This results in less overall distance being travelled, by vehicles, across the transport model network with less wear and tear to vehicles which have given rise to a higher than expected VoC value in the scheme economics.

2.5.4. As of result of this higher than expected VoC value and after discussions with the DfT further assessment work was undertaken to understand more about the scale of those VoC benefits and to assess the robustness of the NWL scheme benefits.

2.5.5. The June 2021 assessment used DfT Transport Analysis Guidance and both assessment methodologies are recommended within DfT Transport Analysis Guidance.

2.5.6. Table 2-14 shows an Adjusted BCR of 2.17 for the Core Growth (Alternative Methodology) scenario which is in the High Value for Money category.

Table 2-14: Analysis of Monetised Costs and Benefits (AMCB)

Item	OBC: Core Growth (Sensitivity Appraisal) scenario (June 2021) (£m) (TUBA 1.9.17)	Core Growth (Alternative Methodology) scenario (April 2022) (£m) (TUBA 1.9.17)
Noise	-	£0.027
Air Quality	-	£0.564
Greenhouse Gases (Environmental assessment)	-	£19.371
Physical Activity	£8.876	£8.876
Accidents	£11.496	£28.411
Economic Efficiency: Consumer Users (Commuting)	£52.612	£67.505
Economic Efficiency: Consumer Users (Other)	£159.535	£49.484
Economic Efficiency: Business Users and Providers	£73.736	£56.684
Wider Public Finances (Indirect Tax Revenues)	-£43.685	£11.828
Initial Present Value of Benefits (PVB)	**£262.570**	**£242.750**
Present Value of Costs (PVC)	**£142.836**	**£142.836**
OVERALL IMPACTS		
Net Present Value (NPV)	**£119.734**	**£99.914**
Initial Benefit to Cost Ratio (BCR)	**1.84**	**1.70**
Wider Economic Impacts & Reliability	£90.692	£66.877
Adjusted Present Value of Benefits (PVB)	**£353.262**	**£309.627**
Net Present Value (NPV)	**£210.426**	**£166.791**
Adjusted Benefit Cost Ratio (BCR)	**2.47**	**2.17**

2.6 VALUE FOR MONEY STATEMENT

2.6.1. In considering overall Value for Money, attention must be paid to the Initial BCR and Adjusted BCR, as well as non-monetised impacts. The Value for Money statement provides a summary of these considerations and is presented in Table 2-15 for the Core Growth (Sensitivity Appraisal) scenario and Table 2-16 for the Core Growth (Alternative Methodology) scenario.

Table 2-15: Value for Money Statement for the Core Growth (Sensitivity Appraisal) scenario

	Core Growth (Sensitivity Appraisal) scenario	Detail
Initial Benefit to Cost Ratio	1.84	Calculated using DfT Transport Analysis Guidance
Adjusted Benefit to Cost Ratio	2.47	Includes wider impacts
Qualitative Assessment	At this time these are considered to be Adverse	**The Environmental Statement will contain more detailed design information and a more thorough impact assessment subsequently providing more site-specific mitigation measures to attempt to reduce impacts and risks further**
Key Risk	There is an Optimism Bias element of £47.069m	Optimism Bias assumed to be 23% of the scheme base cost including inflation i.e., £204.651m
Value for Money category	High	Initial BCR is in the Medium VfM category while the Adjusted BCR is in the High VfM category, which is supported by the qualitative assessment

Table 2-16: Value for Money Statement for the Core Growth (Alternative Methodology) scenario

	Core Growth (Alternative Methodology) scenario	Detail
Initial Benefit to Cost Ratio	1.70	Calculated using DfT Transport Analysis Guidance
Adjusted Benefit to Cost Ratio	2.17	Includes wider impacts
Qualitative Assessment	At this time these are considered to be Adverse	**The Environmental Statement will contain more detailed design information and a more thorough impact assessment subsequently providing more site-specific mitigation measures to attempt to reduce impacts and risks further**
Key Risk	There is an Optimism Bias element of £47.069m	Optimism Bias assumed to be 23% of the scheme base cost including inflation i.e., £204.651m
Value for Money category	High	Initial BCR is in the Medium VfM category while the Adjusted BCR is in the High VfM category, which is supported by the qualitative assessment

2.6.2. As described above both model assessment approaches are equally valid giving an Adjusted BCR within a range from 2.17 to 2.47 based on the latest assumed overall budget position. This means the NWL is still considered to be in the High Value for Money category i.e., BCR between 2.0 and 4.0, according to DfT criteria for a transport infrastructure project

2.7 SWITCHING VALUE ANALYSIS

OBC CORE GROWTH (SENSITIVITY APPRAISAL) SCENARIO

2.7.1. Switching value analysis on the OBC Core Growth (Sensitivity Appraisal) scenario has been undertaken to determine how a change in costs or benefits would alter the Value for Money (VfM) category for the NWL scheme.

2.7.2. Table 2-17 and Table 2-18 provide the changes that would be required, either in scheme costs or benefits, for the NWL scheme to shift from High VfM category (as indicated by the Adjusted BCR) to the Medium or Very High categories on either side of its current position.

Table 2-17: Changing the Adjusted BCR to Medium VfM

Factor	Core Growth
Benefits	Benefits would need to decrease by £69.018m or 19.5%
Costs	Costs would need to increase by £33.795m or 23.7%

2.7.3. If the costs were to remain the same, benefits would need to decrease by 19.5% to lower the NWL scheme into the Medium VfM category.

2.7.4. If benefits were to stay the same, costs would need to increase by 23.7% to lower the NWL scheme into the Medium VfM category.

Table 2-18: Changing the Adjusted BCR to Very High VfM

Factor	Core Growth
Benefits	Benefits would need to increase by £219.510m or 62.1%
Costs	Costs would need to decrease by £54.521m or 38.2%

2.7.5. To switch the NWL scheme into the Very High VfM category, if the costs were to remain the same, benefits would need to increase by 62.1%.

2.7.6. If benefits were to stay the same, costs would need to decrease by 38.2% to switch the NWL scheme into the Very High VfM Category.

CORE GROWTH (ALTERNATIVE METHODOLOGY) SCENARIO

2.7.7. Switching value analysis on the Core Growth (Alternative Methodology) scenario has been undertaken to determine how a change in costs or benefits would alter the Value for Money (VfM) category for the NWL scheme.

2.7.8. Table 2-19 and Table 2-20 provide the changes that would be required, either in scheme costs or benefits, for the NWL scheme to shift from High VfM category (as indicated by the Adjusted BCR) to the Medium or Very High categories on either side of its current position.

Table 2-19: Changing the Adjusted BCR to Medium VfM

Factor	Core Growth
Benefits	Benefits would need to decrease by £25.383m or 8.2%
Costs	Costs would need to increase by £11.978m or 8.4%

2.7.9. If the costs were to remain the same, benefits would need to decrease by 8.2% to lower the NWL scheme into the Medium VfM category.

2.7.10. If benefits were to stay the same, costs would need to increase by 8.4% to lower the NWL scheme into the Medium VfM category.

Table 2-20: Changing the Adjusted BCR to Very High VfM

Factor	Core Growth
Benefits	Benefits would need to increase by £263.145m or 85.0%
Costs	Costs would need to decrease by £65.429m or 45.8%

2.7.11. To switch the NWL scheme into the Very High VfM category, if the costs were to remain the same, benefits would need to increase by 85%.

2.7.12. If benefits were to stay the same, costs would need to decrease by 45.8% to switch the NWL scheme into the Very High VfM Category.

2.8 LOW GROWTH AND HIGH GROWTH

2.8.1. An assessment has been undertaken for the Low Growth scenario and High Growth scenario. It has been agreed with the DfT that the TUBA scheme benefits and the Wider Economic Impacts & Reliability benefits will be pro-rated from the Core Growth (Alternative Methodology) scenario.

2.8.2. The TUBA benefits for the Low Growth scenario and High Growth scenario have been pro-rated based on the information contained in the NWL Economic Appraisal Report (May 2021) i.e., Table 6-29.

2.8.3. For Commuting the Core Growth benefits are £58.488m while the Low Growth benefits are £52.234m. This is 0.893 i.e., 52.234m/58.488m. Applying the value of 0.893072 to the Alternative Methodology commuting benefits i.e., £67.505m gives a Low Growth value for commuting of £60.287m.

2.8.4. The assessment is shown in Table 2-21 and shows that the Adjusted BCR for the Low Growth scenario is 1.78 while the Adjusted BCR for the High Growth scenario is 2.47.

Table 2-21: Low Growth and High Growth scenario

Item	Core Growth (Alternative Methodology) scenario (April 2022) (£m) (TUBA 1.9.17)	Low Growth (TUBA 1.9.17)	High Growth (TUBA 1.9.17)
Noise	£0.027	-	-
Air Quality	£0.564	-	-
Greenhouse Gases (Environmental assessment)	£19.371	£17.445	-
Physical Activity	£8.876	£8.876	£8.876
Accidents	£28.411	£12.793	£12.778
Economic Efficiency: Consumer Users (Commuting)	£67.505	£60.287	£97.318
Economic Efficiency: Consumer Users (Other)	£49.484	£41.959	£61.451
Economic Efficiency: Business Users and Providers	£56.684	£45.335	£74.285
Wider Public Finances (Indirect Tax Revenues)	£11.828	£10.417	£13.265
Initial Present Value of Benefits (PVB)	**£242.750**	**£197.112**	**£267.973**
Present Value of Costs (PVC)	**£142.836**	**£142.836**	**£142.836**
OVERALL IMPACTS			
Net Present Value (NPV)	**£99.914**	**£54.276**	**£125.137**
Initial Benefit to Cost Ratio (BCR)	**1.70**	**1.38**	**1.88**
Wider Economic Impacts & Reliability	£66.877	£57.203	£85.524
Adjusted Present Value of Benefits (PVB)	**£309.627**	**£254.315**	**£353.497**
Net Present Value (NPV)	**£166.791**	**£111.479**	**£210.661**
Adjusted Benefit Cost Ratio (BCR)	**2.17**	**1.78**	**2.47**

3 FINANCIAL CASE

3.1 INTRODUCTION

3.1.1. The Financial Case outlines the proposed financing of the scheme in terms of the affordability of the proposal, the source of funding, annual breakdown of provisions and outturn costs. This section considers the potential costs and associated financial case for the preferred scheme and describes:

- How much the scheme is expected to cost, and how this has been calculated
- The anticipated profile of expenditure (including whole life costs)
- Risks that could affect the cost of the scheme
- How the scheme will be paid for, and by whom

3.2 COSTS

3.2.1. Scheme costs have been developed for the preferred option in line with DfT Transport Analysis Guidance Unit A1.2 (Scheme Costs, May 2022).

3.2.2. The cost estimate is based upon a price base of 2020 Q3. The estimated cost of the scheme at out-turn prices excluding VAT is £251.033 million. The estimated cost of the scheme is shown in Table 3-1.

SCHEME PREPARATION AND CONSTRUCTION

3.2.3. The cost of scheme preparation and construction has been estimated based on discussions held with tenderers as part of the competitive dialogue process. NCC have undertaken an independent review of these costs, and any differences were discussed to generate a revised, robust cost base.

3.2.4. Subject to funding, construction of the NWL will start in late 2024 and the new scheme will open to traffic in late 2026.

3.2.5. There is guidance to follow for scheme economic assessments if the scheme Opening Year is later than the transport model Opening Year. This states that:

> *"If scheme opening is only 1 or 2 years after the first modelled year then the modelled year data can be used to represent the scheme opening year."*

3.2.6. The transport model data is for 2025 and 2040 hence the current 2025 modelled year can be used for the scheme economic assessment.

PROFILE

3.2.7. The assumed annual profile of expenditure is shown in Table 3-2.

Table 3-1: Breakdown of Scheme Costs

Scheme element	pre 21/22	21/22	22/23	23/24	24/25	25/26	26/27	Total
Design, Investigations, Surveys, Procurement, Supervision and Client Costs through to Construction	8,955,804	9,319,594	13,642,318	5,494,235	1,626,035			39,037,986
Statutory Undertakers Works					549,157		183,052	732,210
Land	2,535,004	335,181	752,547	2,459,647	9,007,145	1,531,441	427,692	17,048,657
Construction, Supervision and other Client Costs	59,335	10,954			11,707,891	62,459,047	37,691,135	111,928,362
Total Cost (excluding Optimism Bias or Risk)	11,550,144	9,665,729	14,394,865	7,953,882	22,890,228	63,990,488	38,301,879	168,747,215
Risk			2,625,978	3,583,923	4,411,315	16,575,920	10,169,186	37,366,322
Total Cost (2020 Q3 prices)	11,550,144	9,665,729	17,020,843	11,537,805	27,301,543	80,566,408	48,471,065	206,113,537
Adjustment to outturn (inflation)			723,746	682,339	4,525,295	23,428,151	15,559,395	44,918,926
Scheme Cost (outturn prices)	11,550,144	9,665,729	17,744,589	12,220,144	31,826,838	103,994,559	64,030,460	251,032,463

Table 3-2: Annual Spend Profile %

Scheme Element	pre 21/22	21/22	22/23	23/24	24/25	25/26	26/27	Total
Design, Investigations, Surveys, Procurement, Supervision and Client Costs through to Construction	22.94%	23.87%	34.95%	14.07%	4.17%	0%	0%	100%
Statutory Undertakers Works					75.00%		25.00%	100%
Land	14.87%	1.97%	4.41%	14.43%	52.83%	8.98%	2.51%	100%
Construction, Supervision and other Client Costs	0.05%	0.01%			10.46%	55.80%	33.67%	100%

RISK ALLOWANCE

Estimating uncertainty

3.2.8. The final cost of delivering the schemes will not be known until after completion of the detailed design and land purchase, and completion of the statutory process. For this reason, the scheme cost estimates include allowances to account for this uncertainty, or risk. During the project lifecycle, the risk associated with cost estimates is determined by the level of detailed knowledge at each respective stage. As the level of detail increases, the level of risk, and the risk-adjusted costs usually reduce.

3.2.9. To reflect the uncertainty associated with known risks, a Quantified Risk Assessment (QRA) has been undertaken[1]. The QRA has been developed from an understanding of each specific risk and the probable effects of that risk along with an assessment of the likelihood of occurrence and cost, based on a detailed understanding of the projects costs which is driven from the cost plan/forecast.

3.2.10. The current risk adjustment has been calculated as £37.366m or 23.4% of the total scheme costs.

OUT-TURN PRICE ADJUSTMENT

3.2.11. The cost estimates assume a price base of 2020 Q3. An allowance is therefore made for expected inflation between the date of the cost estimate and the date when the expenditure is expected to occur. This is influenced by the profile of expenditure set out in Table 3-2. The uplift factors to reflect price inflation are shown in Table 2-3 in the Economic Case.

3.3 BUDGETS/FUNDING COVER

FUNDING STRATEGY

3.3.1. It is anticipated that the scheme will be funded entirely from public finances.

3.3.2. The most appropriate funding solution for the scheme is via the Large Local Majors (LLM) programme. LLM schemes should aim for the local or third-party contribution to be at least 15% of the total scheme costs.

3.3.3. The proposed funding breakdown for the scheme is detailed in Table 3-3. This assumes a maximum LLM funding contribution of 85%.

[1] *Risk allowance is a factor applied to project costs to act as a contingency for unforeseen circumstances.*

Table 3-3: Funding request (£m)

	Pre 21/22	21/22	22/23	23/24	24/25	25/26	26/27	Total
Government/ DfT funding	1.024	0	13.754	8.163	28.115	99.895	62.427	213.378
Local contribution	10.526	9.666	3.990	4.057	3.712	4.099	1.605	37.655
Total	**11.550**	**9.666**	**17.745**	**12.220**	**31.827**	**103.995**	**64.030**	**251.033**

LOCAL AUTHORITY CONTRIBUTION

3.3.4. A local contribution, underwritten by NCC, will account for 15% of the scheme costs, which totals **£37.655m**. The exact composition of the local authority contribution from 2021/22 has not yet been finalised, but is expected to come from a combination of the following:

- Funding through the New Anglia LEP
- Possible borrowing through Public Works Loan Board (PWLB)
- Consideration of borrowing via the new UK National Infrastructure Bank.

3.3.5. The details of the local funding mechanism will be clarified as the scheme is developed. In view of the uncertainty about the sources of local funding, Norfolk County Council will underwrite these costs. The local contribution is confirmed in the signed declaration by Norfolk County Council's Section 151 officer, which is included in the Bid Cover Sheet. The declaration also confirms that the Council will underwrite any increase in costs above those set out in the Business Case.

3.3.6. The Council is also prepared to enter into credit arrangements under the prudential borrowing powers from the Local Government Act 2003.

3.3.7. On the basis of the above, the scheme is therefore considered to be affordable from a local perspective.

3.4 EXPECTED WHOLE LIFE COSTS

3.4.1. Although the request for funding is for a contribution towards the capital costs of delivering the scheme, the business case must also consider its whole-life costs. These include the costs of operating and maintaining the highway (including any structures) and associated infrastructure as well as the longer-term costs of infrastructure renewal. This will include the costs associated with maintaining the landscaping and the environmental mitigation measures.

Maintenance and renewals

3.4.2. Maintenance and renewals costs include:

- Highways maintenance liabilities including communication equipment, drainage clearance, road and street lighting operation, winter maintenance (i.e. application of salt and snow clearance) and infrastructural and safety inspections
- Longer term highways renewals, including re-surfacing and renewing the road pavement, care and upkeep of the verge, winter gritting and any associated works
- Structures maintenance liabilities including inspection, deck waterproof replacement, concrete repairs and VRS replacement.

3.4.3. An indicative cost of has been developed based on structures, length of highway and planned renewals programme for each aspect. This would be included as part of NCC annual maintenance programme. This will be further developed as the detailed design is produced.

3.5 ACCOUNTING IMPLICATIONS

3.5.1. The preferred option is expected to have the following implications on public accounts:

- Central government/DfT funding of £213.378m (85%) is sought to deliver the scheme, with the majority of the funds being spent during the financial years 2023-2026
- A local contribution of £37.655m (15%) of the scheme implementation costs is required
- The maintenance costs for the scheme are expected to cost £30.07m in 2020 Q3 prices over a 60 year period, the funding for which will be sourced from the annual maintenance budget.

FUNDING COVER FOR WHOLE LIFE COSTS

3.5.2. The whole life costs will also need to be met by NCC, and provision will be made for this in the Council's budgets for highways and bridge maintenance, which are funded through LTP allocations. It is considered that the NWL will form part of the MRN and would be maintained as part of that network with funding provision specific to the MRN.

3.6 SUMMARY OF THE FINANCIAL CASE

3.6.1. The base scheme costs are **£168.747m**. The scheme costs include a risk allowance taken from the latest QRA.

3.6.2. The total scheme costs, including risk and inflation, are **£251.033m** at out-turn costs.

3.6.0. Funding is sought via the Large Local Majors programme through the National Roads Fund. Central government/DfT funding of **£213.378m** (85%) is sought to deliver the scheme, with the majority of the funds being spent during the financial years 2023-2026. A local contribution of **£37.655m** (15%) of the scheme implementation costs is required.

3.6.1. NCC's Section 151 Officer has provided a Letter of Intent to confirm the Council's financial obligations towards the scheme.

Matrix House
Basing View
Basingstoke, Hampshire
RG21 4FF

wsp.com

APPENDIX B – Update to the DfT Cost Proforma

Appraisal Cost Proforma Summary Sheet

Assumptions:

Price Year Base (Earliest - 1998)	2020

Note: Promoters are requested to enter the price year base they are using into the above

Investment cost optimism bias (%)	23%
Operating cost optimism bias (%)	0%

QRA P(80) (total)	37,366
QRA P(50) (total)	
Design Year Operating Cost (usually 15 years from opening year)	798
Operating Cost (all years total)	65,704

COST BREAKDOWN:

All values in £,000's (thousands)

Financial Year	Investment Cost (in price year base in cell C3, excluding risk)	Cost including real cost inflation (Base Cost)	Risk adjusted cost using QRA P (mean)	Base cost including Optimism Bias	Base cost including OB deflated and discounted to 2010 Market Prices
2020/21	2,535	2,535	2,535	3,118	2,112
2021/22	9,666	9,587	9,587	11,811	7,730
2022/23	14,395	14,475	17,101	17,952	11,354
2023/24	7,954	8,084	11,668	10,070	6,153
2024/25	22,890	25,390	29,801	31,695	18,713
2025/26	63,990	79,273	95,849	99,379	56,690
2026/27	38,302	47,496	57,665	59,884	33,005

Totals for remaining appraisal years:

Totals:	159,732	186,840	224,206	233,909	135,757

APPENDIX C – Update to the Public Accounts Table

Core Growth (Alternative Methodology) scenario - Public Accounts

Public Accounts (PA) Table

	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Local Government Fundi						
Revenue	0					
Operating Costs	7.078					
Investment Costs	20.364					
Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	27.442	*(7)*				
Central Government Funding: Transpo						
Revenue	0					
Operating costs	0					
Investment Costs	115.394					
Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	115.394	*(8)*				
Central Government Funding: Non-Tra						
Indirect Tax Revenues	-11.828	*(9)*				
TOTALS						
Broad Transport Budget	142.836	*(10) = (7) + (8)*				
Wider Public Finances	-11.828	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values.

Core Growth (Sensitivity Appraisal) scenario - Public Accounts

Public Accounts (PA) Table

	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Local Government Fundi						
Revenue	0					
Operating Costs	7.078					
Investment Costs	20.364					
Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	27.442	*(7)*				
Central Government Funding: Transpo						
Revenue	0					
Operating costs	0					
Investment Costs	115.394					
Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	115.394	*(8)*				
Central Government Funding: Non-Tra						
Indirect Tax Revenues	-43.685	*(9)*				
TOTALS						
Broad Transport Budget	142.836	*(10) = (7) + (8)*				
Wider Public Finances	-43.685	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values.

APPENDIX D – Update to the Analysis on Monetised Cost and Benefits Table

Core Growth (Sensitivity Appraisal) scenario i.e., Alternative Methodology AMCB

Analysis of Monetised Costs and Benefits

Noise	27	*(12)*
Local Air Quality	564	*(13)*
Greenhouse Gases	19371	*(14)*
Journey Quality	0	*(15)*
Physical Activity	8876	*(16)*
Accidents	28411	*(17)*
Economic Efficiency: Consumer Users (Commuting)	67505	*(1a)*
Economic Efficiency: Consumer Users (Other)	49484	*(1b)*
Economic Efficiency: Business Users and Providers	56684	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	11828	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	242750	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	142836	*(10)*
Present Value of Costs (see notes) (PVC)	142836	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	99914	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.70	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Core Growth (Sensitivity) scenario AMCB

Analysis of Monetised Costs and Benefits

Noise		*(12)*
Local Air Quality		*(13)*
Greenhouse Gases		*(14)*
Journey Quality		*(15)*
Physical Activity	8876	*(16)*
Accidents	11496	*(17)*
Economic Efficiency: Consumer Users (Commuting)	52612	*(1a)*
Economic Efficiency: Consumer Users (Other)	159535	*(1b)*
Economic Efficiency: Business Users and Providers	73736	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-43685	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	262570	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	142836	*(10)*
Present Value of Costs (see notes) (PVC)	142836	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	119734	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.84	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

APPENDIX E – Update to the Appraisal Summary Table

Appraisal Summary Table: Core Growth (Alternative Methodology) scenario

Date produced:	15-Jun-22

Contact:	
Name	
Organisation	Norfolk County Council
Role	

Name of scheme:	Norwich Western Link
Description of scheme:	The Norwich Western Link will comprise a new dual carriageway all-purpose road to the west of Norwich, from the A47 to the A1067/A1270, including a new viaduct bridge over the River Wensum and its floodplain. The scheme will provide a direct connection between the Strategic Road Network and the A1270 Broadland Northway through the west of Norwich. This will complete an orbital route around Norwich, which forms part of the Major Road Network.

Impacts		Summary of key impacts	Assessment				
			Quantitative			Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme provides business user benefits, with nearly all of the benefits being from journey time savings totalling with £81.766m in user benefits. There are increases in vehicle operating costs, with a benefit of over £6.803m	Value of journey time changes(£): 51,137.000 Net journey time changes (£) 0 to 2min: 13.744 / 2 to 5min: 10.204 / > 5min: 27.189				£56,684,000	
	Reliability impact on Business users	Reliability has been assessed in line with TAG Unit A1.3, Section 6.3 (Reliability – urban roads) based on the calculation of the standard deviation of journey times from journey time and distance for each O-D (origin-destination) pair						
	Regeneration	N/A						
	Wider Impacts	WSP's Wider Impacts in Transport Appraisal (WITA) tool has been used.The tool estimates the following impacts: agglomeration, labour supply and output change in imperfectly competitive markets as described in TAG units A2.1 to unit A2.4:	WI1: Agglomeration impacts £40.008m WI2: Output change in imperfectly competitive markets impacts £5.665m WI3: Tax revenues arising from labour market impacts £0.586m				£46,259,000	
Environmental	Noise	The study area for the assessment has been derived based on guidance within the Design Manual for Roads and Bridges (DMRB), LA 111 Noise and Vibration, May 2020 and is set to a distance of 600m from the kerb of any new roads associated with the scheme. There are 52 residential dwellings within the study area and no additional other sensitive receptors. Generally, within the study area, noise levels are predicted to increase as a result of the scheme, with large increases predicted at isolated receptors towards the centre of the study area where low baseline levels are anticipated. However, some receptors along Wood Lane and Paddy's Lane are predicted to experience noise level reductions as a result of less vehicles using these roads in favour of the scheme. The National Highways A47 North Tuddenham to Easton scheme has been included in both the Do-minimum (without scheme) and Do-something (with scheme) scenarios for the purpose of this assessment.	Households experiencing increased daytime noise in forecast year: 36 Households experiencing reduced daytime noise in forecast year: 9 Households experiencing increased night time noise in forecast year: 3 Households experiencing reduced night time noise in forecast year: 8			NA	£27,000	Noise impacts are experienced by those in the middle income quintiles. Children and young people experience noise disbenefits
	Air Quality	The appraisal has been undertaken using the Impact Pathways approach. Overall, with the Proposed Scheme there are modest improvements in local air quality in terms of NO2 and PM2.5 at locations with relevant human exposure. The overall monetary valuation takes into account ecosystem damage costs. No Air Quality Management Areas are included in the air quality study area. The Proposed Scheme links map onto PCM links which are all compliant with the NO2 limit value both with and without scheme. No exceedances of air quality standards are predicted.	NO2 Change in NO2 assessment score over 60 year appraisal period: -38,720.65 (between 'with scheme' and 'without scheme' scenarios). In 2025 there are there are 20,654 properties with improvement, 2,808 properties with no change, and 2,808 properties with deterioration. In 2040 there are 20,654 properties with improvement, 1,497 properties with no change, and 2,873 properties with deterioration. PM2.5 Change in PM2.5 assessment score over 60 year appraisal period: -9,467.40 (between 'with scheme' and 'without scheme' scenarios). In 2025 there are 1,682 properties with improvement, 1,682 properties with no change, and 2,489 properties with deterioration. In 2040 there are 20,696 properties with improvement, 1,250 properties with no change, and 3,078 properties with deterioration.			N/A	NPV of change in NO2: £94,721 NPV of change in PM2.5: £250,118 Total NPV of change in air quality: £563,552	Air quality impacts are experienced across all quintiles. Children and young people experience air quality benefits
	Greenhouse gases	The greenhouse gases appraisal for road transport emissions has been undertaken in accordance with TAG Unit A3 methodology. The calculations are based on the traffic forecasts for the do-minimum and do-something model scenarios for 2025 (opening year) and 2040 (design year), as generated by the Norwich Area Transport Strategy (NATS) traffic model for the OBC. Non-traded CO2e emissions (petrol and diesel vehicles) and CO2e traded emissions (electric vehicles) have been calculated in accordance with DMRB LA 114. The substantial differences in the findings compared to those for Scheme 'Option C' those presented in the SOBC are largely attributed to the major updates to the NATS model for the OBC and DMRB methodology (previously HA 207/07) for calculating emissions of greenhouse gases from road traffic. Comments on assumptions and uncertainty: 1) Emissions have been calculated across the whole of the NATS model simulation area. 2) Emissions have been estimated for scenarios in 2025 and 2040. For each year between the emissions have been determined by linear interpolation. In the absence of any data for the intervening years, this pragmatic approach adds a degree of uncertainty to the TAG calculations for these years. 3) The NATS model future forecast year is 2040. Beyond 2040 no traffic growth has been assumed. In reality some inter-annual variations in traffic levels and emissions can be expected. This factor adds a degree of uncertainty to the appraisal. 4) Emissions have been estimated based on vehicle fleet composition forecasts which were published pre-COVID-19. The likely impact of COVID-19 on fleet composition in future years cannot be predicted with any certainty at this present time.	Change in non-traded carbon over 60y (CO2e): -257,567 Change in traded carbon over 60y (CO2e): -2,606			N/A	£19,370,545	
	Landscape	There would be subdivision of fields, disrupting field patterns locally. There would be sections of embankment and cutting through the landscape which would affect the pattern locally but the viaduct would have a wider impact. Field patterns are easily substitutable, although loss of mature hedgerow trees would take much longer to re-establish. The viaduct across the River Wensum will introduce a new feature into this landscape and will have a significant impact on tranquillity in the north. The road will also alter tranquillity locally along its entire length, although more limited than the viaduct due to it largely being at-grade or in cutting. The alignment, which is duelled, is larger than the existing road infrastructure through this landscape and therefore out of character. There will be some loss of woodland and arable farmland altering land cover locally.	N/A			Moderate Adverse	N/A	
	Townscape	Scoped out of WebTAG and AST appraisal.	N/A			N/A	N/A	
	Historic Environment	The Proposed Scheme would have a moderate adverse effect on the setting (context) of nearby listed buildings, and will adversely affect the appreciation and understanding of the characteristic historic environmental resource in the area of proposed road construction. The Proposed Scheme would have a low, moderate or major adverse effect on known non-designated assets. The Proposed Scheme would have a low, moderate or major direct impact on previously unrecorded significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised. The heritage significance of such assets would depend on their nature, date, extent and survival but might be local or regional (potentially national if extensive and well preserved).	N/A			Moderate adverse (built heritage) Low, moderate or major adverse (buried remains)	N/A	
	Biodiversity	The possible biodiversity impacts include loss of woodland, hedgerows and wetland, degradation of habitats and impacts to protected species through loss of habitat, disturbance, severance of habitat, fragmentation and killing/injury of individuals. Impacts could occur during construction and operation of the Proposed Scheme. Mitigation and compensation strategies are being developed to reduce the identified possible impacts. Mitigation measures include a range of design features such as sensitive timing of construction works and the use of green bridges and underpasses. Compensation measures include planting new areas of woodland and enhancing existing woodlands. The most significant impact which cannot be mitigated for, in the short term, is the loss of woodland which bats use as foraging habitat.	N/A			Large adverse	N/A	
	Water Environment	No structures are proposed within the channel of the River Wensum or within 10m of the River Wensum. This is expected to minimise impacts to the river flow and channel morphology of the River Wensum. The Proposed Scheme requires the construction of a maintenance access track immediately adjacent to the proposed viaduct to enable inspection of the viaduct over its design life. The track will not require crossing of the River Wensum but will need to be constructed within the floodplain of the River Wensum and cross the land drains located within this area. The access track will be constructed at grade to prevent adverse effects to floodplain storage or flood flow conveyance. Structures such as culverts into a watercourse can potentially remove natural bed substrate and bank-side habitat, as well as change flow dynamics and sediment transport through the Tributary of the River Tud. Crossings of watercourses and any new watercourse channels are expected to maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB guidance, and be sensitive to ecological requirements. The Drainage Strategy at this stage of the assessment indicates that infiltration to ground and discharge to nearby watercourses will be utilised to discharge road runoff. A robust surface water drainage system will be expected to ensure discharge from the Proposed Scheme does not increase flood risk elsewhere up to and including the 1 in 100-year event and allowing for climate change effects and provides sufficient attenuation to restrict the rate and volume of discharge to those agreed with Norfolk County Council (NCC) as the Lead Local Flood Authority (LLFA). A broad range of potential runoff pollutants, such as hydrocarbons (fuel and lubricants), fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road during rainfall events, polluting the receiving groundwater water bodies. Implementation of a Construction Environmental Management Plan (CEMP) and passive treatment incorporated into sustainable drainage systems (SuDS) should be considered and adhered to during construction and operation of the Proposed Scheme, to reduce the risk of contamination to the water environment. Mitigation for reduced groundwater recharge due to the introduction of hardstanding should be considered during detail design stage of the Proposed Scheme.	N/A			Slight Adverse	N/A	
Social	Commuting and Other users	The scheme provides Commuting and Other user benefits, with most of the benefits being from journey time savings totalling £149.872m in user benefits. This are increases in vehicle operating costs, with a benefit of £76.420m.	Value of journey time changes(£): 146,311.000 Net journey time changes (£) 0 to 2min: 50.451 / 2 to 5min: 32.474 / > 5min: 63.386				£116,994,000	The distribution across the quintile areas is not even with the majority of impacts favouring those in the least deprived income quintiles.
	Reliability impact on Commuting and Other users							
	Physical activity	The impacts on Physical Activity has been assessed with DfT's AMAT for three of the four wider walking and cycling interventions. The NWL is forecast to have a beneficial impact of £8.876 million.					£8,876,000	
	Journey quality	Journey Quality has been assessed for traveller care, traveller views and traveller stress. Traveller care impacts have been assessed as moderately beneficial. Traveller views impacts have been assessed as neutral to beneficial, and traveller stress impacts have been assessed as large beneficial.				Moderate Beneficial		
	Accidents	COBALT (COst and Benefit to Accidents – Light Touch) has been used to understand the likely impact of the scheme on accidents in the study area. The impacts on users and road safety (accidents) has been appraised for a period of 60 years from the first year of scheme opening. The results indicate that the scheme will result in a reduction of 929 accidents over the 60 year appraisal period, leading to a reduction of 1,150 casualties (93 Serious and 1057 Slight)	The results indicate that the scheme will result in a reduction of 929 accidents over the 60 year appraisal period, leading to a reduction of 1,150 casualties (93 Serious and 1057 Slight)				£28,411,000	All relevant social groups and user groups experience accident benefits
	Security	Based on the assessment undertaken, the security impacts have been assessed as moderate/large beneficial. This is due to the provision of lighting and illuminated signs on the new link, and the reduction in junctions and stop start traffic.				Moderate Beneficial		N/A
	Access to services	The scheme has not been designed to address accessibility, there is no change in the routes served by the public transport system, although there may be complementary public transport measures considered separately to the NWL at a later time.				Neutral		N/A
	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs in users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs				Neutral		The distribution across the quintile areas is not even with the majority of impacts favouring those in the most deprived income quintiles.
	Severance	There are more roads forecast to experience decreases in flow rather than increases in flow in the study area; thus, showing a beneficial impact of the scheme on traffic flow, therefore the change in vehicle flows are not anticipated to negatively impact pedestrian movement. Where existing routes are severed, new crossing facilities will be provided, which should mitigate the impact of the new road.				Slight Beneficial		All relevant social groups and user groups experience severance benefits
	Option and non-use values	The scheme will not substantially change the availability of transport services within the study area.				Neutral		
Public	Cost to Broad Transport Budget	The cost to the broad transport budget is £142.836m					£142,836,000	
	Indirect Tax Revenues	The indirect tax revenues are £11.828m					£11,828,000	

Appraisal Summary Table: Core Growth (Sensitivity Appraisal) scenario

Date produced:	16-Jun-22

Contact:	
Name	
Organisation	Norfolk County Council
Role	

Name of scheme:	Norwich Western Link
Description of scheme:	The Norwich Western Link will comprise a new dual carriageway all-purpose road to the west of Norwich, from the A47 to the A1067/A1270, including a new viaduct bridge over the River Wensum and its floodplain. The scheme will provide a direct connection between the Strategic Road Network and the A1270 Broadland Northway through the west of Norwich. This will complete an orbital route around Norwich, which forms part of the Major Road Network.

Impacts		Summary of key impacts	Assessment: Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme provides business user benefits, with nearly all of the benefits being from journey time savings totalling with £73.736m in user benefits. There are increases in vehicle operating costs, with a benefit of over £5.777m	Value of journey time changes(£): 73.737 Net journey time changes (£): 0 to 2min: 34.199; 2 to 5min: 8.905; > 5min: 30.633		£73,736,000	
	Reliability impact on Business users	Reliability has been assessed in line with TAG Unit A1.3, Section 6.3 (Reliability – urban roads) based on the calculation of the standard deviation of journey times from journey time and distance for each O-D (origin-destination) pair				
	Regeneration	N/A				
	Wider Impacts	WSP's Wider Impacts in Transport Appraisal (WITA) tool has been used.The tool estimates the following impacts: agglomeration, labour supply and output change in imperfectly competitive markets as described in TAG units A2.1 to unit A2.4. The Reliability element has been included within this value as a pro-rata'd exercise was undertaken from the OBC Core Growth scenario.	WI1 (Agglomeration impacts), WI2 (Output change in imperfectly competitive markets impacts) and WI3 (Tax revenues arising from labour market impacts): £90.692m		£90,692,000	
Environmental	Noise	Not assessed for the Core Growth (Sensitivity) Scenario		NA		
	Air Quality	Not assessed for the Core Growth (Sensitivity) Scenario		N/A		
	Greenhouse gases	Not assessed for the Core Growth (Sensitivity) Scenario	Change in non-traded carbon over 60y (CO2e) Change in traded carbon over 60y (CO2e)	N/A		
	Landscape	There would be subdivision of fields, disrupting field patterns locally. There would be sections of embankment and cutting through the landscape which would affect the pattern locally but the viaduct would have a wider impact. Field patterns are easily substitutable, although loss of mature hedgerow trees would take much longer to re-establish. The viaduct across the River Wensum will introduce a new feature into this landscape and will have a significant impact on tranquillity in the north. The road will also alter tranquillity locally along its entire length, although more limited than the viaduct due to it largely being at-grade or in cutting. The alignment, which is duelled, is larger than the existing road infrastructure through this landscape and therefore out of character. There will be some loss of woodland and arable farmland altering land cover locally.	N/A	Moderate Adverse	N/A	
	Townscape	Scoped out of WebTAG and AST appraisal.	N/A	N/A	N/A	
	Historic Environment	The Proposed Scheme would have a moderate adverse effect on the setting (context) of nearby listed buildings, and will adversely affect the appreciation and understanding of the characteristic historic environmental resource in the area of proposed road construction. The Proposed Scheme would have a low, moderate or major adverse effect on known non-designated assets. The Proposed Scheme would have a low, moderate or major direct impact on previously unrecorded significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised. The heritage significance of such assets would depend on their nature, date, extent and survival but might be local or regional (potentially national if extensive and well preserved).	N/A	Moderate adverse (built heritage) Low,	N/A	
	Biodiversity	The possible biodiversity impacts include loss of woodland, hedgerows and wetland, degradation of habitats and impacts to protected species through loss of habitat, disturbance, severance of habitat, fragmentation and killing/injury of individuals. Impacts could occur during construction and operation of the Proposed Scheme. Mitigation and compensation strategies are being developed to reduce the identified possible impacts. Mitigation measures include a range of design features such as sensitive timing of construction works and the use of green bridges and underpasses. Compensation measures include planting new areas of woodland and enhancing existing woodlands. The most significant impact which cannot be mitigated for, in the short term, is the loss of woodland which bats use as foraging habitat.	N/A	Large adverse	N/A	
	Water Environment	No structures are proposed within the channel of the River Wensum or within 10m of the River Wensum. This is expected to minimise impacts to the river flow and channel morphology of the River Wensum. The Proposed Scheme requires the construction of a maintenance access track immediately adjacent to the proposed viaduct to enable inspection of the viaduct over its design life. The track will not require crossing of the River Wensum but will need to be constructed within the floodplain of the River Wensum and cross the land drains located within this area. The access track will be constructed at grade to prevent adverse effects to floodplain storage or flood flow conveyance. Structures such as culverts into a watercourse can potentially remove natural bed substrate and bank-side habitat, as well as change flow dynamics and sediment transport through the Tributary of the River Tud. Crossings of watercourses and any new watercourse channels are expected to maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB guidance, and be sensitive to ecological requirements. The Drainage Strategy at this stage of the assessment indicates that infiltration to ground and discharge to nearby watercourses will be utilised to discharge road runoff. A robust surface water drainage system will be expected to ensure discharge from the Proposed Scheme does not increase flood risk elsewhere up to and including the 1 in 100-year event and allowing for climate change effects and provides sufficient attenuation to restrict the rate and volume of discharge to those agreed with Norfolk County Council (NCC) as the Lead Local Flood Authority (LLFA). A broad range of potential runoff pollutants, such as hydrocarbons (fuel and lubricants), fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road during rainfall events, polluting the receiving groundwater water bodies. Implementation of a Construction Environmental Management Plan (CEMP) and passive treatment incorporated into sustainable drainage systems (SuDS) should be considered and adhered to during construction and operation of the Proposed Scheme, to reduce the risk of contamination to the water environment. Mitigation for reduced groundwater recharge due to the introduction of hardstanding should be considered during detail design stage of the Proposed Scheme.	N/A	Slight Adverse	N/A	
Social	Commuting and Other users	The scheme provides Commuting and Other user benefits, with most of the benefits being from journey time savings totalling £135.606m in user benefits. This are increases in vehicle operating costs, with a benefit of £76.540m.	Value of journey time changes(£): 135.608 Net journey time changes (£): 0 to 2min: 60.864; 2 to 5min: 15.187; > 5min: 59.557		£212,147,000	
	Reliability impact on Commuting and Other users					
	Physical activity	The impacts on Physical Activity has been assessed with DfT's AMAT for three of the four wider walking and cycling interventions. The NWL is forecast to have a beneficial impact of £8.876 million.			£8,876,000	
	Journey quality	Journey Quality has been assessed for traveller care, traveller views and traveller stress. Traveller care impacts have been assessed as moderately beneficial. Traveller views impacts have been assessed as neutral to beneficial, and traveller stress impacts have been assessed as large beneficial.		Moderate Beneficial		
	Accidents	COBALT (COst and Benefit to Accidents – Light Touch) has been used to understand the likely impact of the scheme on accidents in the study area. The impacts on users and road safety (accidents) has been appraised for a period of 60 years from the first year of scheme opening. The results indicate that the scheme will result in a reduction of 432 accidents over the 60 year appraisal period, leading to a reduction of 541 casualties (1 Fatal, 42 Serious and 498 Slight).	The results indicate that the scheme will result in a reduction of 432 accidents over the 60 year appraisal period, leading to a reduction of 541 casualties (1 Fatal, 42 Serious and 498 Slight)		£11,496,000	
	Security	Based on the assessment undertaken, the security impacts have been assessed as moderate/large beneficial. This is due to the provision of lighting and illuminated signs on the new link, and the reduction in junctions and stop start traffic.		Moderate Beneficial		
	Access to services	The scheme has not been designed to address accessibility, there is no change in the routes served by the public transport system, although there may be complementary public transport measures considered separately to the NWL at a later time.		Neutral		
	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs in users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs		Neutral		
	Severance	There are more roads forecast to experience decreases in flow rather than increases in flow in the study area; thus, showing a beneficial impact of the scheme on traffic flow, therefore the change in vehicle flows are not anticipated to negatively impact pedestrian movement. Where existing routes are severed, new crossing facilities will be provided, which should mitigate the impact of the new road.		Slight Beneficial		
	Option and non-use values	The scheme will not substantially change the availability of transport services within the study area.		Neutral		
Public	Cost to Broad Transport Budget	The cost to the broad transport budget is £142.836m			£142,836,000	
	Indirect Tax Revenues	The indirect tax revenues are £43.685m			-£43,685,000	

APPENDIX F – Update to the Economic Efficiency of the Transport System Table

Core Growth (Sensitivity Appraisal) scenario i.e., Alternative Methodology TEE

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	ALL MODES TOTAL		ROAD Private Cars and LGVs	BUS and COACH Passengers	RAIL Passengers	OTHER
User benefits						
Travel time	76017					
Vehicle operating costs	-8512					
User charges	0					
During Construction & Maintenance	0					
COMMUTING	67505	*(1a)*	0	0	0	0

Non-business: Other	ALL MODES TOTAL		ROAD Private Cars and LGVs	BUS and COACH Passengers	RAIL Passengers	OTHER
User benefits						
Travel time	70294					
Vehicle operating costs	-20805					
User charges	0					
During Construction & Maintenance	0					
NET NON-BUSINESS BENEFITS: OTHER	49489	*(1b)*	0	0	0	0

Business

User benefits			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
Travel time	51136		30816	20320				
Vehicle operating costs	5548		4547	1001				
User charges	0							
During Construction & Maintenance	0							
Subtotal	56684	*(2)*	35363	21321	0	0	0	0

Private sector provider impacts			Freight	Passengers	
Revenue	0				
Operating costs	0				
Investment costs	0				
Grant/subsidy	0				
Subtotal	0	*(3)*	0	0	0	0
Other business impacts						
Developer contributions	0	*(4)*				
NET BUSINESS IMPACT	56684	*(5) = (2) + (3) + (4)*				

TOTAL		
Efficiency Benefits (TEE)	173678	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
values

Core Growth (Sensitivity) scenario TEE

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	ALL MODES TOTAL		ROAD Private Cars and LGVs	BUS and COACH Passengers	RAIL Passengers	OTHER
User benefits						
Travel time	60169					
Vehicle operating costs	-7557					
User charges	0					
During Construction & Maintenance	0					
COMMUTING	52612	*(1a)*	0	0	0	0

Non-business: Other	ALL MODES TOTAL		ROAD Private Cars and LGVs	BUS and COACH Passengers	RAIL Passengers	OTHER
User benefits						
Travel time	75437					
Vehicle operating costs	84097					
User charges	0					
During Construction & Maintenance	0					
NET NON-BUSINESS BENEFITS: OTHER	159534	*(1b)*	0	0	0	0

Business

User benefits			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
Travel time	73736		48528	25208				
Vehicle operating costs	5777		5591	186				
User charges	0							
During Construction & Maintenance	0							
Subtotal	79513	*(2)*	54119	25394	0	0	0	0

Private sector provider impacts			Freight	Passengers	
Revenue	0				
Operating costs	0				
Investment costs	0				
Grant/subsidy	0				
Subtotal	0	*(3)*	0	0	0	0
Other business impacts						
Developer contributions	0	*(4)*				
NET BUSINESS IMPACT	79513	*(5) = (2) + (3) + (4)*				

TOTAL

Efficiency Benefits (TEE)	291659	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
values

APPENDIX G – Update to the Environmental Impact Report (including biodiversity worksheet)

Norfolk County Council

Norwich Western Link

Environmental Impact Report

70041922-WSP-EIR
JUNE 2022

PUBLIC

Norfolk County Council

NORWICH WESTERN LINK

Environmental Impact Report

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70041922

OUR REF. NO. 70041922-WSP-EIR

DATE: JUNE 2022

WSP

62-64 Hills Road
Cambridge
CB2 1LA

Phone: +44 1223 558 050

Fax: +44 1223 558 051

WSP.com

Quality Control

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft	Updated following client comments	Final	Final
Date	March 2021	May 2021	June 2021	June 2022
Prepared by	H Smith/			Various
Checked by	S Johnson/ H Bilston/ M Ashcroft	C Middleton	C Middleton	Various
Authorised by	S Goane	S Goane / L Wooller	S Goane / L Wooller	UK/CJM/601

Contents

TABLES

FIGURES

APPENDICES

1 Introduction

1.1 Introduction

1.1.1. This Environmental Impact Report (EIR) has been developed as part of the Outline Business Case for the Norwich Western Link scheme (NWL) and has been prepared on behalf of Norfolk County Council (NCC) for consideration by the Department for Transport (DfT).

1.1.2. This report forms an addendum to the original EIR for consideration by DfT following the completion of the localised alignment refinement north of Ringland Lane and updated traffic modelling.

1.2 Purpose of this appraisal

1.2.1. This TAG Environmental Appraisal has been prepared in support of the Outline Business Case (OBC) for the Norwich Western Link.

1.2.2. The methods used in the undertaking of the environmental appraisal followed the principles set out in the Department for Transport (DfT) guidance Transport Analysis Guidance (TAG) Unit A3 Environmental Impact Appraisal (May 2019). This provides guidance for appropriately qualified environmental practitioners on appraising the impact of transport proposals on the built and natural environment, and on people. This appraisal is not intended to be an alternative to, or a replacement for, a statutory Environmental Impact Assessment (EIA) (if required).

1.2.3. The reporting of the environmental appraisal is provided in the form of a Worksheet for each of the topics and an Appraisal Summary Table (AST), provided as part of the Economic Case of the OBC.

1.2.4. The environmental topics covered in this environmental appraisal are:

- Noise;
- Air Quality;
- Greenhouse Gases;
- Landscape;
- Historic Environment;
- Biodiversity; and
- Water Environment.

1.2.5. This report presents the findings set out in the AST, supported by TAG Worksheets, for the environmental topics listed above. It also includes a short account of the impacts associated with each of the environmental topics.

1.3 Scheme location

1.3.1. The NWL is located to the east of Norwich and seeks to provide a link between the A47 in the south and the A1067 in the north. The Norwich Western Link will comprise a new dual

carriageway all-purpose road to the west of Norwich, from the A47 to the A1067/A1270, including a new viaduct bridge over the River Wensum and its floodplain. The Scheme will provide a direct connection between the Strategic Road Network and the A1270 Broadland Northway through the west of Norwich. This will complete an orbital route around Norwich, which forms part of the Major Road Network. The location is shown in **Figure 1-1** with the alignment refinement illustrated with the green dashed line.

1.3.2. The Scheme is comprised of:

- A dual carriageway road, including a viaduct over the River Wensum and associated floodplain
- An "at grade" junction with the A1067;
- Dualling of a section of the existing A1067 between the proposed NWL roundabout and existing A1270 roundabout;
- A bridge carrying the NWL over Ringland Lane;
- New pedestrian crossing points, green bridges and bat underpasses where deemed to be required;
- Diversion and extension of existing Public Rights of Way and field paths to create a coherent joined up network; and
- Surface water drainage - principally infiltration basins, sediment forebays and associated carrier drains/ channels.

1.3.3. The Scheme also includes landscaping, planting, ancillary works, environmental mitigation work and Biodiversity Net Gain measures and a wider network of cycle-friendly route options where traffic relief from the NWL enables improved cycle priority.

1.3.4. **Figure 1-1**shows the Scheme location. The Scheme is located to the north-west of Norwich and spans from the A47 in the south to the A1067 in the north. The Scheme is predominantly straight with some curves and a sharper right-hand curve where it joins the A1067 in the north. **Figure 1-1** also shows the location of the A47 highways improvement scheme which is to the south of the Scheme, and the Broadland Northway which is to the north of the Scheme. Other roads in the area are also shown on **Figure 1-1**, as well as the River Yare (to the south), the River Tud (to the south), and the River Wensum (intersects the northern part of the Scheme).

Figure 1-1 - Scheme Location

2 Noise

2.1 Introduction

2.1.1. This section presents the noise appraisal for the Scheme, undertaken to help inform the OBC. The appraisal methodology and baseline conditions are described, followed by a summary of the findings of the noise appraisal, including the outcome of the TAG Unit A3 noise analysis.

2.1.2. The noise assessment to inform the OBC was originally undertaken in 2020 but has now been updated based on revised traffic data provided in 2022. The alignment of the Scheme has also been revised since the 2020 noise assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West). The findings reported within this chapter do not account for the changes to the Scheme design but do reflect the revised traffic data provided in 2022. This is considered acceptable given the limited number of receptors in proximity to the northern end of the Scheme, it is considered that the general pattern of predicted impacts will be similar for the revised Scheme as that presented within this Chapter (which is based on the 2022 traffic data but 2020 Scheme design). Further, the net present value for noise is small in comparison to the overall cost benefit ratio for the Scheme. It is therefore considered unlikely that the change to the Scheme design would have a notable influence on the overall cost benefit ratio for the Scheme.

2.1.3. Table 2-1 includes a definition of basic acoustic terms used in this chapter.

Table 2-1 - Glossary of Basic Acoustic Terms

Term	Definition
A-weighting, dB(A)	The human ear has a non-linear frequency response, being less sensitive at low and high frequencies and most sensitive in the mid-range frequencies. The A-weighting scale is applied to measured sound pressure levels so that these levels correspond more closely to the subjective response.
Decibel (dB)	The unit of measurement used for sound pressure levels. The decibel scale is logarithmic rather than linear. The threshold of hearing is 0 decibels while the threshold of pain is about 130 decibels.
Facade	Sound level that is determined 1 metre (m) in front of a window or door in a facade.
Free-field	The sound level that is measured or calculated, in the open, without any reflections from nearby surfaces except the ground.

2.2 Baseline conditions

2.2.1. Initial consultation with Broadlands DC has been undertaken with regard to the noise and vibration assessment as part of the Environmental Impact Assessment (EIA) process. Further consultation will be undertaken as the EIA process continues and will be reported within the Environmental Statement (ES).

2.2.2. At the northern end of the NWL, the noise climate is dominated by road traffic noise from Fakenham Road (A1067). Moving south, there is some contribution to the noise climate from road traffic on the nearby local roads. At the southern end of the NWL, the noise climate is dominated by road traffic noise from the A47. The disused RAF Attlebridge airfield is located approximately 3km west of the proposed route and is thought not to significantly affect the noise climate.

2.2.3. The A47 is managed by Highways England and is proposed to be dualled and slightly re-routed at the southern end of the NWL (not within the scope of the NWL). As the A47 dualling works are assumed to be complete prior to the opening of the NWL, the assessment of the NWL presented in this report has assumed the A47 is dualled in both the 'with' and 'without' NWL traffic scenarios [1]. Consequently, the noise impacts from the A47 dualling and re-routing will not be considered in this OBC assessment. Based on information available at this stage it has been assumed that the A47 will be surfaced with a low noise road surface and this has been incorporated into the acoustic model.

2.2.4. Generally, except for receptors at the northern and southern ends of the NWL close to the A1067 or the A47, the NWL covers a fairly rural area, with existing ambient noise levels being relatively low.

2.2.5. To account for the potential contribution from sources of noise not included in the acoustic model or excluded from the calculation (for example, as a result of the vehicle flow falling below the threshold for valid calculations of $L_{A10,18h}$), an adjustment for existing ambient noise has been applied. This is especially relevant for more remote locations away from existing roads, where the acoustic model may potentially under-estimate noise levels.

2.2.6. From 30 April to 2 May 2019 a noise survey was undertaken as part of the options selection stage for the NWL. This survey was undertaken at three locations to inform the acoustic modelling that was undertaken at that stage. Measurement position 3 was located at 47 The Street, Ringland which, although outside the study area for the NWL (discussed below), is indicative of the area between the A47 and the A1067 where ambient noise levels are low. Based on the measured noise levels, 34 dB $L_{A10,18h}$ during the daytime and 26 dB L_{night}

[1] The same approach will be adopted in the forthcoming Environmental Impact Assessment (EIA), with the outcomes being reported in the form of an ES.

during the night-time have been added to the acoustic model. These underlying levels are sufficiently low not to affect the noise levels in areas where road traffic noise is dominant but have been applied to help ensure that the existing noise levels in more remote areas are not under-estimated and hence that the future changes in noise levels are not over-estimated.

2.2.7. There are no Noise Important Areas (NIAs) within 600 metres of the NWL. The nearest NIA to the NWL is NIA 5201, located on the existing A47, approximately 1km from the southern end of the NWL.

2.3 Methodology

2.3.1. The appraisal has been completed in accordance with the TAG Unit A3 guidance for Noise Impacts. The methodology references DMRB guidance where appropriate, however, this is not a full and complete assessment under DMRB, as a proportionate appraisal has been undertaken, with the scope and methodology being tailored to support the OBC.

TAG Unit A3 Environmental Impact Appraisal, Department For Transport

2.3.2. With regards to noise impacts, the TAG Unit A3 impact appraisal used to focus on annoyance, however, this emphasis has now shifted in light of growing evidence on the links between environmental noise and health outcomes. Defra has produced guidance on transport-related noise using an 'impact pathway' approach to include:

- Annoyance;
- Sleep disturbance; and
- Health impact, including heart disease (acute myocardial infarction, or AMI), stress and dementia.

2.3.3. The methodology includes five steps as follows:

- Scoping;
- Quantification of noise and impacts;
- Estimation of the affected population;
- Monetary valuation of changes in noise impact; and
- Consideration of the distributional impacts of changes in noise.

SCOPING (STEP 1)

2.3.4. TAG Unit A3 requires that scoping should be consistent with the scoping of the environmental assessment, with the aim being to decide how noise impacts should be appraised and to define a study area for the NWL. The noise appraisal should be proportional to the NWL and its likely impact, with analysis being no more detailed than is required to support robust decision making.

2.3.5. TAG Unit A3 notes (in paragraph 2.2.3) that consideration needs to be given to how to address night-time noise and that for road-based schemes, "*conversion between different noise measures is considered sufficiently robust for the effects of night-time noise on sleep disturbance to be transformed from daytime measures*". This approach has been adopted

for the NWL, through the use of the formulas contained in TRL Project Report PR/SE/451/02[2].

2.3.6. Paragraph 2.2.6 of TAG Unit A3 notes that the guidance "*does not specify any analysis for situations where noise impacts on potentially noise sensitive non-residential receptors such as schools or hospitals*". Where impacts are likely to be significant, the TAG Unit A3 guidance is that they should be reported separately.

2.3.7. For road schemes, TAG Unit A3 makes reference to the DMRB Volume 11, Section 3, Part 7 Noise and Vibration[3]. This guidance was superseded in 2019 by DMRB LA 111 Noise and vibration[4], which itself was most recently updated in May 2020.

Quantification of noise impacts (step 2)

2.3.8. The NWL is likely to affect noise levels in the area, as experienced at nearby sensitive receptors, in the following ways. It will:

- change the physical alignment of existing traffic links at their junction with the NWL and introduce new traffic along the length of the NWL; and
- have the potential to alter vehicle flow characteristics, such as traffic volumes, composition, and speeds on the existing road network.

2.3.9. TAG Unit A3 requires the likely noise impacts to be quantified and to this end reference is made to the Calculation of Road Traffic Noise (CRTN)[5]. A 3-dimensional digital acoustic model has been prepared using CadnaA® software to quantify the likely road traffic noise levels during the operational phase of the NWL, with calculations following the methodology in CRTN (see paragraph 2.3.24 onwards).

2.3.10. TAG Unit A3 includes some guidance on how to deal with property demolitions or house building, stating that "*where there are grounds to confidently predict changes in the affected number of households between the without scheme and with scheme cases, this should be reflected in the appraisal*". However, it is understood that no significant housing

[2] TRL Limited. Project Report PR/SE/451/02. Converting the UK Traffic Noise Index $L_{A10,18h}$ to EU Noise Indices for Noise Mapping. P G Abbott & P M Nelson (TRL Limited). 2002.

[3] Design Manual for Roads and Bridges (DMRB). Volume 11 Environmental Assessment. Section 3 Environmental Assessment Techniques. Part 7 HD 213/11 – Revision 1 – Noise and Vibration. The Highways Agency, Transport Scotland, Welsh Government and the Department for Regional Development Northern Ireland. 2011.

[4] Design Manual for Roads and Bridges. Sustainability & Environmental Appraisal. LA 111 Noise and Vibration Revision 2. Highways England. 2020.

[5] The Calculation of Road Traffic Noise. The Department of Transport and Welsh Office. 1988

developments are currently proposed within the study area for the NWL. Therefore, no committed developments have been included in the monetary valuation of noise impacts. Potential noise impacts on any committed developments within the study area for the operational noise assessment will be considered within the EIA.

2.3.11. The CRTN has been used to predict road traffic noise levels in terms of $L_{A10,18h}$. The following corrections have been used to calculate relevant daytime and night-time noise levels for use in the TAG Unit A3 assessment:

- $L_{Aeq,16h} = L_{A10.18h} – 2$ dB (from paragraph 2.2.13 of TAG Unit A3); and
- $L_{night} = 0.90 \times L_{A10,18h} – 3.77$ dB (from TRL Report PR/SE/451/02, Method 3 for non-motorway roads).

2.3.12. The output from the quantification process is a matrix of households experiencing different noise levels in the with-scheme and without-scheme scenarios. The noise levels are defined in 3 dB wide bands running from 45 dB to 81 dB for both $L_{Aeq,16h}$ and L_{night}.

2.3.13. The calculations have been carried out for the NWL opening year and a forecast (or future) year 15 years after opening:

- do-minimum, opening year 2025, (without-scheme);
- do-something, opening year 2025, (with-scheme);
- do-minimum, forecast year 2040, (without-scheme); and
- do-something, forecast year 2040, (with-scheme).

2.3.14. In this chapter the terms ‘do minimum’ and ‘without-scheme’ have been used interchangeably.

2.3.15. In this chapter the terms ‘do-something’ and ’with-scheme’ have been used interchangeably.

2.3.16. The acoustic model has been used to predict receptor specific noise levels at a height of 4 metres. The façade subject to the greatest magnitude of change has been used in the analysis in line with the guidance in DMRB LA 111.

2.3.17. It should be noted that paragraph 2.2.17 of TAG Unit A3 notes the following regarding night-time impacts “*As well as through the monetisation process described in step three below, night noise impacts should be assessed by determining the number of households where the WHO Interim Night Noise Target of 55 dB L_{night} noise level is exceeded for the last forecast year in the with and without scheme cases*”. For this analysis, it is considered appropriate to use a different sift mechanism, based on the highest noise level, to derive a representative noise level for each dwelling. This is because the use of the façade with the greatest magnitude of noise change may not identify the highest noise level affecting the property.

Estimation of the affected population (step 3)

2.3.18. The matrix of the numbers of residential receptors experiencing without-scheme and with-scheme noise levels in 3 dB bands for $L_{Aeq,16h}$ and L_{night} have been entered into the TAG Noise Workbook to estimate the likely affected population and to monetise the impact.

2.3.19. The TAG Noise Workbook contains dose-response functions for each impact pathway for road traffic noise. These functions describe, at different noise levels, the percentage of the population affected (for sleep disturbance and annoyance/amenity) or the increased risk of adverse health outcomes (for acute myocardial infarction (AMI), stroke and dementia).

2.3.20. These relationships, in combination with the matrix of information generated during Step 2 (regarding the number of households experiencing different with-scheme and without-scheme noise levels), can be used to estimate the number of people affected under each impact pathway.

2.3.21. The TAG Noise Workbook goes on to develop per household, marginal monetary values for each impact pathway (based on an average of 2.3 people per household). These values are contained within the workbook and so the estimation of the population affected for each impact pathway is effectively subsumed within the monetary valuation described in the next sub-section (Step 4).

Monetary valuation of noise impacts (step 4)

2.3.22. The TAG Noise Workbook generates the following outputs, which are intended to complement each other:

- the net present value of the change in noise, both as an overall value and broken down into the five impact pathways; and
- quantitative results in the form of the number of households experiencing increased or decreased noise in the forecast year during the day and night.

2.3.23. The monetary valuation is based on the estimation of the number of Disability-Adjusted Life Years (DALYs) lost (or gained) under each impact pathway, taking into account a value of £60,000 per DALY.

CALCULATION OF ROAD TRAFFIC NOISE (CRTN), 1988

2.3.24. The CRTN memorandum describes the procedures for calculating noise from road traffic. The factors which may influence road traffic noise levels at source can be divided into two groups:

- road related factors - gradient and surface type; and
- traffic related factors - flow, speed and the proportion of heavy-duty vehicles.

2.3.25. The Basic Noise Level (BNL) is described in the CRTN. It does not relate to any specific receptor, but rather is a measure of source noise, at a reference distance of 10 m from the nearside carriageway edge of a specific length of highway. It is determined by obtaining the

estimated noise level from the 18-hour traffic flow and then applying corrections for vehicle speed, percentage of heavy vehicles, gradient and road surface as described in CRTN.

2.3.26. The propagation of noise is also covered in CRTN and includes corrections for distance and, if appropriate, either ground cover or screening. Other receptor specific corrections include the (angle of) view of the road and reflections either from the façade of the receptor and or from reflecting structures on the far side of the road.

STUDY AREA

2.3.27. TAG does not provide guidance in relation to defining a noise study area, and so reference is made to the DMRB LA 111 which includes (in paragraph 3.44, Note 1) the following advice on the extent of a suitable study area for the operational road traffic assessment, although it is acknowledged that the study area can be varied for individual projects.

"An operational study area defined as the following can be sufficient for most projects, but it can be reduced or extended to ensure it is proportionate to the risk of likely significant effects:

1) the area within 600 m of new road links or road links physically changed or bypassed by the project;

2) the area within 50 m of other road links with potential to experience a short term BNL change of more than 1.0 dB(A) as a result of the project."

2.3.28. For this TAG Unit A3 assessment and in line with DMRB LA 111 guidance, the main study area has been determined based on a 600 metre buffer around the NWL and the existing road links replaced by the NWL. Detailed road traffic noise predictions have been undertaken at all receptors within this area.

2.3.29. Whilst there is the potential for the NWL to have an impact beyond the main study area, it would not be proportionate to quantify these impacts as part of the TAG calculations. It is expected that these impacts would be both positive and negative, with some roads relieved by the NWL and others busier as a result of traffic using different routes to access the NWL. Further consideration of the potential noise level impacts on the wider road network will be considered during the forthcoming EIA.

DATA SOURCES

- OS MasterMap from Ordnance Survey;
- OS AddressBase Plus from Ordnance Survey;
- 1 m 2019 DTM (digital terrain model) Lidar from the Defra survey data download website;
- 3d engineering drawings of the Highways England A47 Tuddenham to Easton dualling (interim design fix C, August 2020) that were available at the time of preparation of the OBC;
- 3d engineering drawings of the Norwich Western Link (reference design, Drawing No. NCCT41793-03-D-01 3D) that were available at the time of preparation of the OBC; and

- traffic data (flow, composition and speed) used in the development of the OBC for individual links within the Traffic Reliability Area.

2.3.30. These data have been utilised as follows.

Table 2-2 - Data Utilised in the TAG Unit A3 Appraisal

Model Layer	Existing Model	Future Model
Roads	All roads aligned to OS MasterMap base mapping. Relevant traffic data for the do-minimum scenarios (opening and forecast years) have been assigned to each link. It has been assumed that the A47 and A1270 have a low noise road surface.	For existing roads unaffected by the Scheme, as for Existing Model. The Scheme has been aligned with 3d engineering drawings. Relevant traffic data for the do-something scenarios (opening and forecast years) have been assigned to each link. It is assumed that the Scheme has a low noise road surface.
Viaducts	N/A	3d engineering drawings were used to align the viaduct carrying the Norwich Western Link over the River Wensum and associated flood plain in the do-something scenarios.
Topography	1 m 2019 DTM lidar used to generate height contours at 1 m spacing. 3d engineering drawings for the proposed A47 dualling have been used to generate height contours along the length of this route.	As for existing topography, except for the Scheme corridor where the 3d engineering drawings have been used to generate height contours at 0.1 m spacing along the length of this route.
Buildings	Polygonised footprints extracted from OS MasterMap	
Calculation points	OS AddressBase Plus data used to identify the use of the building	

2.3.31. The NWL reference design includes significant earth bunding at locations along the route which have been included in the acoustic modelling for the NWL. The reference design also includes a three metre high barrier on the outer carriageway edge of each of the River Wensum viaducts. This barrier has been assumed to have acoustic qualities, and so the associated noise level benefits have been included in the calculations.

2.4 IMPACT APPRAISAL AND POTENTIAL MITIGATION

SENSITIVE RECEPTORS

2.4.1. Existing residential receptors within the study area have been identified using OS AddressBase® data in combination with information on the location of buildings taken from provided OS MasterMap data. A total number of 52 dwellings are located within the main study area (see paragraph 2.3.27) and have, therefore, been included within the assessment.

2.4.2. In addition, TAG Unit A3 requires that consideration be given to other noise-sensitive non-residential receptors such as schools, hospitals and designated sites. Whilst no other sensitive buildings have been identified within the study area, the River Wensum is a Site of Special Scientific Interest (SSSI) and so should be considered as a noise sensitive receptor. However, as the TAG Unit A3 analysis focusses on human receptors, this area has not been included in the TAG calculations for the NWL. The effect of noise on the SSSI will be considered during the forthcoming EIA. At that time and given that the River Wensum occupies a large area within which the noise impacts are likely to vary, the impacts on this receptor will be considered across the area as a whole, rather than at specific locations.

IMPACT APPRAISAL

2.4.3. The output spreadsheet from the TAG Unit A3 Noise Workbook is provided in Appendix A.

2.4.4. The results of the noise appraisal are summarised below. As discussed in paragraph 2.1.2, the noise modelling undertaken to inform this report is based on updated traffic data (2022) produced for the alignment refinement, however, the general pattern of impacts is anticipated to be similar for the alignment refinement. These values have been generated by analysing data for each residential receptor based on the façade with the greatest magnitude of noise change:

- In the forecast year, 36 households would experience an increase in daytime noise, whilst nine households would experience a decrease in daytime noise.
- In the forecast year, three households would experience an increase in night-time noise, whilst eight households would experience a decrease in night-time noise.
- The overall appraisal indicates that the operation of the NWL is likely to generate a beneficial noise impact and that the ‘net present value of change in noise’ is calculated to be £26,756.
- The impact pathways described earlier in this chapter have been assessed, and the NWL is likely to generate a beneficial effect for all pathways. The following net present values have been calculated:
  - Sleep disturbance: £35,093;
  - Amenity: £9,926;
  - AMI: £6,857;

- Stroke: £2,089; and
- Dementia: £3,179.

2.4.5. Paragraph 2.2.7 of TAG Unit A3 states "*As well as through the monetisation process described in step three below, night noise impacts should be assessed by determining the number of households where the WHO Interim Night Noise Target of 55 dB L_{night} noise level is exceeded for the last forecast year in the with and without scheme cases*".

2.4.6. In the Do-minimum forecast year three receptors are predicted to exceed the target value of 55 dB $L_{night.}$ In the Do-something forecast year two receptors (which also exceed the target value in the Do-minimum forecast year) are predicted to exceed the target value of 55 dB L_{night}.

DISCUSSION OF IMPACTS

2.4.7. Whilst the TAG Unit A3 assessment indicates an overall positive result in monetary terms for the NWL, it should be noted that a broad range of impacts is anticipated within the study area.

2.4.8. The properties expected to experience the largest beneficial changes in noise level are those located on Wood Lane and Paddy's Lane. Noise level decreases are predicted at these receptors as a result of fewer vehicles using these roads in favour of the NWL. It is likely that some of these receptors will experience significant beneficial effects in terms of the EIA.

2.4.9. Adverse impacts are predicted across the majority of the rest of the study area as a result of the NWL, particularly at isolated receptors towards the centre of the study area where ambient noise levels are currently low. Whilst the absolute noise levels are likely to be fairly low, a high magnitude of change is anticipated at many receptors.

2.4.10. Some of these adverse impacts are not reflected in the TAG calculations due to the 45 dB $L_{Aeq, 16h}$/L_{night} cut-off value embedded within the TAG Unit A3 Noise Workbook, and this, in part, is the reason for the overall positive monetary value. During the forthcoming EIA assessment, further consideration will be given to all numerical and other contextual factors associated with these receptors when determining the significance of the predicted noise levels and changes. Nevertheless, it is likely that a number of receptors in the study area will be found to experience a significant adverse effect in terms of the EIA

2.4.11. An EIA is to be undertaken by WSP and an ES will be prepared, which will contain more detailed design information and a more thorough impact assessment. More detail will be provided in the ES regarding the predicted noise level changes and likely significant effects of the NWL and further consideration will also be given to mitigation measures where appropriate.

2.4.12. A high level Construction and Environment Management Plan (CEMP) and Mitigation Plan will be produced as part of the ES submission which will detail the measures required to mitigate the identified impacts. This will help give certainty on the delivery of the mitigation

and compensation measures. A more detailed CEMP will be taken forward by the contractor post Planning Submission.

2.5 SUMMARY

2.5.1. A noise appraisal has been undertaken following the methodology presented in TAG Unit A3, Environmental Impact Appraisal, dated May 2019.

2.5.2. A 3-dimensional digital acoustic model has been generated based on the guidance contained within CRTN and the DMRB LA 111. The noise modelling undertaken to inform this report is based on updated traffic data (2022) for the alignment refinement, however, the general pattern of impacts is anticipated to be similar for the revised Scheme alignment.

2.5.3. The affected population has been estimated and the monetary valuation of changes in noise impact has been determined using the TAG Unit A3 Noise Appraisal Workbook (see Appendix A).

2.5.4. The overall appraisal indicates that the operation of the NWL, without mitigation, is likely to generate a beneficial noise impact, and the 'net present value of change in noise' is calculated to be £26,756. Whilst this indicates a positive scheme from a noise perspective, it should be noted that large adverse impacts are predicted at many receptors within the study area, although these are mostly at low levels (which in turn means they have less influence on the overall monetised value of the NWL). As the financial value for noise is anticipated to have a minimal influence on the overall cost benefit ratio for the Scheme, it has not been considered necessary to update the noise modelling to reflect the revised Scheme design at this stage.

2.5.5. It is anticipated that the NWL would generate a characteristic pattern of noise impacts:

- Noise decreases for properties located adjacent to roads which will be relieved by the NWL; and
- Noise increases at isolated properties within the corridor of the new road where the baseline noise levels are expected to be low.

2.5.6. Whilst consideration has been given to mitigation measures at earlier stages, resulting in the inclusion of the River Wensum viaduct barriers and earth bunding along the NWL, further measures to minimise adverse impacts arising from the operation of the NWL will be considered during the forthcoming EIA assessment.

2.5.7. The ES is being prepared by WSP, which will contain more detailed design information and a more thorough impact assessment subsequently providing more site-specific mitigation measures to attempt to reduce impacts and risks further.

3 AIR QUALITY

3.1 INTRODUCTION

3.1.1. This section presents the air quality impacts appraisal for the NWL, which was undertaken in accordance with TAG Unit A3. The air quality assessment to inform the OBC was originally undertaken in 2020 but has now been updated based on revised traffic data provided in 2022. The alignment of the Scheme has also been revised since the 2020 noise assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West).

3.2 LEGISLATION

3.2.1. The relevant ambient air quality legislation is given in **Table 3-1**.

Table 3-1 – Relevant Air Quality Standards and Legislation

Pollutant	Measured as	Concentration (µg/m^3)	Legislation	Requirement
Nitrogen dioxide (NO_2)	Annual mean	40	Part IV of the Environment Act 1995 and The Air Quality (England) Regulations 2000 (as amended 2002)	Standard set as an objective. Under the Environment Act, local authorities are required to review air quality within their areas and where objectives are not likely to be achieved are required to declare an Air Quality Management Area (AQMA) and put in place an Air Quality Action Plan to bring about improvement.
			Directive 2008/50/EC on ambient air quality and cleaner air for Europe The Air Quality Standards Regulations 2010 (as amended 2016)	Standard set as a limit value. The Secretary of State must ensure that levels of do not exceed the limit value.

Pollutant	Measured as	Concentration (µg/m^3)	Legislation	Requirement
$PM_{2.5}$ (particulate matter less than 2.5 micrometres in diameter)	Annual mean	20	Directive 2008/50/EC on ambient air quality and cleaner air for Europe. Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, includes an amendment to the Air Quality Standards Regulations 2010 setting the limit value for $PM_{2.5}$ as 20µg/m^3.	Standard set as a limit value. The Secretary of State must ensure that levels of do not exceed the limit value.

3.3 CONSULTATION

3.3.1. Over the course of the project there has been consultation with the Environmental Health Officer for Broadland DC. Further consultation will be undertaken as part of the separate Environmental Impact Assessment process, which is to be reported within the ES.

3.4 STUDY AREA

3.4.1. The air quality study area was determined by defining the affected road network (ARN) using Design Manual for Roads and Bridges (DMRB) LA 105 scoping criteria[6]. For this appraisal, a link qualifies as part of the ARN where there is:

- Change in annual average daily traffic (AADT) flow of 1,000 vehicles or more; or

[6] DMRB HA 207/07 Air Quality guidance and associated Interim Advice Note 170/12, which are referred to in TAG Unit A3 (May 2019) guidance, were superseded by LA 105, which is available to download at: https://www.standardsforhighways.co.uk/dmrb/ [accessed April 2022]

It should be noted that as the scheme is not part of the Strategic Road Network, the DMRB speed pivoting and banding approach to vehicle emissions has not been applied.

- Change in AADT flow of heavy duty vehicles of 200 or more; or
- Change in road alignment of 5 metres (m) or more.

3.4.2. As illustrated in Figure 3-1, the ARN, which includes the NWL, extends from Dereham in the west along the A47 to Great Yarmouth in the east, and includes adjoining roads. The ARN also extends into Norwich and includes section of the 'A147 inner ring road, to the west and north of the city centre.'

3.4.3. The air quality study area encompasses 200m around the ARN. All impacts beyond 200m will be imperceptible and are therefore scoped out.

3.4.4. The air quality study area intersects several local authority districts, including: Breckland District Council (DC), Broadland DC, South Norfolk DC, Norwich City Council (CC) and Great Yarmouth Borough Council (BC).

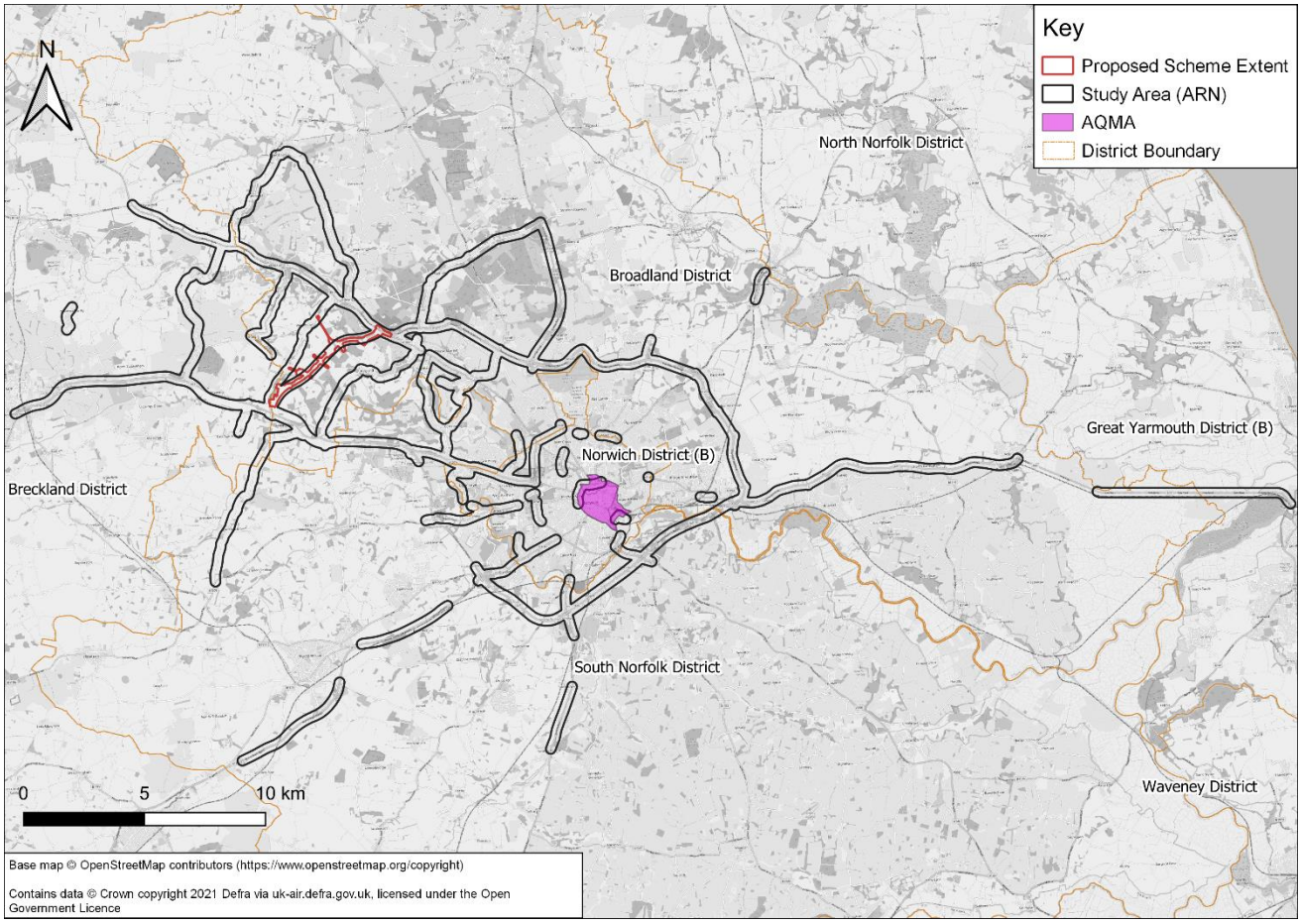


Figure 3-1 - Air Quality Study Area

3.5 APPRAISAL METHODOLOGY

3.5.1. The appraisal was undertaken following TAG Unit A3 on Air Quality Impacts and involved:

- Quantitative assessment based on modelling to determine vehicle emissions of oxides of nitrogen (NO_x) and fine particulate matter ($PM_{2.5}$) with and without the Scheme in the

opening year (2025) and design year (2040) scenarios, and dispersion modelling to determine annual mean concentrations of nitrogen dioxide (NO_2) and $PM_{2.5}$ at the relevant receptors in each scenario. Concentrations were predicted by dispersion modelling using ADMS-Roads model software[7].

- Monetary valuation of the Air Quality Impacts using the impact pathways approach, which accounts for changes in human exposure to annual mean NO_2 and $PM_{2.5}$ concentrations at relevant receptors and overall emissions of NO_x and $PM_{2.5}$ to determine the effects of impacts that do not directly affect households such as ecosystem damage.

3.5.2. Data sources used to inform this appraisal include:

- Breckland DC[8], Broadland DC[9], South Norfolk DC[9], Norwich CC[10] and Great Yarmouth BC[11] Local Air Quality Management reports;
- WSP baseline NO_2 diffusion tube survey undertaken between September 2019 and March 2020 (see **Appendix B** for details);
- Traffic data without and with the Scheme in 2025 (opening year) and 2040 (design year) from the Norwich Area Transport Strategy Model (2019 base year);
- Road source emissions data from Defra's Emissions Factors Toolkit (version 11.0)[12];
- Meteorological data for 2019 from Norwich airport – used in predicting pollutant concentrations at receptors;
- Background and roadside pollutant concentration data from Defra's 2018-based Pollution Climate Mapping (PCM) model[13,14];

[7] Further information on ADMS-Roads can be found on the Cambridge Environmental Research Consultants webpage: http://www.cerc.co.uk/environmental-software/ADMS-Roads-model.html

[8] Breckland DC, Annual Air Quality Reports. Available at: Air quality reports – Breckland Council

[9] Broadland District Council and South Norfolk District, Air Quality Reports. Available at: Broadland and South Norfolk Air Quality Reports – Broadland and South Norfolk (southnorfolkandbroadland.gov.uk)

[10] Norwich City Council, Air Quality Monitoring Reports and Assessments. Available at: Air quality monitoring reports and assessments | Norwich City Council

[11] Great Yarmouth Borough Council, Pollution – Advice on Local Air Quality. Available at: Where can I get advice on local air quality? - Great Yarmouth Borough Council (great-yarmouth.gov.uk)

[12] Defra (2021) Emissions Factors Toolkit (version 11.0). Available at: Emissions Factors Toolkit | LAQM (defra.gov.uk)

[13] Defra (2020) Background Maps (2018 reference year). Available at: Background Maps | LAQM (defra.gov.uk)

[14] Defra (2020) NO_2 and PM projections data (2018 reference year). Available at: 2020 NO₂ and PM projections data (2018 reference year) - Defra, UK

- Conversion of modelled NO_x concentrations to NO_2 concentrations using Defra's NO_x to NO_2 calculator (version 8.1)[15]; and
- Ordnance Survey AddressBase data, provided by NCC under Contractor Licence, to identify sensitive receptor locations with relevant exposure to annual mean pollutant concentrations.

3.6 BASELINE CONDITIONS

3.6.1. An overview of baseline air quality conditions within the air quality study area (**Figure 3-1**) is given in **Table 3-2**.

3.6.2. Due to the Government's Covid-19 pandemic restrictions in 2020, pollutant concentrations reported by local authorities for that year were markedly lower than for 2019. This was mainly due to substantial reductions in road traffic during that time. Following the lifting of the restrictions, traffic has returned to pre-pandemic levels. The baseline conditions were therefore considered in relation to monitoring data in years including and proceeding 2019.

Table 3-2 - Baseline Conditions Within the Air Quality Study Area

Local Authority	NO_2	$PM_{2.5}$	Summary
Breckland DC	For 2019, there were no Breckland DC NO2 monitoring sites within the air quality study area; the nearest were within Dereham. For the district as a whole, monitored annual mean NO2 concentrations for 2019 were below the 40µg/m3 standard. There are no AQMA's for NO2 within the air quality study area in this district. The main sources of NOx are road traffic emissions from the A1067, A47 and A1075. The PCM model predictions for roadside annual mean NO2 concentrations for 2019	For 2019, there are no monitoring sites or AQMA's for PM2.5 within the district. From monitoring of PM10 at East Wretham, Breckland DC reported that annual mean PM2.5 concentrations are likely to be well below the (then) standard of 25µg/m3. Furthermore, the annual mean PM10 concentration for 2019 at East Wretham was 15µg/m3, indicating the PM2.5 concentration to be below the current standard of 20µg/m3. The main sources of PM2.5 are road traffic emissions from the A1067, A47 and A1075.	Overall, baseline air quality is likely to be good within the air quality study area in this district.

[15] Defra (2020) NO_x to NO_2 calculator (version 8.1). Available at: NOx to NO2 Calculator | LAQM (defra.gov.uk)

Local Authority	NO_2	$PM_{2.5}$	Summary
	are well below the 40µg/m3 standard. The highest concentration is 23.5µg/m3 on the A47 (census ID 802074965). Predicted concentrations for later years are lower. Background annual mean NO2 concentrations for 2019 are well below the 40µg/m3 standard.	Background annual mean PM2.5 concentrations for 2019 are well below the 20µg/m3 standard.	
Broadland DC	For 2019, there were four Broadland DC NO_2 monitoring sites within the air quality study area: BN1 on the A47 at North Burlingham; BN11 on Reepham Road at Hellesdon; BN12 on Boundary Road at Hellesdon; BN13 on Mile Cross Lane at Hellesdon. The highest concentration was 28µg/m^3 at BN11. In 2019/20, five WSP roadside monitoring sites were located within the air quality study area in this district: NWL_2 and NWL_3 on the A1067 Fakenham Rd; NWL_5 on the A1067 over the River Wensum at Attlebridge; NWL_6 on the A1067 at Lenwade; and NWL_7 on the A47 north of Honingham. The highest annual mean concentration for 2019 was 31.6µg/m^3 at NWL_7. There are no AQMA's for NO_2 within the air quality study area in this district. The main sources of NOx are road traffic emissions from vehicles on the B1150, A47,	For 2019, there were no monitoring sites or AQMAs for $PM_{2.5}$ within the district. The main sources of $PM_{2.5}$ are road traffic emissions from the A1067, A1270, A140, A1042 and A47. Background annual mean $PM_{2.5}$ concentrations for 2019 are well below the 20µg/m^3 standard.	Overall, baseline air quality is likely to be good within the air quality study area in this district.

Local Authority	NO_2	$PM_{2.5}$	Summary
	A140, A1042, A1067, A1151, A1194, A1242 and A1270. The PCM model predictions for roadside annual mean NO_2 concentrations for 2019 are well below the 40µg/m^3 standard. The highest concentration is 31.7µg/m^3 on the A140 (census ID 802026505) north of the junction with the A1042. Predicted concentrations for later years are lower. Background annual mean NO_2 concentrations for 2019 are well below the 40µg/m^3 standard.		
South Norfolk DC	For 2019, there were four South Norfolk DC monitoring sites within the air quality study area: DT1 on Newmarket Rd at Cringleford; DT2 on Longwater Lane at Costessey; DT9 on Bungay Rd; and DT11 at Thickthorn Cottages off the B1172 Norwich Rd. The highest concentration was 23.9µg/m^3 at DT9. In 2019/20, two WSP roadside monitoring sites were within the air quality study area in this district: NWL_8 on the A47 west of Easton; and NWL_9 on the A1074 Dereham Rd at New Costessey. The highest concentration was 32.7µg/m^3 at NWL_9. The main sources of NOx are road traffic emissions from	For 2019, there were no monitoring sites or AQMAs for $PM_{2.5}$ within the district. The main sources of $PM_{2.5}$ are road traffic emissions from the A11 and A47. Background annual mean $PM_{2.5}$ concentrations for 2019 are well below the 20µg/m^3 standard.	Overall, baseline air quality is likely to be good within the air quality study area in this district.

Local Authority	NO_2	$PM_{2.5}$	Summary
	vehicles on the A11, A47 and A140. The PCM model predictions for roadside annual mean NO_2 concentrations for 2019 are well below the 40µg/m^3 standard. The highest concentration for 2019 is 28.3µg/m^3 on the A1074 (census ID 802058422). Predicted concentrations for later years are lower. Background annual mean NO_2 concentrations for 2019 are well below the 40µg/m^3 standard.		
Norwich CC	For 2019, there were five Norwich CC monitoring sites within the air quality study area: DT1 at 256 King St; DT21 at Rotary House; DT22 at Carrow Bridge House; DT25 at 24 Bargate Court; and DT29 at 4 Chapelfield North. The highest concentration was 43.5µg/m^3 at DT29, which is within the Norwich Central AQMA and exceeds the standard of 40µg/m^3. In 2019/20, one WSP roadside monitoring site was within the air quality study area: NWL_10 on the A1074 Dereham Road, where the annual mean concentration for 2019 was 29.6µg/m^3. The air quality study area encroaches on the AQMA, which was declared in 2012	For 2019, there were no monitoring sites or AQMA's for $PM_{2.5}$ within the district. The main sources of $PM_{2.5}$ are road traffic emissions from the B1108, B1150, A11, A140, A146, A147, A1067, A1074, A1151, A1042, A1054, A1242 and A1402. Background annual mean $PM_{2.5}$ concentrations for 2019 are well below the 20µg/m^3 standard.	Except for the Norwich Central AQMA, baseline air quality is likely to be good within the air quality study area in this district.

Local Authority	NO_2	$PM_{2.5}$	Summary
	due to exceedances of the annual mean NO_2 standard. The main sources of NOx are road traffic emissions from vehicles on the B1108, B1150, A11, A140, A146, A147, A1067, A1074, A1151, A1042, A1054, A1242 and A1402. The PCM model predictions for roadside annual mean NO_2 concentrations for 2019 are well below the 40µg/m^3 standard. The highest concentration for 2018 is 33.2µg/m^3 on the A1054 (census ID 802008756). Predicted concentrations for later years are lower. Background annual mean NO_2 concentrations for 2019 are well below the 40µg/m^3 standard.		
Great Yarmouth BC	For 2019, there were no Great Yarmouth DC NO_2 monitoring sites within the air quality study area. The main sources of NOx are road traffic emissions from vehicles on the A47 and A149. The PCM model predictions for roadside NO_2 concentrations within the air quality study area are well below the 40µg/m standard. The highest concentration for 2018 is 29.8µg/m^3 on the A47 (census ID 802048491). Predicted concentrations for later years are lower. Background annual mean NO_2 concentrations for 2019 are	For 2019, there were no monitoring sites or AQMA's for $PM_{2.5}$ within the district. The main sources of $PM_{2.5}$ are road traffic emissions from vehicles on the A47 and A149. Background annual mean $PM_{2.5}$ concentrations for 2019 are well below the 20µg/m^3 standard.	Overall, baseline air quality is likely to be good within the air quality study area in this district.

Local Authority	NO_2	$PM_{2.5}$	Summary
	well below the 40µg/m^3 standard.		

3.6.3. **Figure 3-2** shows annual mean NO_2 concentrations, as the most extensively measured pollutant.

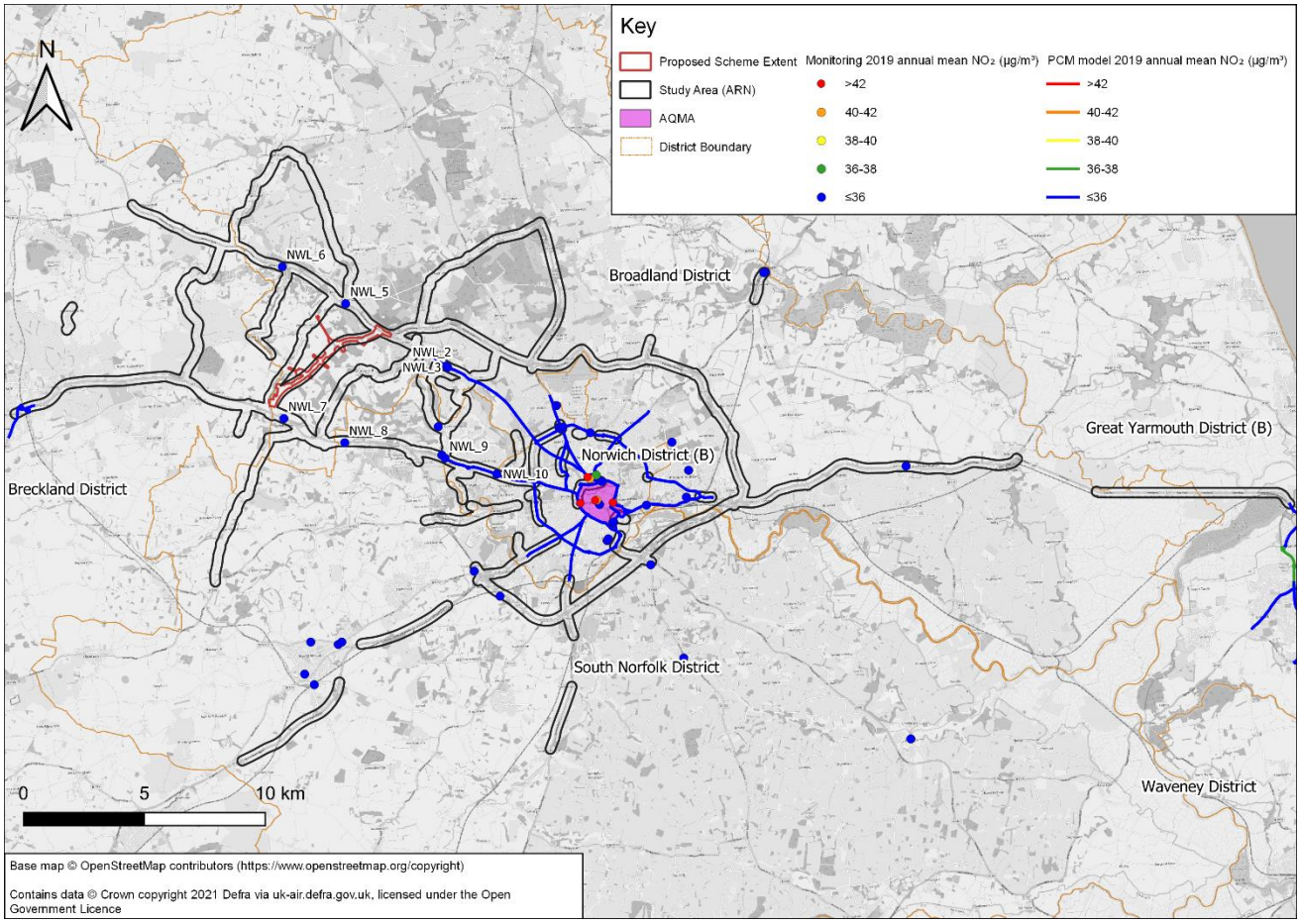


Figure 3-2 - Baseline Conditions within the Study Area

3.7 APPRAISAL SUMMARY

3.7.1. The Air Quality Impacts TAG sheet is provided in **Appendix C**.

3.7.2. As reported in the AST, with the NWL there are modest improvements in local air quality in terms of NO_2 and $PM_{2.5}$ at locations with relevant human exposure. The overall monetary valuation takes into account ecosystem damage costs. The Norwich Central AQMA is included in the air quality study area. The NWL links map onto PCM links which are all

compliant with the NO_2 limit value both with and without scheme. No exceedances of air quality standards are predicted.

3.8 MITIGATION

3.8.1. The NWL itself will mitigate traffic congestion on the road network and reduce journey times, which in-turn will reduce pollutant concentrations at receptors along routes that would otherwise experience higher volumes of traffic and emissions. The appraisal indicates no specific need for air quality mitigation.

NO_2

3.8.2. In 2025 there are 20,676 properties with improvement, 1,540 properties with no change, and 2,808 properties with deterioration. In 2040 there are 20,654 properties with improvement, 1,497 properties with no change, and 2,873 properties with deterioration.

3.8.3. The NPV of change for NO_2 over the 60-year appraisal period (2025-2084 inclusive) is a benefit of £101,733.

$PM_{2.5}$

3.8.4. In 2025 there are 20,853 properties with improvement, 1,682 properties with no change, and 2,489 properties with deterioration. In 2040 there are 20,696 properties with improvement, 1,250 properties with no change, and 3,078 properties with deterioration.

3.8.5. The NPV of change for $PM_{2.5}$ over the 60-year appraisal period (2025-2084 inclusive) is a benefit of £489,228.

3.9 COMMENTS ON ASSUMPTIONS AND UNCERTAINTIES

3.9.1. Impacts in the design year (2040) are based on vehicle emissions factors and background concentrations for 2030 as the last forecast year in Defra's Emissions Factors Toolkit version 11.1 and 2018-based background map dataset. 2030 emissions factors and background concentrations are applied in all years thereafter, up to the end of the 60-year appraisal period (2084). Consequently, any improvements in air quality that may occur after 2030 are not factored into the appraisal. In this respect the appraisal is considered to be conservative.

3.9.2. Traffic growth has not been forecast beyond 2040 and so traffic levels are assumed to be the same in all years thereafter, up to the end of the 60-year appraisal period). This is a limitation, which is commonly encountered in TAG appraisal. It is not considered to be a significant limitation as vehicle emissions should continue to diminish into the future as ‘zero emissions’ vehicles replace conventional vehicles thereby neutralising the effect of further traffic growth.

3.10 CONCLUSION

3.10.1. Overall, the NWL results in modest local air quality benefits at properties within 200m of the ARN.

4 GREENHOUSE GASES

4.1 INTRODUCTION

4.1.1. This section presents the greenhouse gases (GHG) appraisal for the sensitivity test for NWL, which was undertaken in accordance with TAG Unit A3.

4.1.2. The GHG assessment to inform the OBC was originally undertaken in 2020 but has now been updated based on revised traffic data provided in 2022. The alignment of the Scheme has also been revised since the 2020 noise assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West).

4.2 LEGISLATION

4.2.1. The Climate Change Act 2008[16] introduced a legally binding target to reduce GHG emissions to at least 80% below base year (1990) levels by 2050. This target has more recently been amended to 100% by The Climate Change Act 2008 (2050 Target Amendment) Order 2019 [17].

4.2.2. The Act introduced 'carbon budgets', which set maximum GHG emission limits not to be exceeded during set periods, to achieve specified reductions in GHG emissions versus base year levels.

4.2.3. 'The Sixth Carbon Budget - The UK's path to Net Zero' was published in December 2020 [18]. This sets out the carbon budget that will run between 2033 and 2037. It is reported that under the 'Balanced Pathway', options to reduce emissions - including take-up of zero emission technologies and reduction in travel demand - combine to reduce surface transport emissions by around 70% to 32 million tonnes CO_2e by 2035 from 113 million tonnes for 2019, and to approximately 1 million tonnes CO_2e by 2050.

4.3 CONSULTATION

4.3.1. No formal consultation has been undertaken to date in relation to the GHG emissions, however discussions with the Norfolk County Council Sustainability Manager have been held to discuss the council's latest Environmental Policy which includes targets related to resource efficiency and carbon reduction. A key aspiration captured within the policy is for the council

[16] The Climate Change Act 2008 c.27. Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents [accessed January 2021]

[17] The Climate Change Act 2008 (2050 Target Amendment) Order 2019 No.1056. Available at: https://www.legislation.gov.uk/uksi/2019/1056/contents/made [accessed January 2021]

[18] Climate Change Committee (2020), The Sixth Carbon Budget - The UK's path to Net Zero'. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget/ [accessed January 2021]

to collectively achieve 'net zero' carbon emissions on estates by 2030, but within wider areas, work towards 'carbon neutrality' also by 2030 [19].

4.4 STUDY AREA

4.4.1. The GHG study area includes all road links within the simulation area of the Norwich Variable Demand Model (VDM).

4.5 APPRAISAL METHODOLOGY

4.5.1. The greenhouse gases appraisal for road transport emissions has been undertaken in accordance with TAG Unit A3 Greenhouse Gases'[20]. The calculations are based on the traffic forecasts for the do-minimum and do-something model scenarios for 2025 (opening year) and 2040 (design year), as generated by the VDM for the OBC. Non-traded CO_2e emissions (petrol and diesel vehicles) and CO_2e traded emissions (electric vehicles) have been calculated in accordance with DMRB LA 114 'Climate' methodology[21].

4.6 BASELINE CONDITIONS

EXISTING BASELINE

4.6.1. GHG emissions occur constantly and widely as a result of human and natural activity including energy consumption (fuel, power), industrial processes, land use and land use change. Baseline transport emissions for 2019 within Norwich, Norfolk, and nationally are presented in **Table 4-1** for context[22].

Table 4-1 – Baseline Transport Emissions (Tonnes of CO_2) for 2019

Emissions Sources	Norwich	Norfolk	National
Road Transport (A roads)	52,600	977,100	49,580,900

[19] Norfolk County Council. Environmental Policy. Presented and approved at Full Council on 25 November 2019. Available at: https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/natural-environment-policies/environmental-policy [accessed January 2021]

[20] Available at: https://www.gov.uk/guidance/transport-analysis-guidance-tag

[21] Available at: https://www.standardsforhighways.co.uk/dmrb/

[22] Department for Business, Energy & Industrial Strategy. UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019. Available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019 [accessed May 2022]

Emissions Sources	Norwich	Norfolk	National
Road Transport (Motorways)	n/a	n/a	27,602,400
Road Transport (Minor roads)	51,200	740,600	42,886,200
Transport Other	11,400	153,400	2,439,800
Diesel Railways	2,900	13,300	1,794,200
Transport Total	118,00	1,884,500	124,303,400

FUTURE BASELINE

4.6.2. Future baseline end-user traffic GHG emissions (modelled using data from the Scheme's sensitivity assessment traffic model) are presented in **Table 4-2** for the year 2025 (the first operational year of the Scheme) and the future modelled year 2040. In addition, the average annual and total GHG emissions from 2025 to 2084 are presented for comparison with the 60-year operational period of the Scheme.

Table 4-2 - Baseline GHG Emissions (Tonnes of CO_2e) for 2025, 2040 and 2025-2084

Scenario	2025 (operational year)	2040 (future year)	Average per year (2025-2084)	Total (2025-2084)
Baseline ('Do Minimum')	622,470	442,055	466,110	27,966,625

4.7 APPRAISAL SUMMARY

4.7.1. The GHG TAG sheet is provided in **Appendix D**.

4.7.2. The sensitivity assessment shows that the Scheme gives rise to lower CO_2e emissions compared to the do-minimum situation, with savings (benefits) over the 60-year appraisal period (2025 - 2084 inclusive) of 249,280 tonnes in non-traded carbon associated with conventional (petrol and diesel) vehicles, and 2,606 tonnes from traded carbon associated with electric vehicles (i.e. electrical power generation sources).

4.7.3. The differences are generally associated with lower values of total annual vehicle kilometres in each year that are predicted due to the Scheme. For 2025, the distance travelled over the simulated road network is predicted to be approximately 11.33 million vehicle kilometres in the do-minimum scenario compared to 11.26 million vehicle kilometres in the do-something scenario - a reduction of approximately 74,479 vehicle kilometres. For 2040, the distance

travelled over the simulated road network is predicted to be approximately 13.4 million vehicle kilometres in the do-minimum scenario compared to 13.24 million vehicle kilometres in the do-something scenario - a reduction of approximately 156,464 vehicle kilometres.

4.7.4. Over the 60-year appraisal period, the financial benefit in terms of carbon savings from the operation of vehicles in road transport sector due to the Scheme is estimated at £19,370,545.

4.8 MITIGATION

4.8.1. As demonstrated by the VDM, the Scheme will provide shorter route options – bringing about shorter journeys by road vehicle and reducing traffic levels on strategic routes such as the A47. This in-turn is expected to bring down CO_2e emissions from road transport within the study area.

4.8.2. At this stage of the project, specific GHG mitigation requirements have not been identified. The GHG assessment that is to be undertaken for the EIA will be more detailed – including consideration of emissions from construction activities and embodied carbon and will confirm any specific requirements for mitigation.

COMMENTS ON ASSUMPTIONS AND UNCERTAINTIES

4.8.3. The calculated emissions are predictions, which are based on the best available predicted traffic data and government supported methods for calculating emissions and monetary valuation.

4.8.4. Emissions have been calculated across the whole of the VDM simulation area and smaller minor roads within this area may not be represented. However, it is expected that traffic levels and changes on such roads are likely to be relatively small compared the roads that are included. Any such omission is unlikely to substantially affect the findings of the GHG appraisal.

4.8.5. Emissions have been estimated for scenarios in 2025 and 2040. For each year between the emissions have been determined by linear interpolation. In the absence of any data for the intervening years, this pragmatic approach adds a degree of uncertainty to the TAG calculations for these years.

4.8.6. The VDM future forecast year is 2040. Beyond 2040 no traffic growth has been assumed. In reality some inter-annual variations in traffic levels and emissions can be expected. This factor adds a degree of uncertainty to the appraisal.

4.8.7. Emissions have been estimated based on vehicle fleet composition forecasts which were published pre-COVID-19. The likely impact of COVID-19 on fleet composition in future years cannot be predicted with any certainty at this present time.

4.8.8. The DfT TAG GHG workbook addresses uncertainty in valuation by presenting upper and lower estimates of the net present value of the carbon impacts. For the Scheme the upper estimate is £29,055,818 and the lower estimate is £9,685,273.

4.9 CONCLUSION

4.9.1. Overall, the Scheme is beneficial in achieving reductions in carbon emissions from the operation of vehicles in the road transport sector and supports national and regional policy initiatives towards the Net Zero target in 2050.

5 LANDSCAPE

5.1 Introduction

5.1.1. This section presents the Landscape and Visual appraisal for the Scheme, required to identify any potential constraints in relation to landscape and visual features to help inform the OBC. This includes a summary of the baseline conditions, methodology and the likely operational impacts of the NWL on the environmental features.

5.1.2. The landscape assessment to inform the OBC was originally undertaken in 2020 but has now been updated due to the alignment of the Scheme being revised since the 2020 landscape assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West).

5.2 Baseline Conditions

5.2.1. Consultation with Norfolk County Council Landscape Team, as well as Broadland District Council and Breckland District Council landscape officers, was conducted in March 2020 in order to discuss and agree the location of viewpoints for the Landscape and Visual Impact Assessment (LVIA). Design Workshops were also established with landscape officers from the relevant local authorities to ensure they were informed of the latest developments and emerging designs and were able to provide meaning full input and feedback to the design development.

5.2.2. The NWL runs through agricultural land to the north west of Norwich. The landscape is a wet lowland shallow valley in the northern section of the study area, whilst to the south, the land rises and gently undulates becoming a plateau. The River Tud valley is located to the south east of the study area. It is a landscape characterised by predominately regular fields of arable farming throughout, although mixed plantation woodland and emergence of pig rearing is present in various sections of the route. The Wensum Valley Hotel, Golf and Country Club is located to the north west of the study area.

5.2.3. The prevailing field pattern within the study area is small to medium sized fields contained by hedgerow and infrequent mature trees. There are medieval manors which form country house estates such as Morton Hall to the north and Easton Estate to the south. There are small ponds throughout this landscape, often uniform in shape. The river valley to the north and east following the River Wensum is wet meadow and contains a number of small lakes.

5.2.4. The closest large settlement to the study area is Norwich itself, however the study area encompasses a relatively rural landscape with small settlements and isolated dwellings. The biggest settlement is Honingham located to the south, with Ringland and Weston Longville other notable settlements within this landscape.

5.2.5. The study area has several minor roads which cross through the landscape and the more substantial A47 and A1067 highways to the south and north respectively. The wind turbines to the east of the Scheme on the old airfield and the overhead line which runs north to

south, combined with roads, are notable influences within this landscape and potentially reduce the sense of tranquillity.

5.3 Methodology

5.3.1. An initial appraisal of potential landscape and visual impact has been undertaken for the NWL. This has followed guidance contained in Chapter 5 – The Environmental Capital Approach and Chapter 6 – Impacts on Landscape in TAG Unit A3[23]. Information on the pattern, tranquillity, cultural associations and land cover elements have been provided in a summary worksheet along with other key landscape environmental resources. An appraisal of how the NWL would fit within the landscape have been provided, along with an overall potential impact on landscape and visual receptors using the standard seven-point scale defined in TAG Unit A3.

5.3.2. The appraisal has been carried out based on the reference design, desk-based research and an awareness of the existing landscape context from a review of Ordnance Survey (OS) mapping, aerial mapping and a site visit. A brief review of National Character Areas[24] and the Broadland District Landscape Character Assessment[25] has been undertaken but there has been no detailed study of local character.

5.4 Impact Appraisal

Townscape

5.4.1. The NWL is predominantly located within agricultural land, where the overriding character is of agricultural fields with sparse settlement. There is a lack of built environment that would warrant a townscape appraisal of the study area, other than that identified within a landscape appraisal.

5.4.2. It has therefore been concluded that this environmental topic area (Townscape) is not relevant to the decision-making process and an appraisal of this topic area has not been undertaken for the Scheme.

Landscape

5.4.3. The NWL is anticipated to introduce a major road into the landscape, which would cut through the landscape, disrupting field patterns, removing woodland and changing local land cover. This would likely result in a noticeable change in the landscape pattern. While not a totally uncharacteristic feature in the landscape, the A47 and A1067 run east to west at the northern and southern extents of the NWL, the scale of the NWL would be

[23] Department for Transport, (2019). TAG UNIT A3 Environmental Impact Appraisal

[24] Natural England, (2014). National Character Area profiles: No.84. Mid Norfolk & No.78. Central North Norfolk

[25] Broadland District Council, (2013). Landscape Character Assessment - Supplementary Planning Document (SPD)

uncharacteristic and dissimilar to existing landscape elements, such as Ringland Lane, Breck Road, and The Broadway.

5.4.4. The NWL would be visible to receptors within the landscape and is likely to have adverse effects on the visual amenity of private and public receptors.

5.4.5. The proposed viaduct over the River Wensum is anticipated to introduce a highly visible, hard and linear feature into the landscape, dominating the River Wensum wet lowland valley and would be uncharacteristic and out of proportion with the surrounding landscape. Moving traffic (and headlights) would become elevated in the landscape, making it more visible, reducing tranquillity and adding uncharacteristic movement into a static landscape.

5.4.6. There would be the loss of agricultural land, ponds, woodland, field trees, sections of hedgerow and hedgerow trees. Some of this loss could be replaced through mitigation planting. There would also be fragmentation of agricultural fields. The loss of existing landscape features would likely have an adverse effect on the overall landscape character, and the likely scale of the Scheme would detract and increase the presence of man-made influences into this landscape at the local scale.

5.4.7. The overall impact on the landscape is anticipated to be **moderate adverse**. This is because of the scale of the NWL, while not totally uncharacteristic of the surrounding landscape, is likely to be at a much larger scale. The proposed viaduct would be particularly uncharacteristic and out of proportion with the surrounding landscape. An appraisal of how the NWL would fit within the landscape has been provided, along with an overall potential impact on landscape and visual receptors using the standard seven-point TAG Unit A3 scale in Appendix E.

Potential Mitigation

5.4.8. The appraisal of landscape and visual impact (through use of TAG and AST) are carried out prior to mitigation. A high-level CEMP and Mitigation Plan will be produced as part of the ES submission which will detail the measures required to mitigate the identified impacts. This will help give certainty on the delivery of the mitigation and compensation measures. A more detailed CEMP will be taken forward by the contractor post Planning Submission.

5.4.9. Potential mitigation measures for adverse landscape and visual effects typically include replacing vegetation lost through construction of the NWL and to restore and enhance landscape character. The loss of existing vegetation will be avoided where possible and new bunds and native planting will be introduced to provide visual screening to sensitive receptors. Earthworks will be designed with appropriate slope profiles to integrate into the surrounding landscape. The design of proposed structures will consider landscape character and visual amenity, designed as a coherent ‘family’ in their visual appearance with a continuity of form and detailing. The viaduct, while still sitting within the ‘family’ of structures, is considered further due to its significance within the landscape. The viaduct is designed to complement its setting and achieve a distinctiveness without dominance that

does not compete with the landscape. The broad principles are set out in the Environmental Scoping Report March 2020 and more detailed measures will be provided in the ES.

Summary

5.4.10. The landscape is predominantly gently undulating arable farmland, with plateau to the south, located between two shallow river valleys. River Tud in the south and River Wensum in the north being the larger of the valleys with noticeable difference in character of wet meadow and mosaic of lakes and drainage ditches. There is some human influence, of note is the over-head line and two wind turbines to the west, with the A47 and A1067 roads noticeable from the plateau. Settlement is sparse, mainly small farmsteads - the biggest settlement is Honingham located to the south. Land cover is predominately arable fields, contained by clipped hedgerow and infrequent mature trees, with some fields turned to pig rearing. Mixed plantation woodland is common throughout this landscape, often following field boundaries. Roads are generally small lanes, gently curved, and following the field boundaries.

5.4.11. The NWL would alter the local landscape character through the introduction of the viaduct, loss of woodland and the width of the new road (dual carriageway). There would be subdivision of fields and sections of embankment and cutting through the landscape which would affect the field pattern and tranquillity locally, however, the viaduct would have a wider impact introducing a new feature into this landscape and will have a significant impact on tranquillity in the north.

5.4.12. An ES is being prepared by WSP, which will contain more detailed design information and a more thorough impact assessment subsequently providing more site-specific mitigation measures to attempt to reduce impacts and risks further.

6 Historic Environment

6.1 Introduction

6.1.1. This section of the report provides a high-level appraisal of the likely historic environment impacts specific to the NWL. The historic environment comprises above ground and buried heritage assets, including buildings, structures, monuments, and landscapes of heritage interest, including, where appropriate, the setting of sensitive (designated) heritage assets, along with archaeological remains and palaeoenvironmental deposits.

6.1.2. Statutory provision for the safeguarding of heritage assets has been made at a national and local level. For this reason, their presence or potential presence can constitute a constraint and may affect the initial appraisal of a scheme and in the subsequent design, planning and programming.

6.1.3. The historic environment assessment to inform the OBC was originally undertaken in 2020 but has now been updated due to the alignment of the Scheme being revised since the 2020 historic environment assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West).

6.2 Baseline Conditions

6.2.1. Consultation has taken place with Norfolk County Council County Archaeologist, regarding the scope of the assessment for buried heritage assets and the scope of archaeological evaluation work required.

Designated heritage assets

6.2.2. There are no known statutorily designated heritage assets such as scheduled monuments, registered parks or gardens or registered battlefields within the area of NWL. There are no known conservation areas as defined by the Local Planning Authority (LPA). Norfolk does not have any Archaeological Priority Areas.

6.2.3. DMRB guidance state that the study area should include the setting of any designated heritage asset or other cultural heritage resource in the footprint of the NWL or within the zone of influence or potentially affected by noise. Professional judgement was used to define a 500m buffer around the Red Line Boundary for the identification of non-designated heritage assets and 1km buffer for designated heritage assets, due to the longer views and hence the potential impacts upon the setting of these assets. In addition, professional judgement will be used to scope in assets located beyond the 1km study area where there is the potential for settings impacts.

6.2.4. The 1km study area around the site contains 17 listed buildings, of which two are listed Grade I (high heritage significance in accordance with DMRB criteria), one is listed Grade II* (high significance) and 14 are listed Grade II (medium significance).

6.2.5. The two Grade I listed buildings are the Church of St Peter (NHLE ref: 1171129) in Ringland, 920m south-east of the NWL, and the Church of All Saints including Boundary

Wall to Churchyard (NHLE ref: 1372689) in Weston Longville, 390m south-west of the NWL (at Ringland Lane/Marl Hill Road). The Grade II* listed building is the Church of St Margaret (NHLE ref: 1051548), a ruin of a former 11th–13th century church building, 565m north-east of the NWL. The Grade II listed buildings are located between 5m and 1km from the NWL. The presence of curtilage structures associated with these buildings within the site is considered unlikely, with the exception of Barn 50m north-west of Low Farm House, but it would be considered as part of a more detailed future assessment. Curtilage is the original property boundary of the listed building and, whilst an associated structure within the curtilage may not be specifically mentioned in the statutory description, may be covered by the listing protection.

Non-designated heritage assets

6.2.6. There have been 12 investigations that were either carried out within the site or extended into the site.

6.2.7. A geophysical survey of the Norwich Western Link route was carried out from November 2020 to March 2021. A total of 102Ha was surveyed. The results of the survey found probable and possible archaeological activity along the length of the route.

6.2.8. Six of the other investigations were in the northern part of the site and were carried out as part of work connected with the construction of the Norwich Northern Distributor Route (NNDR), and comprised geophysical survey and trial trenching along the whole route of the NNDR. Four parcels of the geophysical survey, Area F1, Area F1a, Area F1b and Block 2, and two areas of trial trenching Block F1a and Block F2, extended into the site.

6.2.9. The trial trenching in Block F1a recorded several ditches and pits which contained possible middle Bronze Age pottery, late Bronze Age to early Iron Age pottery, 11th century pottery and struck and burnt flints. No archaeological features or finds were recorded during the Block 2 trial trenching.

6.2.10. Trial trenching at Old Hall Farm in 2019 was undertaken the northern part of site, to the south of the A1067. Eleven trial trenches were excavated. Three trenches revealed ditches and pits with later Neolithic/early Bronze Age pottery.

6.2.11. A watching brief on the Ringland to Attlebridge Replacement Water Main in 2012 took place along Weston Road in the central part of the site. No significant archaeological features or artefacts were uncovered.

6.2.12. A geophysical survey and trial trench evaluation were carried out for the A47 Improvement Works (North Tuddenham to Easton) in 2019 and 2020. A total of 48 areas were investigated. Areas 21 and 22 extended into the southern part of the site. The geophysical survey in Areas 21 and 22 recorded ferrous/magnetic disturbance at the edges of both areas, but there were no certain archaeological features recorded. Four trenches in Area 21 and eight in Area 22 contained archaeological features, comprising a total of twelve ditches, two pits and four postholes. Finds recovered comprised isolated post-medieval pottery and metalwork and possible later medieval metalwork.

6.2.13. A geophysical survey was undertaken on the proposed Dudgeon extension onshore cable route. Two of the survey areas (Area 15 and Area 16) extended into the central part of the site. No results of the survey are recorded on the HER.

6.2.14. An evaluation was undertaken on the route of the Hornsea pipeline in 2022. Eleven trenches were excavated in the central part of the NWL site. The archaeological features that were recorded were limited to post-medieval field boundaries.

6.2.15. Within the site boundary the following non-designated heritage assets are recorded on the Norfolk Historic Environment Record (HER). An initial indication of the likely significance of the assets has been included as part of this appraisal:

- The findspot of prehistoric flint flakes (HER ref: 18044). This asset is of likely low significance;
- A possible Roman field system, identified from cropmarks (HER ref: 53485). This asset is of medium or possibly high heritage significance, depending on nature and extent;
- An area of post-Roman features and prehistoric finds, found during the evaluation on the Norwich Northern Distributor Road (HER ref: 63365), the significance of which is low or medium;
- Possible Iron Age/Roman field boundaries and enclosures, identified from cropmarks (HER refs: 54357, 50610, 50615). These assets are of medium or high significance, depending on their nature and extent;
- Later medieval/post-medieval field systems; field boundaries/trackways, identified from cropmarks (HER refs: 50608, 50609, 50614, 50616, 54364). These assets are of likely low significance;
- Undated ditches and pits (HER refs: 50605, 50619, 53625, 53681, 54356), identified from cropmarks. These assets are of unknown significance;
- A World War 2 accommodation and training site (HER ref: 53474). This asset is of medium significance;
- Attlebridge Airfield (HER ref: 3063) and associated structures dating to World War 2 (HER refs: 40750, 40754, 40755, 40756, 40757, 40758, 41342,). These assets are of low or medium significance;
- A possible World War Two military structure (HER ref 50611). This asset is of medium significance;
- A World War 1 and 2 military training site (HER ref: 50618). This asset is of medium significance;
- Honingham Park, a post-medieval landscape park (HER ref: 44183). This asset is of medium significance; and
- Two records of features found during an evaluation at the A47 improvement works: Undated ditches and pit, and a post-medieval ditch and undated ditches and discrete features (HER refs 65195 and 65196).

Potential for possible, previously unrecorded archaeological remains

6.2.16. There is a moderate to high potential for previously unrecorded non-designated heritage assets within the site boundary. Any previously unrecorded assets could be of low, medium or high significance, depending on their nature, date, extent and survival.

6.2.17. The River Wensum and River Tud Valley geology includes areas of natural sand and gravel which, along with the riverine topography, provide an indication of suitability for early settlement due to the preference for well-drained gravels close to predictable resources provided by rivers. The study area therefore has moderate to high potential for archaeological remains, the value and integrity of which, are likely to be insufficiently understood to inform an assessment at this stage. River alluvium may contain well-preserved (due to waterlogging) palaeoenvironmental remains. Such remains have evidential value for the past environment in which prehistoric and later people lived and would be of low or medium heritage significance.

6.2.18. The proposed site boundary is outside the known historic settlements of Weston Longville, Honingham and Ringland, and thus the potential for buried remains is likely to be low, other than agricultural features such as field ditches. In terms of the integrity of the historic landscape, this appears to have remained largely in terms of field parcels and boundaries that would have been established following Parliamentary enclosure, other than in the area of the airfield.

6.2.19. Due to the land being agricultural there is a high potential for buried archaeological remains from the prehistoric period onwards to survive along the NWL. Mechanised ploughing will have caused some disturbance to any archaeological remains present to a depth of around 0.3–0.4m, although cut features such as pits and ditches are likely to survive intact.

6.3 Methodology

6.3.1. This appraisal uses information derived from a Heritage Constraints Report for the Norwich Western Link which was produced by WSP in April 2019 as part of the initial optioneering exercise.[26] Baseline data was also consulted online to ensure that it is up to date. An accompanying TAG worksheet has been produced for according to the Department for Transport (DfT) TAG Unit A3 Environmental Impact Appraisal. The key data sources comprised:

- National Heritage List for England (NHLE). Statutory designations, including scheduled monuments; statutorily listed buildings; registered parks and gardens; and registered battlefields;

[26] Norwich Western Link Heritage Constraints Report (WSP, April 2019)

- Norfolk Historic Environment Record (HER) Primary repository of archaeological information including past investigations, local knowledge, find spots, and documentary and cartographic sources;
- Broadland District Local Planning Authority. Information on Conservation Areas;
- British Geological Survey (BGS). Solid and drift geology and topography, which can provide an indication of potential for early human settlement;
- National Library of Scotland. Online historic Ordnance Survey mapping from the 1st edition (1860s/70s) onwards; and
- Google Satellite imagery and Streetview. The imagery was scrutinised to assist with the appraisal of possible impacts to the setting of designated heritage assets.

6.3.2. The study area comprised a 500m buffer around the Red Line Boundary for the identification of non-designated heritage assets and 1km buffer for designated heritage assets, due to the longer views and hence the potential impacts upon the setting of these assets.

6.3.3. A site visit was undertaken on 6 June 2019 as part of the optioneering exercise. This was a rapid visual appraisal of above ground heritage assets potentially impacted by five route options that were under consideration at the time. Assets were viewed from publicly accessible areas.

6.3.4. A second site visit was undertaken on 7 November 2019 as part of the Strategic Outline Business Case (SOBC). Surveyors undertook an initial visual assessment of designated heritage assets potentially impacted by the preferred option, including possible impacts to heritage significance through changes to setting. Heritage assets were viewed from publicly accessible areas. Surveyors did not enter the internal spaces of any above ground heritage assets.

6.3.5. A third site visit was undertaken on 16 and 17 March 2021 as part of the Historic Environment Desk Based Assessment (HEDBA). Surveyors undertook a walkover of the whole of the proposed route and a visual assessment of designated heritage assets potentially impacted by the preferred option, including possible impacts to heritage significance through changes to setting. Surveyors did not enter the internal spaces of any above ground heritage assets. Surveyors were not able to view assets located within the Morton Hall Estate.

6.3.6. A geophysical survey was carried out from November 2020 to March 2021 over 102Ha of the site. Probable and possible archaeological activity was identified, including possible enclosures with internal features. Anomalies possibly relating to burnt/fired material have also been identified. Agricultural activity has been identified in the form of modern ploughing trends, former mapped and unmapped field boundaries and ridge and furrow cultivation.

6.4 Impact Appraisal

Above ground heritage assets

6.4.1. There are unlikely to be any direct impacts (i.e. physical removal or alteration) on designated heritage assets.

6.4.2. The NWL has the potential to impact on the significance of designated heritage assets located beyond the site boundary through changes to their setting. Setting is the way in which an asset is understood and experienced and is not an asset in itself. Changes to setting could include the loss of surrounding rural and agricultural land, impacts from traffic flow and noise, and impacts from road infrastructure, including road lighting.

6.4.3. The Church of St Peter, dating to the 13th–15th centuries, is located in Ringland, approximately 920m south-east from the site boundary at its closest point. The asset has a visual and historic relationship to its churchyard and to designated heritage assets in Ringland. The asset is also defined by its location in the village of Ringland. Long views out from the asset will be characterised by the surrounding rural and agricultural landscape. The NWL could potentially impact on the asset's setting through the introduction of a new built form in the wider surrounding rural landscape. This would potentially impact on how the church is currently experienced, notably in journeys towards or away from the asset.

However, it would not impact on the asset's relationship to its churchyard or to Ringland, while distance from the site is likely to reduce any impacts to the asset's immediate rural landscape.

6.4.4. The Church of All Saints including Boundary Wall to Churchyard largely dating to the 13th–14th centuries, is located in Weston Longville, approximately 390m south-west of the site boundary at its closest point (Ringland Lane/Marl Hill Road). The asset will have a visual and historic relationship to its churchyard and to designated heritage assets in Weston Longville. The asset is also defined by its location in Weston Longville and by surrounding rural and agricultural land. The NWL could potentially impact on the asset's setting through the introduction of a new built form in the wider surrounding rural landscape. This would potentially impact on how the church is currently experienced, notably in journeys towards or away from the asset.

However, it would not impact on the asset's relationship to its churchyard or to Weston Longville. The passing places on Ringland Lane and possible works to facilitate construction access between Marl Hill Road and Ringland Lane would not impact on the asset's significance.

6.4.5. The Grade II* listed Church of St Margaret is largely a ruin of a 11th–13th century church building, located approximately 565m north-east from the site boundary at its closest point. The asset is defined by its relationship to a group of Grade II listed buildings at Morton Hall. These are: Water Cistern at South East Corner of St Margaret's Churchyard (NHLE ref:

1170905), Garden Walls to West of Morton Hall (NHLE ref: 1170917), Morton Hall (NHLE ref: 1051549) and Garden Walls Including Owl House at Home Farm, Morton Hall Estate (NHLE ref: 1390577). The asset is also defined by its surrounding rural landscape. The NWL could potentially impact on assets by introducing a new built form in the wider surrounding rural landscape, some of which is historically connected to the Morton Hall Estate, together with a likely increase in traffic noise. However, it would not impact on the asset's relationships to each other as part of the Morton Hall Estate. The passing places on Ringland Lane and possible works to facilitate construction access between Marl Hill Road and Ringland Lane would not impact on the asset's significance.

6.4.6. The nearest Grade II listed building to the Scheme is Barn 50m north-west of Low Farm House (NHLE ref: 1051550), a 17th century threshing barn, located approximately 5m east of the site boundary. The proximity of the asset to the route would introduce a new built form into the asset's immediate and wider setting. The asset's isolated position and surrounding rural agricultural landscape would be significantly impacted by the Scheme, as would that of the farm complex, altering how the designated heritage asset is currently experienced. Visual and noise impacts would also become very prominent in the asset's setting. However, the asset's historic relationship to the village of Ringland would not be impacted.

6.4.7. The Grade II listed buildings in Weston Longville and Honingham are defined by their relationships to each other and to the surrounding wider landscape. Potential impacts are unlikely, while the passing places on Ringland Lane and possible works to facilitate construction access between Marl Hill Road and Ringland Lane would not impact on the assets' significance. The NWL would not impact on the assets' key relationships.

6.4.8. The NWL could also potentially impact on two isolated Grade II listed buildings located beyond the site boundary. These are the Grade II listed The Lodge (NHLE ref: 1390576), 1.2km north-east of the site boundary and Stables and Coach House to Honingham Hall (NHLE ref: 1372666), just over 1km south-east of the site boundary. This would primarily be through the loss of surrounding rural and agricultural land, historically connected to the Morton Hall and Honingham Hall estates, as well as by potential visual or noise impacts.

6.4.9. Taken overall, the NWL would potentially have a **major adverse effect** on the setting (context) of the Grade II listed Barn 50m north-west of Low Farm House and potentially a **minor adverse effect** on the setting (context) of other listed buildings located beyond the site boundary. It will potentially adversely affect the appreciation and understanding of the characteristic historic environmental resource.

Buried heritage assets

6.4.10. Within the site boundary the non-designated heritage assets described in the Baseline Conditions and previously unrecorded non-designated assets could potentially be impacted. Possible palaeoenvironmental remains in the Wensum valley could be affected locally by the excavation for the viaduct piers.

6.4.11. Works carried out as part of the initial site set up, including preliminary topsoil stripping across the site and any temporary access roads and temporary work compounds and topsoil storage areas, the installation of site fencing and welfare facilities could cause an impact. The excavations for the proposed road would entirely remove any archaeological remains within the excavation footprint. The excavation of any new attenuation ponds, planting, landscaping, service trenches and drains would entirely remove any archaeological remains within the trench footprint.

6.4.12. Prior to the implementation of an agreed mitigation strategy, the NWL would result in a **number of low, moderate or major adverse effects** on the undesignated heritage assets recorded on the HER along with any previously unrecorded buried heritage assets, resulting in loss of features such that their integrity is substantially compromised. The severity of environmental effect would depend on the significance of the asset. The heritage significance of such assets would depend on their nature, date, extent and survival but might be local or regional (potentially national if extensive and well preserved). A more detailed assessment for planning would consider the individual effects in greater detail.

6.4.13. An accompanying TAG worksheet has been produced in line with the Department for Transport (DfT) TAG Unit A3 Environmental Impact Appraisal.

6.5 Potential Mitigation

6.5.1. Where any potential adverse effects resulting from the NWL are identified, strategies to reduce the impact of the NWL should be examined. Where the effects are on the setting of heritage assets, and where the setting is judged to contribute the significance of the asset, the impacts may be mitigated by design, such as the introduction of screening or an appropriate road lighting scheme.

6.5.2. For below ground remains, the impacts can be reduced where feasible and warranted, through either mitigation by design, allowing remains to be preserved *in-situ*, or through preservation by record (i.e. archaeological excavation).

6.5.3. The Norfolk County Archaeologist and the Historic England regional office for the East of England should be approached for an opinion, as well as the relevant conservation officers for the area. Following best practice, this should be undertaken in addition to and preferably before the formal scoping process.

6.5.4. Following further assessment and consultation, recommendations for preliminary site-based archaeological investigations will be made. This might typically include a staged programme of non-intrusive geophysical survey, followed by targeted archaeological trial evaluation trenches. Sufficient time should be allowed in the planning programme to allow the results of such work to feed into the planning submission documents. The results of the assessment and site-based evaluation, along with informal and formal consultations should enable the formulation of appropriate mitigation through design considerations, targeted archaeological excavation in advance of construction and recording, and/or archaeological monitoring during preliminary groundworks. The successful implementation of an agreed

programme of archaeological mitigation would aim to reduce or offset any adverse effects to negligible.

6.5.5. A high-level CEMP and Mitigation Plan will be produced as part of the ES submission which will detail the measures required to mitigate the identified impacts. This will help give certainty on the delivery of the mitigation and compensation measures. A more detailed CEMP will be taken forward by the contractor post Planning Submission.

6.6 Summary

6.6.1. In conclusion, the NWL would have major and minor moderate adverse effect on the setting (context) of listed buildings located beyond the site boundary. It will adversely affect the appreciation and understanding of the characteristic historic environmental resource. Impacts may be mitigated by design, such as the introduction of appropriate screening.

6.6.2. The NWL also would result in a number of low, moderate or major adverse effects on the undesignated heritage assets recorded on the HER along with any previously unrecorded buried heritage assets. The impacts can be reduced where feasible and warranted, through either mitigation by design, allowing remains to be preserved in-situ, or through preservation by record (i.e. archaeological excavation).

6.6.3. Further surveys took place in 2020 and 2021 to complete the Archaeological baseline and will feed into the future assessment work for the NWL. The ES is being prepared by WSP, which will contain more detailed design information and a more thorough impact assessment subsequently providing more site-specific mitigation measures to attempt to reduce impacts and risks further.

7 Biodiversity

7.1 Introduction

7.1.1. This section describes the existing biodiversity baseline and the anticipated impacts of the NWL on biodiversity features present within the Biodiversity Study Areas. Outline details on mitigation and compensation strategies for the features have been provided. All biodiversity features scoped into the ES[27] (as described in the '2020 Scoping Report') have informed the TAG appraisal in support of the OBC. Biodiversity features scoped into the ES comprise: designated sites, habitats, flora and fauna. Further details specific to each feature are provided below.

7.1.2. Baseline data collection commenced in July 2018 based on the six potential highway alignment options. Survey work continued, focussing on the Preferred option (the NWL) from July 2019. Survey work is ongoing and is expected to be completed by the end of September 2022. This biodiversity section outlines the baseline findings gathered to date.

7.1.3. The biodiversity assessment to inform the OBC was originally undertaken in 2020 but has now been updated due to the alignment of the Scheme being revised since the 2020 biodiversity assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West).

7.2 Consultation

7.2.1. Over the course of the project there has been statutory consultation with Natural England and the Environment Agency to agree approaches to survey and assessment and to discuss mitigation and compensation proposals. Additionally, an Ecology Liaison Group has been set up with a good range of conservation groups who are active in recorded species and habitats in Norfolk, represented.

7.3 Study Area

7.3.1. The Biodiversity section of the 2020 Scoping Report contains details on the approximate study areas for the biodiversity features potentially impacted by the NWL.

7.3.2. Table 7-1 sets out study areas for features considered further to the 2020 Scoping Report which will also be reported in the ES.

[27] NWL EIA Scoping Report 2020

Table 7-1 - Study Area for Additional Scope in Biodiversity Features

Biodiversity Feature	Study Area
Non-vascular plants, fungi and lichens	Desk Study Biological records for all non-vascular plant, fungi and lichen species within and up to 2km from the Scheme.
	Field Survey National vegetation classification (NVC) within the Scheme. Fungi survey - all woodland and grassland within the Scheme. Lichen survey 200m buffer from Scheme.
Ancient / veteran hedgerows	Desk Study Within and directly connected (root protection area) to the Scheme.
	Field Study Within and directly connected (root protection area) to the Scheme.

7.4 Baseline Conditions

7.4.1. The TAG provides details on the various biodiversity features of relevance to the Scheme.

Biodiversity Context

7.4.2. The following sources were consulted to collate historical ecological records within the relevant study areas of the Scheme.

- Ordnance Survey (OS) website (www.ordnancesurvey.co.uk);
- Online photographic resources, including publicly accessible aerial photography;
- The Multi-agency Geographic Information for the Countryside (MAGIC) service; and
- Norfolk Biodiversity Information Service (NBIS).

7.4.3. Records were limited to statutory and non-statutory designated sites and species records from 2010 onwards. In addition, reports containing the results of bat surveys completed by third parties to inform nearby development schemes were reviewed to extract historical bat roost and activity records.

Designated Sites

7.4.4. The following internationally designated sites are within 10km of the Scheme, increased to 30km for bats (**Table 7-2**).

Table 7-2 – Internationally Designated Sites

Site and designation	Approximate distance and direction from Scheme
River Wensum Special Area of Conservation (SAC)	Within the Scheme footprint

Site and designation	Approximate distance and direction from Scheme
Norfolk Valley Fens SAC	6.3km north-east
Paston Barns SAC	c. 26km north-east

7.4.5. Given the distance and lack of identifiable potential effect pathways from the Scheme to Paston Barns SAC and Norfolk Valley Fens SAC, these sites have been scoped out of the assessment. This approach has been agreed with Natural England.

7.4.6. Nationally statutory designated sites have been considered up to 5km from the Scheme. Of the five sites identified, listed in the 2020 Scoping Report, one is scoped into the ES (**Table 7-3**).

Table 7-3 – Nationally Designated Sites Scoped into the ES

Site and designation	Approximate distance and direction from Scheme
River Wensum SSSI	Within the Scheme footprint

7.4.7. Non-statutory designated sites have been considered within a 2km buffer, or beyond where sites are potentially hydrologically linked to the Scheme. Impacts on County Wildlife Sites (CWS) at distances greater than 200m, or not hydrologically linked to the NWL are not considered likely and so have been discounted. Those sites within 200m have been considered based on potential air quality impacts. **Table 7-4** includes those CWSs that will be considered within the ES.

Table 7-4 – Local Non-Statutory Designated Sites Scoped into the ES

Site and designation	Approximate distance and direction from the NWL Boundary
River Wensum Pastures, Ringland Estates County Wildlife Sites (CWS) (Ref: 2303)	Within the NWL Boundary
Broom & Spring Hills CWS (Ref: 1341)	Within the NWL Boundary
Wensum Pastures at Morton Hall CWS (Ref: 2070)	Within the NWL Boundary
Land adjoining Foxburrow Plantation CWS (Ref: 2116)	Within the NWL Boundary

Site and designation	Approximate distance and direction from the NWL Boundary
Fakenham Road, Roadside Nature Reserve (RNR) (Ref: 2116)	Within the NWL Boundary
Primrose Grove CWS (Ref: 2305)	15m south
Old Covert, Wood Lane CWS (Ref 2109)	10m west
Gravelpit Plantation and Church Hill CWS (Ref: 2304)	10m east
Mouse Wood CWS (Ref: 2050)	15m west
Attlebridge Hills CWS (Ref: 1343)	20m north
Triumph & Foxburrow Plantations CWS (Ref:1344)	400m north
Walsingham Plantation CWS (Ref: 1351)	510m east
Hall Hills/Ringland Covert CWS (Ref: 2105)	570m east
Church Hill Common CWS (Ref: 1340)	630m east
Fen West of East Tuddenham CWS (Ref: 660)	660m south
Fen Plantation CWS (Ref: 2117)	670m south
River Tud at Easton and Honingham CWS (Ref: 250)	675m south-east
Park Grove CWS (Ref: 2033)	730m west
Dryhill Plantation CWS (Ref: 2113)	900m east
Church Meadow, Alder Carr, Three Corner Thicket and Nursery Plantation CWS (Ref: 2296)	960m south-east
Jennis' Wood CWS (Ref: 2113)	1.1km east
Marriott's Way CWS (Ref: 2176)	1.2km north
Ave's Gap CWS (Ref:2306)	1.3km east
Lake adjacent to Concrete Plant CWS (Ref: 1346)	1.6km north-west
Bush Meadow Plantation CWS (Ref: 1347)	1.7km north-west
Weston Meadow CWS (Ref: 1345)	1.7km west

Site and designation	Approximate distance and direction from the NWL Boundary
Lenwade Pits (East) CWS (Ref: 1349)	1.8km north-west
Taverham Mill CWS (Ref 256)	1.9km south-east
Ringland Pits CWS (Ref: 1339)	2km east

Habitat

Ancient Woodland

7.4.8. Two parcels of ancient woodland, as listed on the national Ancient Woodland Inventory, are present within 200m of the NWL Boundary:

- Primrose Grove is approximately 15m to the south of the NWL Boundary;
- Mouse Wood is located approximately 10m to the west of the NWL Boundary, separated by Wood Lane (B1535) which provides an access route to the NWL Boundary.

7.4.9. The results of the woodland survey undertaken for the NWL are described in the section detailing National Vegetation Classification (NVC).

Important Hedgerow Survey

7.4.10. A hedgerow survey was undertaken in 2020. The survey identified a total of 25 hedgerows within or partially within the NWL Boundary. All of the hedgerows, aside from one, were concluded to qualify as HPI under the Natural Environment and Rural Communities Act (NERC) 2006.

7.4.11. A total of eighteen hedgerows qualified as Important (as defined under the Hedgerow Regulation 1997), however none of the hedgerows were found to contain ancient or veteran features.

Habitats of Principal Importance (HPI)

7.4.12. The desk study identified the following habitats on Natural England's Priority Habitat Inventory (PHI) within the Scheme, and up to 200m from the NWL footprint:

- Floodplain Grazing Marsh[28];
- Deciduous Woodland[29]; and

[28] UK Biodiversity Action Plan Priority Habitat Descriptions: Coastal and Floodplain Grazing Marsh - Coastal and Floodplain grazing marsh

[29] UK Biodiversity Action Plan Priority Habitat Descriptions: Lowland Mixed Deciduous Woodland - http://data.jncc.gov.uk/data/2829ce47-1ca5-41e7-bc1a-871c1cc0b3ae/UKBAP-BAPHabitats-30-LowlandMixedDecWood.pdf

- Lowland Fens[30].

7.4.13. Phase 1 Habitat and National Vegetation Classification (NVC) surveys have been completed to provide baseline habitat data and to consider the types and distribution of habitats. The results of these results in relation to HPI are summarised under 'Detailed Botanical and Habitat Assessment' below.

7.4.14. It should be noted that Lowland Fens although noted in desk study information, is not a habitat type which has been recorded within the Scheme.

River Habitat Survey

7.4.15. A River Habitat Survey (RHS) was completed in summer 2020 along a 500m stretch of the River Wensum which encompassed the NWL Boundary. The survey data will inform the ES and the Water Framework Directive (WFD). The Habitat Modification Score (HMS) determined the Site to be 'obviously modified'. The Habitat Quality Assessment (HQA) class for the River Wensum was calculated as 3, describing the habitat quality as 'Fair'.

Biodiversity Net Gain

7.4.16. The biodiversity baseline calculation will include all habitats (other than irreplaceable[31] habitats and statutory designated sites) within the NWL prior to development. This baseline is informed by the Phase 1 habitat and UKHab data and results of the condition assessment, with reference to the Biodiversity Metric 3.1 (Natural England 2022[32]). The metric constitutes industry recognised best practice for quantifying whether a development is able to achieve biodiversity net gain.

Detailed Botanical and Habitat Assessment

Phase 1 Habitat Survey

7.4.17. A Phase 1 Habitat Survey covering the NWL Boundary was completed in 2020 to record dominant plant species and classify habitats according to their vegetation type. The survey will be updated in 2022 to verify the findings of the previous survey and cover new areas not previously surveyed following changes to the Scheme Boundary. The update survey will

[30] UK Biodiversity Action Plan Priority Habitat Descriptions: Lowland Fens - http://data.jncc.gov.uk/data/6fe22f18-fff7-4974-b333-03b0ad819b88/UKBAP-BAPHabitats-27-LowlandFens.pdf

[31] Following Defra guidance, irreplaceable habitats (e.g. veteran trees) within the Scheme will be identified and excluded from biodiversity unit calculations. It is noted that net-gain or no net-loss of biodiversity cannot be achieved for the Scheme as a whole if there is a negative impact on an irreplaceable habitat or statutory designated site for nature conservation. As such a different approach will be taken for irreplaceable habitats.

[32] Natural England (2019). ARCHIVE SITE for the Biodiversity Metric 2.0 and the Biodiversity Metric 3.0 User Guide. Natural England Joint Publication.

record habitats following the UK Habitat Classification Definitions Version 1.1 so that the data can be used to inform the Biodiversity Net Gain (BNG) assessment. The results of the survey will also be used to inform the ES.

7.4.18. The survey recorded a range of habitats within the NWL Boundary, including the River Wensum and Wensum Valley with its associated floodplain grazing marsh, streams and ditches. Moving south from the floodplain, the NWL Boundary incorporates sections of a series of woodlands which have been referred to collectively as the 'Northern Woodlands', relating to their northerly position within the NWL Boundary. Continuing south, the NWL Boundary becomes predominantly an intensive arable landscape occasionally intersected by hedgerows, with a segment of an unnamed woodland also included to the south of Ringland Lane. As the NWL progresses in a southerly direction, The Broadway woodland is reached with Foxburrow Plantation woodland following this, which is bordered to the south by Foxburrow Stream and associated wet grassland area. Intensive arable land, compartmented by hedgerows, forms the remaining area of the NWL Boundary to its southern end.

National Vegetation Classification (NVC)

7.4.19. An NVC survey, covering woodland and grassland habitats within the NWL Boundary, was undertaken in 2021 to complete the baseline. Nine different NVC communities/sub-communities were recorded within the grassland/arable margin survey areas, with a further five mosaics/transitional communities recorded. Within the woodland survey areas there were four different communities/sub-communities recorded; some woodlands were found to be a poor fit to standard NVC habitat communities as they predominantly comprise non-native conifers, these areas were not assigned a classification.

7.4.20. Habitats of Principal Importance (HPI) recorded within the NWL Boundary during NVC surveys comprised lowland meadows HPI, purple moor-grass and rush pasture HPI, lowland mixed deciduous woodland HPI and wet woodland HPI.

Macrophyte Survey

7.4.21. Macrophyte surveys have been undertaken on the River Wensum in 2019 and 2020 and on the adjoining floodplain ditches in 2020. Species of note recorded during the survey of the River Wensum include water crowfoot *Ranunculus fluitans*. This species is listed within the qualifying habitats description on the River Wensum SAC designation. Fragments of water crowfoot were recorded in the floodplain ditches however these were smothered in silt and displayed early signs of decomposition.

7.4.22. A macrophyte survey was also undertaken in Summer 2021 on Foxburrow Stream.

7.4.23. Update macrophyte surveys covering the River Wensum, adjoining floodplain ditches and Foxburrow Stream will be undertaken in 2022 to complete the baseline following changes to the Scheme Boundary.

7.4.24. The results of the surveys will be used to inform the ES.

Non-vascular Plants, Fungi and Lichen Survey

7.4.25. A fungal survey undertaken in October 2020 and May 2021 determined the habitats surveyed (i.e. areas of woodland and hedgerows within the Scheme boundary) to be of local ecological importance for fungi. No rare or protected fungi were recorded.

7.4.26. A lichen survey of the potential zone of influence of the Scheme alignment was undertaken in September 2021. The 22 lichen species recorded in the four Survey Areas have no formal national conservation status.

Veteran / Ancient Trees and Hedgerow Survey

7.4.27. An arboriculture assessment in 2020 identified the presence of 36 ancient or veteran features within the Scheme. The assessment also concluded that hedgerow plants did not qualify as ancient or veteran[33].

Fauna

Terrestrial Invertebrate Survey

7.4.28. Terrestrial invertebrate surveys covering the NWL Boundary were undertaken in 2021 to complete the baseline. The survey recorded a diverse range of invertebrate fauna, which included 43 species currently regarded as Nationally Rare, Scarce, Data Deficient, or Section 41 Species of Principal Importance.

Aquatic Macroinvertebrate Survey

7.4.29. Surveys for aquatic macroinvertebrates have been undertaken in 2020. The macroinvertebrate communities identified in the samples taken were classified as Moderate to Fairly High conservation value (River Wensum, Foxburrow Stream and Ringland Ditch) with the exception of Hall Ditch, which achieved Fairly High conservation value in the spring and High conservation value in the autumn.

7.4.30. Update macroinvertebrate surveys covering the River Wensum, adjoining floodplain ditches and Foxburrow Stream will be undertaken in 2022 to complete the baseline following changes to the Scheme Boundary.

7.4.31. The results of the surveys will be used to inform the ES.

White-clawed crayfish Survey

7.4.32. Surveys have been undertaken within the River Wensum in 2019. Survey work identified the presence of the non-native signal crayfish *Pacifastacus leniusculus* within the stretch of the River Wensum which was surveyed. No white-clawed crayfish *Austropotamobius pallipes*

[33] WSP (2021a) Norwich Western Link - Ancient Hedgerow Report. Cambridge

were recorded. No further surveys are required and this feature has been scoped out of the assessment.

Desmoulin's whorl snail Survey

7.4.33. Survey work in 2019, 2020 and 2021 identified Desmoulin's whorl snail *Vertigo moulinsiana* within the Scheme. The results indicated the continued presence of a large population within the south-eastern section (south), as well as the continued presence of this species in the central floodplain ditch within the Scheme Boundary.

Fish Survey

7.4.34. Electric fishing surveys in 2020 recorded a range of fish species including: chub *Squalius cephalus* pike *Esox lucius*, and dace *Leuciscus leuciscus* within the River Wensum. Brook lamprey *Lampetra* spp were recorded in adjoining ditches of the River Wensum. No fish were recorded within the Foxburrow Plantation stream. Bullhead *Cottus gobio* were not caught during the fish surveys, however, were observed during the aquatic macroinvertebrate survey of the River Wensum.

7.4.35. Update fish surveys covering the River Wensum, adjoining floodplain ditches and Foxburrow Stream will be undertaken in 2022 to complete the baseline following changes to the Scheme Boundary.

7.4.36. The results of the surveys will be used to inform the ES.

Amphibians

7.4.37. Great crested newt (GCN) *Triturus cristatus* surveys were undertaken on ponds within and up to 500m from the NWL Boundary. Ponds which returned a positive result for GCN eDNA were then subject to further population size class assessment surveys in 2021. The survey identified the presence of 'small' population in a single water body (15) situated approximately 280m from the Scheme boundary.

Common Toad Survey

7.4.38. The impact assessment for common toad *Bufo bufo* will be informed by a desk-based habitat level assessment which will also feed into the Biodiversity Net Gain (BNG) assessment. This approach has been agreed with Natural England following consultation.

Reptile Survey

7.4.39. Reptile survey work in 2019 and 2020 identified low numbers of common reptile species (common lizard *Zootoca vivipara*, grass snake *Natrix helvetica* and slow-worm *Anguis fragilis*), within the Scheme.

Birds

Wintering Birds

7.4.40. Wintering bird surveys were undertaken in 2019/20 and 2020/21 to complete the baseline. No observations of significant over-wintering assemblages were made during the 2019/20

survey. A total of 74 species, including 39 which are legally protected or species of conservation concern, was recorded during the 2020/21 survey.

Breeding Birds

7.4.41. Several species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), including hobby *Falco subbuteo*, kingfisher *Alcedo atthis*, barn owl *Tyto alba* and red kite *Milvus milvus*, were recorded during a breeding bird survey undertaken in 2021.

Barn Owl Survey

7.4.42. Barn owl surveys completed in 2021 identified a total of three occupied breeding sites (OBS) and thirteen potential nest sites (PNS). While one POBS is immediately adjacent to the Scheme none are within the NWL Boundary.

Bats

7.4.43. A suite of bat surveys has been completed to inform the Scheme since 2019. The data confirms that the local bat assemblage contains at least nine species that forage and, or commute within the NWL Boundary. Of these, common and soprano pipistrelle are the most abundant as would be expected given their generalist habitat preferences. The assemblage also contains rarer species, notably the barbastelle which utilises habitat within the Survey Area for roosting and foraging.

7.4.44. The baseline surveys included: radiotracking surveys (focusing on barbastelle bat), vantage point surveys, automated bat detector surveys, bat tracking surveys, hibernation surveys and emergence/re-entry roost surveys. In addition, existing third party data (gathered to inform nearby schemes) has been reviewed to extract existing contextual roost records and activity data.

Bat Surveys of Trees (excluding radio-tracking)

7.4.45. Surveys between 2019 and 2021 inclusive identified a total of 36 trees supporting bat roosts within the Survey Area (Scheme plus buffer), comprising the following:

- One barbastelle summer day roost;
- Five brown long-eared bat Plecotus auritus summer day roosts, one brown long-eared bat maternity roost and one brown long-eared bat hibernation roost;
- Twelve soprano pipistrelle Pipstrellus pygmaeus roosts, including summer day roosts. One tree supporting a hibernation roost for soprano pipistrelle;
- Four common pipistrelle Pipistrellus pipistrellus roosts, all of which were summer day roosts;
- Three summer day roosts for Natterer's bat Myotis nattereri;
- Two trees with unidentified Myotis sp. roosts, including a hibernation roost and a summer day roost;
- One tree supporting a hibernation roost for both an individual noctule Nyctalus noctula and individual brown long-eared bat;

- One summer day roost for an unidentified *Pipistrellus* sp., and one hibernation roost for unidentified *Pipistrellus* sp.;
- Three trees supporting roosts of unknown species.

Bat Surveys of Structures

7.4.46. Of the 29 structures assessed for suitability to support roosing bats, five were confirmed to be used by roosting bats, eight were assigned a high roosting suitability, four were considered to have moderate suitability, and five were assigned low suitability to support roosting bats. Summer day roosts were recorded in six of the seven structures that were subjected to further survey in 2021, three of which were already confirmed roosts. Five hibernation roosts were also identified.

Bat Activity Surveys

7.4.47. Vantage point surveys undertaken in 2020 and 2021 identified barbastelle and *Myotis* sp. commuting routes across the NWL Boundary.

7.4.48. Further vantage point surveys will be undertaken in 2022 to supplement the baseline.

Radio-tracking

7.4.49. Radio-tracking was initially undertaken in May 2019, with follow-up survey-work conducted in 2021 to complete the baseline. The primary species of interest was barbastelle, and secondary priority species included bats from the genera *Myotis*.

7.4.50. A total of 38 bat roosts were located during the radio-tracking surveys, of which 26 were verified through emergence surveys. Most roosts were recorded in trees and one roost supporting brown long-eared bats was identified in a residential bungalow. Barbastelle and brown long-eared bats were confirmed to be using the Scheme for foraging, and barbastelle were confirmed as using the Survey Area for roosting.

Back Tracking Surveys

7.4.51. Back-tracking surveys completed in 2020 recorded barbastelle commuting and foraging activity across the NWL Boundary.

Automated Detector Surveys

7.4.52. Automated static detectors were deployed across the Scheme and in adjacent habitat between 2019 and 2021. The data analysis for 2021 is ongoing and will be reported in full to support the ES baseline.

7.4.53. The confirmed species or species groups recorded to be using habitats within proximity of the NWL during the automated bat detector surveys in 2020 comprised: *Myotis* sp.; *Nyctalus* sp.; serotine bat *Eptesicus serotinus*; barbastelle; brown long-eared bat; common pipistrelle; soprano pipistrelle; and Nathusius' pipistrelle.

7.4.54. The River Wensum, Rose Carr and The Nursery, Long Plantation, the woodland south of Ringland Lane, The Broadway, and Foxburrow Plantation recorded the highest numbers of bat passes per night in 2020.

7.4.55. Further automated detector surveys will be undertaken in 2022 to supplement the baseline.

Badger Survey

7.4.56. Badger *Meles meles* setts and evidence of commuting and foraging activity was recorded during surveys undertaken between 2019 and 2022.

7.4.57. Badger surveys identified a single sett with a single partially used entrance hole in a woodland in the south of the Scheme, and badger latrines, hair, and snuffle holes were also recorded in this area.

7.4.58. In the northern woodlands, the field survey identified one active main sett and one potential main sett, along with four annex setts, five subsidiary setts, and 16 outlier setts. Additional signs of badger recorded in these areas included latrines, badger hair, snuffle holes, and bedding. A number of prominent mammal runs were also present.

Badger Bait Marking Survey

7.4.59. Badger bait marking surveys were undertaken in 2021 to establish the territory sizes of badger clans that may be impacted by the Scheme. The surveys identified mixing between four setts, as well as distinct territorial boundaries between two other setts.

7.4.60. Survey work has identified the presence of badger within the Scheme. Evidence of setts, commuting and foraging activity have been recorded.

Otter Survey

7.4.61. Otter *Lutra lutra* surveys were undertaken in 2020 and 2021 following the recording of an otter on the River Wensum during a white-clawed crayfish survey in 2019. No otter holts were considered to be present at the time of survey, but otters are considered to be utilising habitats within the area surveyed.

Water Vole Survey

7.4.62. Water vole *Arvicola amphibius* surveys were undertaken in 2019, 2020 and 2021, with the latest survey covering a wider area of the River Wensum and associated floodplain ditches to inform mitigation and areas for compensation and enhancement.

7.4.63. Surveys in 2020 confirmed the presence of a medium population of water voles in the River Wensum and a low population in a single adjoining floodplain ditch. No evidence of water voles was recorded in Foxburrow Stream and therefore water voles have been considered likely absent from this watercourse.

Other Species of Principal Importance (SPI) – Mammals

7.4.64. Brown hare *Lepus europaeus* and hedgehog *Erinaceus europaeus* (both Species of Principal Importance (SPI)) have been recorded within the Scheme during ecological survey work undertaken to date. The impact assessment for additional SPI mammals will be informed by a desk-based habitat level assessment, and this will inform the BNG assessment.

7.5 Methodology

7.5.1. The appraisal of the likely impacts on biodiversity has been undertaken in accordance with TAG Unit A3 Chapters 5 and 9. The appraisal highlights the importance of identified key resources (features), using guidance contained in Table 9 and 10 of TAG Unit A3, to ascribe biodiversity value.

7.5.2. The Scheme has been developed with consideration for the Mitigation Hierarchy. Ecological impacts upon features have been avoided where possible (e.g. the avoidance of ancient woodland loss). Where avoidance is not possible impacts have been mitigated (e.g. through the provision of green bridges and underpasses) and, where necessary, compensated for (e.g. through the provision of alternative habitat). The Scheme will look to achieve a minimum of 10% biodiversity net gain through following DEFRA guidance on The Biodiversity Metric 3.1.

7.5.3. It is important to note that the baseline data collection is ongoing and will not be completed until August 2022. The appraisal is based on data collected and analysed to end of May 2022 and professional judgement regarding the magnitude of possible impact arising from the Scheme design.

7.5.4. TAG assesses construction and operational impacts together and assumes that mitigation measures will be adopted as part of the development of the NWL. Table 7-5 provides high level details on possible impacts and the mitigation and compensation strategies which are currently being considered. Overall Assessment Scores are assigned to each feature based on the biodiversity value and magnitude of impact (with anticipated mitigation measures). The assessment scale ranges from Large Beneficial to Very Large Adverse.

7.5.5. Where schemes include plans for mitigation, this should generally be taken account of in the appraisal of impacts as set out by TAG guidance[34]. For the purpose of this assessment all mitigation including habitat creation in close proximity to the relevant key environmental resource to help conserve existing biodiversity interest is factored in. TAG requires mitigation not in close proximity to relevant key environmental resources to be excluded; in a scenario where habitat creation proposals alter this assessment would need to be revisited.

7.5.6. Outline mitigation strategies relevant to key biodiversity features are provided in **Table 7-5**.

[34] Department for Transport (2021). *TAG Unit A3, Environmental Impact Appraisal*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/983703/tag-unit-a3-environmental-impact-appraisal.pdf

7.5.7. The assessment presented here will be refined and updated as part of the Ecological Impact Assessment and Habitat Regulations Assessment which will feed into the EIA process. This assessment does not pre-empt the outcome of the EIA.

7.6 Impact Appraisal and Potential Mitigation

7.6.1. The majority of surveys for habitats and species impacted by the NWL have been completed, and outline mitigation and compensation strategies have been developed based on the data currently available. **Table 7-5** provides preliminary details on the strategies which are currently being considered. The outline strategies will be further discussed and agreed with statutory consultees.

7.6.2. A high-level CEMP in addition to Ecological and Bat Mitigation Strategy documents will be produced as part of the ES submission. These will detail the measures required to mitigate the identified impacts. Ongoing strategic work will focus on the development of a framework for habitat creation that will focus on key ecological features known to be present at NWL. This will help give certainty on the delivery of the mitigation and compensation measures. A more detailed CEMP will be taken forward by the contractor post Planning Submission.

Table 7-5 – Potential impacts and high-level mitigation and compensation strategies for biodiversity features

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
Designated Sites		
River Wensum SAC and SSSI	Habitat loss, pollution, degradation of habitat, shading, disturbance.	High viaduct to avoid shading impacts. Pollution prevention measures. Measures to protect riparian and aquatic habitats from disturbance or loss.
County Wildlife Sites (CWS) within Scheme boundaries: River Wensum Pastures, Ringland Estates CWS, Broom & Spring Hills CWS, Wensum Pastures at Morton Hall CWS, Primrose Grove CWS, Land	Habitat loss, degradation, pollution, disturbance.	Modification of footprint to reduce habitat loss. Protection measures for retained habitats. Creation of new habitat as part of landscaping and biodiversity net gain strategy. The Fakenham Road RNR is likely to be lost as a result of the Scheme and habitat creation targeted at hoary mullein is being considered.

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
adjoining Foxburrow Plantation CWS and Fakenham Road Roadside Nature Reserve (RNR) (Ref: 2116),		
County Wildlife Sites up to 200m of the Scheme boundaries: Old Covert, Wood Lane CWS, Gravelpit Plantation and Church Hill CWS, Mouse Wood CWS, Attlebridge Hills CWS, River Tud at Easton and Honingham CWS, Church Meadow, Alder Carr, Three Corner Thicket and Nursery Plantation CWS, Taverham Mill CWS and Ringland Pits CWS	Habitat loss, degradation, pollution, disturbance.	Protection measures during construction and future enhancement to mitigate potential effects identified in relation to the operational phase.
Protected and notable species		
Terrestrial invertebrates	Habitat loss (subject to further survey), habitat degradation, pollution	Provision of compensatory habitat through a landscaping and biodiversity net gain strategy.
Aquatic invertebrates	Habitat loss (subject to further assessment), habitat degradation, pollution.	Protection of retained habitats. Pollution prevention measures. Provision of a viaduct over the River Wensum to minimise habitat loss. Enhancement of existing water courses.

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
Desmoulin's whorl snail	Killing/injury of individuals during construction, habitat loss, pollution, degradation of habitat, impacts from nitrogen deposition	Protection of retained habitats. Pollution prevention measures. Habitat enhancement in areas of the River Wensum floodplain over 200m away from the Scheme. Provision of a viaduct over the River Wensum to minimise habitat loss.
Fish including brook lamprey and bullhead	Habitat loss, degradation of existing habitat, disturbance, pollution	Pollution prevention measures. Enhancement of existing water courses. Provision of a viaduct over the River Wensum.
Great crested newt	Possible habitat loss, disturbance.	Clearance 0.75ha of terrestrial habitat within 500m of Water Body 15 to proceed under a non-licenced Method Statement.
Common toad	Killing/injury of individuals during construction, habitat loss, pollution, death by vehicle collision	Enhancement of existing aquatic habitat within the floodplain, provision of new terrestrial habitat through a landscaping and biodiversity net gain strategy. Provision of a viaduct over the River Wensum reducing habitat loss. Provision of wildlife underpasses.
Reptiles	Killing/injury of individuals during construction, death by vehicle collision habitat loss, pollution.	Provision of a viaduct over the Wensum reducing habitat loss. Sensitive timing of works. Habitat manipulation to encourage reptiles to move from the NWL prior to development. Provision of new foraging/basking/sheltering habitat through a landscaping and biodiversity net gain strategy.
Birds – breeding and winter	Habitat loss, degradation of habitat (subject to further survey), disturbance.	Protection of retained habitats. Sensitive timing of works. Provision of bird boxes to replace lost nesting habitat. Provision of compensatory bird habitat through a landscaping and biodiversity net gain strategy.
Barn owl	Habitat loss, death by vehicle collision.	A suitably qualified ecologist to undertake nest exclusion measures at the OBS

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
		adjacent to the Scheme, involving removing and relocating the nest box to an appropriate location away from construction works and in advance of works. This will take place outside of the breeding season (September to February inclusive), and therefore it is not envisaged that a licence will be required. A pre-works check for nesting barn owl will also be carried out on the two PNS by a suitably qualified ecologist prior to the felling of these trees. Measures will also be included to reduce collision risk such as regular management of verges and appropriate screening. Provision of compensatory habitat through a landscaping and biodiversity net gain strategy. Provision of barn owl boxes in the wider area adjacent to the NWL, at sufficient distance to avoid road traffic collision mortality.
Bats	Roost loss, severance of commuting routes and foraging areas, disturbance, mortality / injury resulting from collision with traffic.	Retention, creation and enhancement of roosting, foraging and commuting habitat. Where habitat must be removed provision of replacement bat foraging and roosting habitat as part of the comprehensive landscaping and biodiversity net gain strategy. Provision of suitable crossing features such as landscape treatment retaining trees, green bridges and underpasses to reduce effects of habitat fragmentation. Provision of bat boxes and alternative measures of creating replacement roost resource. Sensitive lighting strategy (largely avoiding lighting beyond baseline conditions). Works undertaken under a European Protected Species Mitigation Licence

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
		(EPSML) as necessary. Soft felling of trees with prior exclusion of bats as appropriate and sensitive timing of works. Provision of temporary habitat / guides which seeks to minimise habitat fragmentation during construction.
Badger	Sett destruction, disturbance, death by vehicle collision.	Closure of certain badger setts under development licence from Natural England. Sensitive timing of works. Pre-construction badger survey. Measures to mitigate disturbance, pollution and potential killing/injury of badgers during the construction phase. Retention, creation and enhancement of woodland, hedgerow, scrub and grassland. The provision of compensatory foraging habitat through a landscaping and biodiversity net gain strategy where existing habitat requires removal. Provision of pipe culverts, fencing, underpasses and green bridges to reduce effects of habitat fragmentation.
Otter	Possible habitat loss (subject to further survey), disturbance, barrier to movement, death by vehicle collision.	Retention and enhancement of aquatic habitats. Provision of measures to reduce effects of habitat fragmentation, including a viaduct over the River Wensum. Measures to mitigate disturbance, pollution and potential killing / injury of otters during the construction phase of the Scheme.
Water vole	Killing/injury of individuals during construction, habitat loss (subject to further survey), disturbance, pollution.	Retention and enhancement of aquatic habitats. Provision of a viaduct over the River Wensum and underpasses to reduce effects of habitat fragmentation. Works under a Conservation Licence Sensitive timing of works. Measures to mitigate disturbance, pollution and potential killing/injury of water voles

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
		during the construction phase of the Scheme.
Brown hare	Killing/injury of individuals during construction, habitat loss, death by vehicle collision	Wildlife underpasses and green bridges to help reduce the severance impacts. Provision of replacement habitat through a landscaping and biodiversity net gain strategy.
Hedgehog	Killing/injury of individuals during construction, habitat loss, death by vehicle collision.	Wildlife underpasses and green bridges to help reduce severance impacts. Provision of habitat through landscaping and biodiversity net gain strategy.
Habitats and Protected/Notable Vascular and Non-Vascular Plant, Fungi and Lichens		
Ancient woodland	Degradation/disturbance of habitat (subject to further surveys), pollution.	Avoidance of habitat loss of ancient woodland. Protection of retained woodland.
Woodland and trees (non-ancient)	Habitat loss, degradation/disturbance of habitat (subject to further surveys).	Protection of retained habitats. Creation and enhancement of woodland habitat through a landscaping and biodiversity net gain strategy.
Ancient and veteran trees	Habitat loss, degradation/disturbance of habitat (subject to further surveys).	Avoidance of habitat loss of ancient and veteran trees. Protection of retained ancient and veteran trees.
Floodplain grazing marsh	Habitat loss, degradation/disturbance of habitat, pollution (subject to further surveys).	Protection of retained habitats. Pollution prevention measures. Provision of compensatory habitat through a landscaping and biodiversity net gain strategy.
Hedgerows	Habitat loss, severance, degradation, pollution.	Protection of retained hedges. Creation and enhancement of hedgerows.

Biodiversity feature	Possible impact (in the absence of mitigation)	Mitigation/compensation strategy being considered (not all confirmed) in construction and operation phases of development
Rivers/streams	Habitat loss, pollution, degradation of habitat, shading.	Provision of a viaduct over the River Wensum to avoid direct habitat loss and shading impacts. Pollution prevention measures. Protection of retained habitat. Provision of underpasses. Enhancement of existing water courses.
Macrophytes	Habitat loss, pollution, degradation of habitat.	Provision of a high viaduct to avoid shading impacts. Pollution prevention measures. Enhancement of existing water courses.
Non-vascular plants, fungi and lichens	Habitat loss, pollution, degradation (subject to further surveys).	Provision of compensatory habitat through a landscaping and biodiversity net gain strategy.

Biodiversity Net Gain and Veteran / Ancient Tree and Hedgerow Strategy

Biodiversity Net Gain

7.6.3. Biodiversity Net Gain (BNG) is an objective and approach to development that leaves biodiversity in a better state than before. It is anticipated that BNG will be made mandatory within the new Environment Bill, with the expectation that developments deliver at least a 10% BNG. A BNG strategy for the Scheme is currently being developed.

7.6.4. BNG for the Scheme will be delivered with reference to the 10 good practice principles published by Chartered Institute of Ecology and Environmental Management (CIEEM), Construction Industry Research and Information Association (CIRIA) and Institute of Environmental Management and Assessment (IEMA) [35]. The NWL will impact veteran / ancient trees and important hedgerows which are considered in policy terms an irreplaceable habitat (see below) and crosses an SAC. Therefore, in line with the best practice principles, BNG cannot be claimed for the whole Scheme. The aim is to achieve BNG for all applicable habitats. A separate strategy for veteran / ancient trees and important hedgerows is currently being developed.

[35] CIEEM, CIRIA, IEMA (2016). Biodiversity Net Gain – Good practice principles for development (2016)

7.6.5. Natural England advised that BNG should be considered on a landscape scale and that it should target woodland and wetland. Barbastelle bat will be a particular focal point for the BNG strategy. It is anticipated that BNG delivery will be focussed within the 6km core sustenance zone for barbastelle bat[36] roosts recorded in proximity to the Scheme. Approaches for BNG delivery are likely to include woodland creation and woodland management to enhance the woodlands in the long term for barbastelle bat and other species.

Ancient Woodland and Ancient/Veteran Trees Strategy

7.6.6. Ancient woodland was identified from inventory data at an early stage of routing and the importance of avoiding these areas and maintaining a minimum buffer of 15m will be achieved. Ancient/veteran trees are equally important, but the inventory is a voluntary database and incomplete. Survey has identified ancient/veteran trees and some will be removed under the scheme. Retained trees will be protected and suitably buffered. A strategy is currently under development and further information regarding mitigation will be included within the ES following a complete baseline.

7.7 Summary

7.7.1. The TAG assessment (see Appendix G has concluded that there are Large Adverse impacts on the following features:

- Bats (all species).

7.7.2. The Scheme will require the removal of up to up to 4.8ha broadleaved and mixed semi-natural woodland and 6.3ha mixed or coniferous plantation woodland, and 5.5km of hedgerow. Tree roosting resource within the areas removed and retained woodland close to the Scheme will be reduced, and this will include the removal, or potential degradation of roost resource. Known roosts affected by the Scheme include hibernation roosts used by small numbers of bats, summer roosts used by small numbers of bats and a maternity roost. The removal of habitat will also change the availability of foraging and commuting habitat.

7.7.3. In the absence of mitigation, the Scheme has potential to affect bats, through direct effects upon confirmed bat roosts and removal or degradation of habitat used by foraging and commuting bats, including rarer species, notably the barbastelle bat. A European Protected Species (EPS) licence will therefore be required to ensure compliance with the relevant protective legislation pursuant to bats and their roosts.

[36] Bat Conservation Trust (2016). Core sustenance zones: determining zone size. 04.02.19.

7.7.4. An Outline Bat Mitigation Strategy has been drafted and is subject to consultation. It has been developed to outline the principles for mitigation which will be prepared in greater detail to meet WPS licensing requirements.

7.7.5. Detailed designs for the Scheme are subject to refinement, and habitat loss will be avoided where possible in line with the mitigation hierarchy.

7.7.6. The outline bat mitigation strategy includes habitat creation and enhancement components and seeks to increase the area of habitat available to the local bat assemblage in the longer term. The following measures are proposed:

- Where practicable, woodland will be retained on site to maintain habitat availability and reduce the requirement for mitigation. Semi-natural woodland will also be replaced on a 1:3 area ratio, to include planting on and off-site. These new areas will in time provide suitable habitat for foraging and roosting bats. A minimum of 11.1ha further woodland will be also enhanced to provide habitat resource during the construction phase and the time required for new habitat to become established; and,
- on-site hedgerow planting will be undertaken at a 1:1 replacement ratio, and further hedgerow creation and enhancement is proposed to strengthen and connect the wider habitat network used by bats off-site. Hedgerows will be managed to benefit a range of biodiversity, including the local bat population; and,
- habitat creation and enhancement measures proposed for the River Wensum floodplain will also benefit bats that forage in association with riparian habitat.

7.7.7. The Outline Bat Mitigation Strategy also includes features to promote continued landscape permeability and design features to guide bat movement away from or above the traffic corridor:

- Landscape permeability will be preserved through a combination of habitat retention, creation and enhancement and provision of landscape treatment retaining trees, green bridges and underpasses. There will be at least three mitigation structures and two underpasses designed specifically to facilitate bat movement, including the wide-span viaduct above the River Wensum. The viaduct will function to allow bats to continue commuting and foraging along the river corridor without obstruction; and,
- woodland retention and landscaping will be designed to create safer opportunities for bats to fly above the traffic corridor in Long Plantation and Gravelpit Plantation, where the Scheme is in cutting.

7.7.8. Mitigation for impacts to roosting resource includes:

- Roost retention and protection;
- Roost removal using appropriate methods and seasonal timing; and
- The provision of replacement and additional roosting resource, including the veteranisation of trees and installation of bat boxes.

7.7.9. Mitigation for foraging resource that aims to maintain the overall area and quality of foraging resource available to the local bat assemblage will be achieved through a combination of

habitat retention, creation and enhancement. Habitat creation and enhancement off site will be provided within the core sustenance zone used by the local bat population, for barbastelle bats this represents land up to approximately 6km from known barbastelle bat roosts. Larger areas of woodland intended to provide higher quality foraging and roosting resources to the local bat population will be generally set back from the road by at least 100m to reduce the risk of traffic collision injury and mortality.

7.7.10. The mitigation strategy remains under development, reflecting the refinement to the northern alignment and desire to add greater detail ahead of EPS licensing. At this stage a precautionary approach to assessment continues to be taken, and as such the magnitude of effect upon bats is assessed to be 'intermediate negative' defined as '*The key environmental resource's integrity will not be adversely affected, but the effect on the resource is likely to be significant in terms of its ecological objectives.'.* This may be updated subject to completion of the ecological impact assessment and finalisation of the associated mitigation strategy.

7.7.11. The combination of a high value biodiversity feature and an effect of intermediate negative magnitude gives a large adverse effect. It should be noted that this assessment is precautionary and reflects the status of the detailed design and outline mitigation strategy.

7.7.12. The TAG assessment has concluded that there are Moderate Adverse impacts on the following features:

- Wensum Pastures at Morton Hall CWS;
- Land adjoining Foxburrow Plantation CWS;
- Broom & Spring Hills CWS;
- Fakenham Road RNR;
- Ancient/veteran trees;
- Important Hedgerows;
- Lowland meadow HPI;
- Purple moor-grass and rough pasture HPI; and
- Lowland mixed deciduous woodland HPI.

7.7.13. A Moderate Adverse impact is expected on the above CWS's due to habitat loss and/or severance which could impact the integrity of the CWS. The habitat creation strategy for the Scheme will seek to compensate for this habitat loss, and an underpass will be included to ensure the stream within the Land adjoining Foxburrow Plantation will maintain flow post construction into the River Tud.

7.7.14. The Fakenham Road RNR is designated because of the presence of hoary mullein *Verbascum pulverulentum*. This site will be lost due to the construction of the NWL. A compensation strategy will be developed which will aim to recreate the habitat and lead to an increase in hoary mullein within the study area.

7.7.15. Ancient/veteran trees will be removed as a result of the Scheme if a suitable root protection area cannot be adequately maintained, to provide an appropriate buffer distance, typically

of at least 15m. Indirect impacts from nitrogen deposition will be modelled as part of an assessment of air quality impacts. A strategy for ancient/veteran trees is under development which will help to mitigate the impact of the loss of the trees and will be presented within the ES. However, they are regarded as an irreplaceable habitat and will not be factored into BNG calculations.

7.7.16. A total of eight hedgerows qualified as Important (as defined under the Hedgerow Regulation 1997), however none of the hedgerows were found to contain ancient or veteran features. Mitigation for impacts to hedgerows will involve creation and enhancement.

7.7.17. The NWL bisects areas of lowland mixed deciduous woodland HPI. The woodland to be lost is not ancient. As part of the compensation strategy new woodland will be planted and existing woodland will be enhanced for biodiversity benefit in the longer term. Ancient woodland within Primrose Grove CWS is located 15 m from the Scheme boundary.

7.7.18. The NWL also bisects a single area of purple moor-grass and rough pasture HPI near Foxburrow plantation. Lowland meadow HPI is present within the Scheme boundary north of Fakenham Road and also a strip between Rose Carr and Low Farm.

7.7.19. The assessment for all other features ranges from slight adverse or neutral impacts based on the adoption of preliminary mitigation and compensation measures stated in **Table 7-5**. This includes the River Wensum SAC and SSSI which through the viaduct design of the Scheme, impacts are largely avoided.

7.7.20. This assessment is based on the data which has been collected and analysed up to May 2021. It is a provisional impact assessment and has been undertaken before the Ecological Impact Assessment, Habitats Regulations Assessment and Water Framework Directive (WFD) assessment have been completed.

7.7.21. The overall assessment score for the NWL is a Large Adverse Impact due to the loss of woodland foraging habitat available to the local bat assemblage which includes the rarer barbastelle bat. This is a precautionary assessment and reflects the status of the mitigation strategy which is yet to be finalised as set out above. Effects upon all other biodiversity features are assessed to be moderate adverse or of lesser significance.

7.7.22. Further surveys are planned in 2022 which will complete the ecological baseline and will feed into the future assessment work for the NWL. The ES is in preparation and will contain more detailed design information and a full assessment of ecological impacts (in line with CIEEM guidelines). The ES will take into account the final design and final mitigation strategies designed to avoid and reduce impacts upon biodiversity features and where possible deliver enhancements.

8 Water Environment

8.1 Introduction

8.1.1. This section presents Water Environment appraisal for the NWL, required to identify any potential constraints in relation to the Water Environment to help inform the OBC. This includes a summary of the baseline conditions, methodology and the likely impact of the NWL on the nearby sensitive receptors.

8.1.2. The water assessment to inform the OBC was originally undertaken in 2020 but has now been updated due to the alignment of the Scheme being revised since the 2020 water assessment for the OBC (the main change being at the northern end of the Scheme which has moved to the West).

8.2 Baseline Conditions

8.2.1. Over the course of the project there has been statutory consultation with Natural England and the Environment Agency to agree approaches to survey and assessment and to discuss mitigation and compensation proposals. In addition, consultation has also been held with Norfolk County Council as Lead Local Flood Authority.

Surface Water

8.2.2. The NWL crosses the River Wensum. The River Wensum is a low gradient groundwater (chalk aquifer) dominated chalk stream. The River Wensum lies within the Anglian River Basin District (RBD); the Management Catchment is Broadland Rivers, and the Operational Catchment is the Wensum. The waterbody is designated as heavily modified and is currently achieving Moderate status. The hydromorphological status 'Supports Good' and hydrological regime currently 'Does Not Support Good'.

8.2.3. The floodplain of the River Wensum in this locality is mostly comprised of managed grassland with areas of fen, wet grassland, woodland and wet woodland. The floodplain has historically been drained for agricultural purposes by a series of Internal Drainage Board 'main drains' and other smaller land drains managed by Norfolk Rivers Internal Drainage Board (IDB). The main drains run parallel to the river, and then join the main channel below each impoundment.

8.2.4. The NWL crosses one unnamed ordinary watercourse, named the Tributary of the Tud or Foxburrow Stream, located between Honingham and Weston Green under the jurisdiction of Norfolk County Council (NCC) as Lead Local Flood Authority (LLFA). The watercourse flows south from Weston Green and joins the River Tud to the east of Honingham approximately 2km downstream of the NWL. In addition to this, the NWL crosses two significant overland flow paths between Weston Road (NGR TG 11652 14387) and Ringland Lane (NGR TG 12528 15116), believed to be ephemeral ordinary watercourses. The flow paths discharge to the River Wensum.

8.2.5. The River Tud, a main river and tributary of the River Wensum, is located approximately 300m to the south of the southern extent of the NWL. The River Tud rises from its source on East Dereham and flows in an easterly direction for approximately 27km to its confluence with the River Wensum below Hellesdon Mill approximately 14.8km downstream of the NWL crossing over the River Wensum (NGR 619831, 310153).

Groundwater

8.2.6. The Study Area is dominated by White Chalk Subgroup (bedrock geology), designated a major aquifer and Principal Aquifer by the Environment Agency. These are deemed capable of supporting water supplies and/or river baseflow at a regional scale, meaning they usually provide a high level of water storage.

8.2.7. The superficial deposits in the study area are dominated by Sheringham Cliffs Formation to the north and these deposits are composed of sands and gravels. Alluvium and River Terrace Deposits are present along the river channel. The Alluvium is composed of clay, silt, sand and gravel and the River Terrace Deposits are composed of sand and gravel. The south of the site is dominated by the Lowestoft Formation and its composition varies between clay, sand and gravel. There are also sporadic superficial Head Deposits and Happisburgh Glacigenic Formation deposits in the study area. Both are variable in composition and are generally composed of poorly sorted clay, silt, sand and gravel.

8.2.8. The Lowestoft Formation, Alluvium and River Terrace Deposits are classified as Secondary A Aquifers by the Environment Agency. Secondary A Aquifers are defined as permeable strata capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers. The Head Deposits are classified as Secondary B Aquifers and these are defined as having low permeability layers which may store and yield limited amounts of groundwater but may support local water supplies. The Sheringham Cliffs Formation is classified as both a Secondary A and Secondary Undifferentiated Aquifers by the Environment Agency. Secondary Undifferentiated Aquifers are geologies which have been classed as either Secondary A or B Aquifers historically.

8.2.9. The site is located within a Groundwater Source Protection Zone (SPZ) Total Catchment Zone 3. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon drinking water. Zones around location sites are defined by groundwater travel times to an abstraction. SPZ Total Catchment Zone 3 is defined as the area around a source within which all groundwater recharge is presumed to be discharged at source and defined by a 400-day travel time to the source.

Flood Risk

Fluvial Flood Risk

8.2.10. Review of the Environment Agency Flood Map for Planning (Rivers and Sea) indicates that the majority of the study area is located in the low-risk Flood Zone 1 where the risk of

flooding from fluvial sources is less than 1 in 1000 (0.1%) in any year. However, the study area does include sections located in the medium risk Flood Zone 2, where the risk of fluvial flooding is between 1 in 1000 (0.1%) and 1 in 100 (1%) in any year, and the high-risk Flood Zone 3, where there is a greater than a 1 in 100 (1%) risk of fluvial flooding in any year. The mapped fluvial flood zones are associated with the River Wensum and the unnamed ordinary watercourse located between Honingham and Weston Green.

8.2.11. Flooding from the River Wensum in the vicinity of the NWL is largely confined to the surrounding rural floodplain and open green space. According to historic flooding records kept by the Environment Agency, the largest flood on the Wensum occurred in 1912. More recently, two rainfall events occurred on 27 May and 20 July 2014 and resulted in the flooding of 80 properties within the Norwich urban area. Along the reach of interest, no flooding incidents have been reported. There are a number of receptors within the wider area including villages both upstream and downstream of the NWL (Attlebridge and Ringland) as well as other isolated properties in the mapped fluvial floodplain within the study area.

Surface Water Flood Risk

8.2.12. Review of the Environment Agency Flood Risk from Surface Water map indicates that sections of the study area are at high, medium and low risk of flooding from surface water sources. Flooding from surface water is typically associated with natural overland flow paths and local depressions in topography where surface water runoff can accumulate during or following heavy rainfall events.

8.2.13. In this locality, it is believed that areas at risk of surface water flooding are limited to fluvial flow associated with ephemeral ordinary watercourses and drainage ditches that are not mapped on the flood map due to catchment size. This indicates that fluvial flood flows will broadly remain within the watercourse channels up to the 1 in 1000-year event. The most notable of these are between Weston Road (NGR TG 11652 14387) and Ringland Lane (NGR TG 12528 15116) where two significant overland flow paths are identified (as discussed above), believed to be ephemeral ordinary watercourses coinciding with the location of Head deposits in this area.

Other Sources

8.2.14. There is reservoir flood risk in the study area as indicated by the Environment Agency Flood Risk from Reservoirs map. Within the study area, the maximum breach extents are mapped to flow beneath the existing A1067 Fakenham Road bridge and conveyed downstream within the River Wensum floodplain. The Flood Risk from Reservoirs Map only represents reservoirs designated under the Reservoirs Act 1975 with a volume of 25,000m^3 or greater and does not include other large storage features.

8.3 Methodology

8.3.1. The study area for the assessment of impacts to surface water features has been defined by the likely risk to these features. The risk of direct impacts has considered features within

0.5km of the Red Line Boundary (RLB). This is considered appropriate for assessment of risks such as spillage or overland migration of contaminants from professional judgement and experience of similar Schemes. The risk of indirect impacts to surface water features is dependent on hydraulic connectivity and flow characteristics (i.e. how easily pollutants could migrate downstream) however a study area of up to 1km is considered appropriate for the assessment of risks to downstream water quality and geomorphology from professional judgement and experience of similar Schemes.

8.3.2. The study area for the assessment of impacts to groundwater resources includes features up to 1km from the NWL. The importance of groundwater receptors greater than 1km from the NWL will be considered with regard to the connectivity to features within the study area. Receptors considered to be of high importance will be included in the study area. These features may include groundwater abstractions (public and private), local and regional aquifers. The study area is considered appropriate for the assessment of indirect effects.

8.3.3. The current study area for the assessment of flood risk is defined by the likely extent of changes to flood extents as a result of the NWL, although at this stage a distance of 1km is considered appropriate for identification of receptors that may be affected by the NWL.

8.3.4. The potential impacts of the Scheme on the Water Environment have been assessed in accordance with guidance and best practice. The following information sources have been used to inform the assessment:

- TAG Unit A3 – Environmental Impact Appraisal, Department for Transport, May 2019[37];
- Design Manual for Roads and Bridges LA 113 - Road drainage and the water environment[38];
- Geology of Britain Viewer, British Geological Survey, 2020[39];
- Catchment Data Explorer, Environment Agency 2020[40];
- Designated Sites View, Natural England, 2020[41];

[37] Environmental Impact Appraisal, Transport Analysis Guidance (TAG) Unit A3. Department for Transport, May 2019. Available at: https://www.gov.uk/transport-analysis-guidance-webtag. Last accessed October 2020.

[38] Highways England (2019) DMRB LA 113 Road drainage and the water environment. Available at https://www.standardsforhighways.co.uk/dmrb/search/d6388f5f-2694-4986-ac46-b17b62c21727. Last accessed October 2020.

[39] Geology of Britain Viewer, British Geological Survey (2019) available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html Last accessed October 2020.

[40] Environment Agency's online Catchment Data Explorer, Environment Agency (2019) available at: https://environment.data.gov.uk/catchment-planning/. Last accessed October 2020.

[41] Designated Sites View, Natural England. https://designatedsites.naturalengland.org.uk/, Last accessed October 2020.

- Transport Analysis Guidance (TAG), Department of Transport, 2019[42];
- Norwich Western Link, Environmental Scoping Report, Norfolk County Council, 2020[43];
- Magic Map (Nature on the Map), Defra, 2020[44]; and
- Environment Agency's online interactive maps, which hold flood risk and environment data for features including flood risk from rivers, surface water and reservoirs and aquifer and groundwater vulnerability mapping.

8.3.5. The guidance and best practice information listed above has been used to undertake a qualitative assessment of the potential impacts of the Scheme upon various features of the water environment. To appraise the magnitude and significance of the NWL, guidance in TAG Unit A3 – Environmental Impact Appraisal has been followed using best judgement for the most likely impact on each feature or group of features.

8.3.6. The data available online on the EA's interactive maps will only be accurate to when the maps and datasets were last updated by the EA. The maps are designed to be viewed at different scales, for example, groundwater, where data will be collated and interpreted at a higher level and therefore may not reflect local ground conditions at a location.

8.4 Impact Appraisal and Potential Mitigation

8.4.1. Receptors identified in this assessment include: The River Wensum; Tributary of the River Tud; mapped fluvial floodplains; and the underlying groundwater body (combined superficial and bedrock aquifer). The assessment presented below is post mitigation. A full appraisal of potential impacts to surface water and groundwater is provided in the Water Environment impacts worksheet in Appendix E; a summary of potentially significant impacts is given below.

Surface Water

8.4.2. The appraisal considers the proposed superstructure crossing the River Wensum, comprising a viaduct with piers within the floodplain. No structures are proposed within the channel of the River Wensum and footprint within a 9m zone of River Wensum. This is expected to minimise impacts to the river flow and channel morphology.

8.4.3. The NWL requires the construction of a maintenance access track immediately adjacent to the proposed viaduct to enable inspection of the viaduct over its design life. The track will not require crossing of the River Wensum but will need to be constructed within the

[42] Environmental Impact Appraisal, Transport Analysis Guidance (TAG) Unit A3. Department for Transport, May 2019. Available at: https://www.gov.uk/transport-analysis-guidance-webtag. Last accessed October 2020.

[43] Natural England, MAGIC Map. Available at: https://magic.defra.gov.uk/ Last accessed October 2020.

[44] Norwich Western Link, Environmental Impact Assessment Scoping

floodplain of the River Wensum and cross the land drains located within this area. This will need to be assessed for potential impacts relating to fragmentation/disruption to floodplain connectivity.

8.4.4. The proposed crossing of the Tributary of the River Tud will introduce a culvert into the river channel that will remove natural bed substrate and bank-side habitat, as well as potentially change flow dynamics and sediment transport. This in turn could increase sediment deposition or scour. Crossings of watercourses and any new watercourse channels are expected to maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB guidance, and be sensitive to ecological requirements.

8.4.5. The Drainage Strategy at this stage of the assessment indicates that infiltration to ground and discharge to nearby watercourses will be utilised to discharge road runoff. Surface water runoff is likely to contain high levels of sediment and hydrocarbons that can pollute surface water and groundwater features. A robust treatment system will therefore be required including measures to manage accidental spillages.

8.4.6. The impact of the NWL on the River Wensum is predicted to be **Negligible with Low Significance**. This is attributable to the high importance of the ecological and hydromorphological quality of the River Wensum and the low risk associated with works to the new bridge crossing.

8.4.7. The impact of the NWL on the Tributary of River Tud (Foxburrow Stream) is predicted to be **Minor Adverse with Insignificant Significance** to the ecological and hydromorphological quality of the Tributary of River Tud associated with the required culverting of this minor watercourse.

8.4.8. The impact of the NWL on the ecological quality of floodplain of the River Wensum is predicted to be **Minor Adverse with Low Significance** associated with the construction of the maintenance access track.

Groundwater

8.4.9. Any potential changes to groundwater flow may impact the Public Water Supply and river baseflows. Local groundwater flooding can occur as a result of below ground structures (piles/foundations/lined ponds/SuDS) having the potential to create a groundwater flow barrier which could result in groundwater level rise in shallow aquifers and potentially cause groundwater flooding. The impact is considered to be **Negligible/Minor Adverse** with a significance of **Low Significance**. More detailed assessments are required for the River Wensum crossing which include the most significant below ground structures (bridge foundations).

8.4.10. Construction activities will require soil stripping and excavation, removing or reducing the protective cap on groundwater aquifers. Reducing the thickness of unsaturated layers increases groundwater vulnerability. This includes but is not limited to the construction of drainage structures proposed for the NWL. The Scheme design will need to consider

potential mitigation requirements during the construction and detail design phase to reduce the impact on the groundwater water bodies. Potential risks imposed may be reduced, mitigated and manged with the implementation of industry best practice and solutions tailored for the NWL.

8.4.11. A broad range of potential runoff pollutants, such as hydrocarbons (fuel and lubricants), fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road during rainfall events, polluting the receiving groundwater water bodies. Implementation of a CEMP and passive treatment incorporated into SuDS should be considered and adhered to during construction and operation of the NWL, to reduce the risk of contamination to the water environment. With the above mitigation measure in place the magnitude of impact to groundwater quality is considered to be **Minor Adverse** with a significance of **Low Significance.**

8.4.12. Mitigation for reduced groundwater recharge due to the introduction of hardstanding should be considered during detail design stage of the Scheme. There is potential for a minor beneficial magnitude of positive impact the groundwater water bodies to be implemented during design phase of the mitigation measures.

Flood Risk

8.4.13. The north of the NWL will pass through the fluvial Flood Zones 2 and 3 associated with the River Wensum. As discussed above the proposed crossing of the River Wensum will comprise of a viaduct. Piers will be located in the floodplain spaced approximately 70m apart with no embankments proposed, and no structures will be located within the channel of the River Wensum or within 10m of River Wensum. The viaduct soffit will be situated above the 1 in 100-year flood level; the soffit levels and available freeboard will be confirmed at planning stage informed by detailed modelling. This is expected to minimise impacts to flood flow conveyance or loss of flood storage. The design of the structure will be agreed with the relevant authorities at ES stage. It is also expected that the access track will be constructed at grade to prevent adverse effects to floodplain storage or flood flow conveyance.

8.4.14. Any loss of fluvial flood storage or impact associated with flood flow conveyance will be compensated to ensure no increased risk of flooding to the NWL or elsewhere up to the 1 in 100-year event considering the potential effects of climate change.

8.4.15. The proposed crossing of natural overland flow paths could increase surface water flood risks if hydraulic connectivity is not maintained, both through blockage of these flow paths or if overland flow inadvertently overwhelms the Scheme's surface water drainage system. In order to protect the NWL and maintain hydrological continuity, consideration will be given to maintaining these overland flow paths beneath the NWL.

8.4.16. The NWL will replace currently undeveloped land with impermeable surface that could increase the rate and volume of surface water runoff. A robust surface water drainage system will be expected to ensure discharge from the NWL does not increase flood risk

elsewhere up to and including the 1 in 100-year event and allowing for climate change effects. The required attenuation and restriction of the rate and volume of discharge will be agreed with NCC as the LLFA.

8.4.17. The impact of the NWL on flood flow conveyance and storage in the floodplain of the River Wensum is predicted to be **Minor Adverse with a Low Significance** associated with the construction of the proposed viaduct and maintenance access track.

8.4.18. The impacts of the NWL on flood flow conveyance of the Tributary of River Tud (Foxburrow Stream) is predicted to be **Minor Adverse with Insignificant Significance** associated with the construction of the NWL crossing and culvert.

8.4.19. A high-level CEMP and Mitigation Plan will be produced as part of the ES submission which will detail the measures required to mitigate the identified impacts. This will help give certainty on the delivery of the mitigation and compensation measures. A more detailed CEMP will be taken forward by the contractor post Planning Submission.

8.5 Summary

8.5.1. The overall Summary Assessment score for the NWL is predicted to be **Moderate Adverse.** This is attributable to the high importance to the River Wensum and the **Negligible** impact of the ecological and hydromorphological quality of the River Wensum and the low risk associated with works to the new bridge crossing. A **Moderate Adverse** impact is predicted to the tributary of the River Tud; the mapped fluvial floodplain; and the underlying groundwater body (combined superficial and bedrock aquifer). Measures are being developed to further mitigate and compensate for these issues.

8.5.2. A conservative approach to the loss of floodplain has been taken until quantitative analysis of potential effects is undertaken to inform the need for compensatory storage or other mitigation.

8.5.3. The ES is being prepared by WSP, which will contain more detailed design information and a more thorough impact assessment subsequently providing more site-specific mitigation measures to attempt to reduce impacts and risks further.

Appendix A

NOISE TAG WORKBOOK

Noise Workbook - Worksheet 1

Proposal Name:	Test
Present Value Base Year	2010
Current Year	2022
Proposal Opening year:	2025
Project (Road, Rail or Aviation):	road

Net present value of change in noise (£):	£26,756

*positive value reflects a **net benefit** (i.e. a reduction in noise)

Net present value of impact on sleep disturbance (£):	£35,093
Net present value of impact on amenity (£):	-£9,926
Net present value of impact on AMI (£):	£6,857
Net present value of impact on stroke (£):	-£2,089
Net present value of impact on dementia (£):	-£3,179

Quantitative results

Households experiencing increased daytime noise in forecast year:	36
Households experiencing reduced daytime noise in forecast year:	9
Households experiencing increased night time noise in forecast year:	3
Households experiencing reduced night time noise in forecast year:	8

Qualitative Comments:

The study area for the assessment has been derived based on guidance within the Design Manual for Roads and Bridges (DMRB), LA 111 Noise and Vibration, May 2020 and is set to a distance of 600m from the kerb of any new roads associated with the scheme. There are 52 residential dwellings within the study area and no additional other sensitive receptors. Generally, within the study area, noise levels are predicted to increase as a result of the scheme, with large increases predicted at isolated receptors towards the centre of the study area where low baseline levels are anticipated. However, some receptors along Wood Lane and Paddy's Lane are predicted to experience noise level reductions as a result of less vehicles using these roads in favour of the scheme.
The Highways England A47 dualling scheme has been included in both the Do-minimum (without scheme) and Do-something (with scheme) scenarios for the purpose of this assessment.

Data Sources:

Norwich Western Link Reference Design
Highways England A47 Dualling Interim Design Fix C Design
OS Mastermap data (from which buildings and roads were extracted)
OS Addressbase Plus Data
2019 LIDAR 1m DTM data
Road traffic flows as provided by project transport consultants

Appendix B

NO2 DIFFUSION TUBE SURVEY

Annualised Results for 2018 from WSP NO_2 Diffusion Tube Survey between 9 September 2019 and 6 March 2020

Site ID	Site Name	X, Y Coordinates	Annualised NO_2 Concentration ($\mu g/m^3$)
NWL_1	Castle Meadow	623203, 308616	Insufficient data capture
NWL_2	A1067 Fakenham Road	616984, 314157	21.0
NWL_3	A1067 Fakenham Road	617039, 314101	23.0
NWL_4	River Wensum at Scheme crossing	-	Site access not granted
NWL_5	A1067 over the River Wensum at Attlebridge	612822, 316727	20.0
NWL_6	A1067 at Lenwade	610205, 318259	18.5
NWL_7	A47 north of Honingham	610271, 311986	27.7
NWL_8	A47 west of Easton	612784, 310988	10.6
NWL_9	A1074 Dereham Rd, New Costessey	616934, 310350	25.5
NWL_10	A1074 Dereham Rd, Norwich	619069, 309691	25.9

Notes:

a) All sites were located at roadside.

b) Annualisation of survey data has been undertaken for 2018 in accordance with Defra LAQM.TG(16) procedure. This process used ratified monitoring data from established Automatic Urban and Rural Network background sites at Norwich Lakenfields and Wicken Fen covering the year 2018 and extending to the end of the survey in 2020, and a bias adjustment factor of 0.89 (national factor for 2018 Gradko 50% TEA/Acetone diffusion tube preparation).

c) The diffusion tube at site NWL_1 was co-located with the Norwich CC Castle Meadow (CM1) continuous automatic monitoring station. Only 2 months of data were collected due to tubes going missing between changeovers.

Appendix C

AIR QUALITY TAG WORKBOOK

Air Quality Valuation Workbook - Worksheet 3

Scheme Name:	Norwich Western Link
Present Value Base Year	2010
Current Year	2022
Proposal Opening year:	2025
Project (Road/Rail or Road and Rail):	Road Transport (RT)

Overall Assessment Score:

Damage Costs Approach (Emissions)

Present value of change in NOx emissions (£):	£0
Present value of change in PM2.5 emissions (£):	£0
OR	
Present value of change in PM10 emissions (£):	£0

Impact Pathways Approach (Concentrations)

Present value of change in NO2 concentrations (£):	£101,733
Of which:	
Concentration costs:	£260,872
Other impacts:	-£159,139
Present value of change in PM2.5 concentrations (£):	£489,228
Of which:	
Concentration costs:	£495,737
Other impacts:	-£6,510

Total Change

Total value of change in air quality (£):	£590,960

*positive value reflects a **net benefit** (i.e. air quality improvement)

Quantitative Assessment:

Impact Pathways Approach (Concentrations)

Change in NO2 assessment scores over 60 year appraisal period: (between 'with scheme' and 'without scheme' scenarios)	-38,720.65
Change in PM2.5 assessment scores over 60 year appraisal period: (between 'with scheme' and 'without scheme' scenarios)	-9,467.40

Damage Costs Approach (Emissions)

Change in NOX emissions over 60 year appraisal period (tonnes): (between 'with scheme' and 'without scheme' scenarios)	0
Change in PM2.5 emissions over 60 year appraisal period (tonnes): (between 'with scheme' and 'without scheme' scenarios)	0
OR	
Change in PM10 emissions over 60 year appraisal period (tonnes): (between 'with scheme' and 'without scheme' scenarios)	0

Qualitative Comments:

The air quality impacts appraisal has been undertaken in accordance with TAG Unit A3 methodology. The calculations are based on the traffic forecasts for the do-minimum and do-something model scenarios for 2025 (opening year) and 2040 (design year), as generated by the Norwich Area Transport Strategy (NATS) traffic model for the OBC.

The affected road links map onto PCM links which are all compliant with the NO2 limit value both with and without scheme. The Impact Pathways approach has been applied in valuation. This accounts for impacts in terms of changes in human exposure to ambient concentations of air pollutants, and impacts that do not directly affect households such as ecosystem damages which are determined in terms of changes in emissions.

Comments on assumptions and uncertainties:
1) Impacts in the design year (2040) are based on vehicle emissions factors and background concentrations for 2030 as the last forecast year in Defra's Emissions Factors Toolkit version 11.0 and 2018-based background map dataset. 2030 emissions factors and background concentrations are applied in all years thereafter, up to the end of the 60 year appraisal period (2084). Consequently, any improvements in air quality that may occur after 2030 are not factored into the appraisal. In this respect the appraisal is considered to be conservative.
2) Traffic growth has not been forecast beyond 2040 and so traffic levels are assumed to be the same in all years thereafter, up to the end of the 60 year appraisal period). In this respect the appraisal is considered to be conservative.

Sensitivity Analysis:

Upper estimate net present value of change in air quality (£):	£2,077,440
Lower estimate net present value of change in air quality (£):	£36,584

Data Sources:

Traffic data from NATS model output. Emissions from Defra Emissions Factors Toolkit v11.0. Defra 2018-based background pollutant maps. Pollution Climate Mapping model, 2018 reference year (Open Government Licence v3.0). Property counts derived from Ordnance Survey AddressBase data (under contractor licence from NCC).

Appendix D

GREENHOUSE GASES TAG WORKBOOK

Greenhouse Gases Workbook - Worksheet 1

Scheme Name: Norwich Western Link

Present Value Base Year	2010
Current Year	2022
Proposal Opening year:	2025
Project (Road/Rail or Road and Rail):	road

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£): £19,370,545

*positive value reflects a **net benefit** (i.e. CO2E emissions reduction)

Quantitative Assessment:

Change in carbon dioxide equivalent emissions over 60 year appraisal period (tonnes): -260,173
(between 'with scheme' and 'without scheme' scenarios)

Of which Traded -2606.353903

Change in carbon dioxide equivalent emissions in opening year (tonnes): -3,321
(between 'with scheme' and 'without scheme' scenarios)

Net Present Value of traded sector carbon dioxide equivalent emissions of proposal (£): £201,461
(N.B. this is not additional to the appraisal value in cell I17, as the cost of traded sector emissions is assumed to be internalised into market prices. See TAG Unit A3 for further details)

*positive value reflects a **net benefit** (i.e. CO2E emissions reduction)

Change in carbon dioxide equivalent emissions by carbon budget period:

	Carbon Budget 1	Carbon Budget 2	Carbon Budget 3	Carbon Budget 4
Traded sector	0	0	0	-145.1317602
Non-traded sector	0	0	0	-10052.20814

Qualitative Comments:

The greenhouse gases appraisal for road transport emissions has been undertaken in accordance with TAG Unit A3 methodology. The calculations are based on the traffic forecasts for the do-minimum and do-something model scenarios for 2025 (opening year) and 2040 (design year), as generated by the Variable Demand Model (VDM) for the OBC sensitivity asessment. Non-traded CO2e emissions (petrol and diesel vehicles) and CO2e traded emissions (electric vehicles) have been calculated in accordance with DMRB LA 114.

Comments on assumptions and uncertainty:
1) Emissions have been calculated across the whole of the VDM model simulation area.
2) Emissions have been estimated for scenarios in 2025 and 2040. For each year between the emissions have been determined by linear interpolation. In the absence of any data for the intervening years, this pragmatic approach adds a degree of uncertainty to the TAG calculations for these years.
3) The VDM model future forecast year is 2040. Beyond 2040 no traffic growth has been assumed. In reality some inter-annual variations in traffic levels and emissions can be expected. This factor adds a degree of uncertainty to the appraisal.
4) Emissions have been estimated based on vehicle fleet composition forecasts which were published pre-COVID-19. The likely impact of COVID-19 on fleet composition in future years cannot be predicted with any certainty at this present time.

Sensitivity Analysis:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):	£29,055,818
Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):	£9,685,273

Data Sources:

Traffic data for do-minimum and do-something scenarios in 2025 and 2040 were derived from the VDM model.

Appendix E

LANDSCAPE TAG WORKBOOK

TAG Landscape Impacts Worksheet

	Step 2	Step 3				Step 4
Features	**Description**	**Scale it matters**	**Rarity**	**Importance**	**Substitutability**	**Impact**
Pattern	The landscape to the northern end of the proposed route is a wet lowland shallow valley containing the River Wensum. To the south, the land rises up and gently undulates, becoming a plateau of small to medium regular sized fields contained by hedgerow. The River Tud valley with its associated drainage features is located to the southeast. Irregular blocks of woodland cut through this landscape, reducing the order and regularity of field pattern. There are scattered farmsteads through the landscape, along with small settlements - the most notable being Honingham to the south and Weston Longville to the west. Small lanes also cut through the landscape, generally fairly straight with gentle curves.	Local	Common feature at a local scale	Important at the local and regional level	Easily substitutable, although loss of mature hedgerow trees would take much longer (over 25 years) to re-establish.	**Slight Adverse** The Proposed Scheme would bisect and subdivide fields locally, however the alignment is reflective of the pattern of existing roads within this landscape.
Tranquillity	There is some human influence within this landscape, including scattered farmsteads and small settlements, as well as historic estates such as Morton Hall to the north. Ringland and Weston Longville are notable settlements within this landscape. The wind turbines to the east on the old airfield and overhead line which runs north to south are also notable influences within this landscape. Some arable fields have been turned into pig rearing. Views from the plateau give a wider perception of human influence, particularly of traffic along the A47 and A1067. The eastern and western fringes of the study area have the greatest human influence. Perception/ actual tranquility levels likley to be reduced where large roads are visible or where certain human influences are more visible (pig rearing and wind turbines).	Local	Not rare locally	Important at the local level.	Not easily substitutable in the north, but easier to maintain in the south through replacement hedgerow planting.	**Moderate Adverse** The introduction of the viaduct over the River Wensum will substantially reduce tranquillity in the wider area, and locally to the south due to the road being largely in cutting or at-grade, with short sections on embankment influencing a wider area.
Cultural	The landscape has long been associated with farming. Field patterns are largely intact from 14th century, however there is evidence of larger fields and removal of hedgerows in some areas. There are medieval manors which form 18th-century country house estates such as Morten Hall to the north and Easton Estate to the south.	Local	Not rare locally or regionally	Important at local and regional scale.	Not easily substitutable, although former field boundaries can be readily replaced.	**Slight Adverse** The proposed route would bisect the landscape and alter the pattern of enclosure.
Landcover	Landcover is predominately arable farming throughout this landscape with mixed plantation woodland, although some fields have been turned over to pig rearing. There are small ponds throughout this landscape often regular in shape. The river valley to the north and east following the River Wensum is wet meadow and small lakes. Field are contained by hedgerows and infrequent mature trees.	Predominant landcover common at local to regional scale, others less common.	Not rare locally or regionally	Important at the local level.	Easily substitutable.	**Moderate Adverse** The Proposed Scheme would introduce a new viaduct and large dual carriageway through the landscape, and result in the loss of some of the plantation woodland and arable fields.
Summary of character	The landscape is gently undulating arable farmland, with plateau to the south, located between two shallow river valleys. River Tud in the south and River Wensum in the north being the larger of the valleys with noticeable difference in character of wet meadow and mosaic of lakes and drainage ditches. There is some human influence, of note is the over-head line and two wind turbines to the west, with the A47 and A1067 noticeable from the plateau. Settlement is sparse, mainly small farmsteads - the biggest settlement is Honingham located to the south. Land cover is predominately arable fields, contained by clipped hedgerow and infrequent mature trees, with some fields turned to pig rearing. Mixed plantation woodland is common throughout this landscape, often following field boundaries. Roads are generally small lanes, gently curved, and following the field boundaries.	Common locally	Not rare locally or regionally	Important at the local and regional level	The majority of elements are easily substituitable, although the loss of mature hedgerow trees would take much longer to re-establish. Tranquility is also difficult to substitute. Loss of long views along the river valley is not easily substitutable along with historic elements, which would not be easily replaceable.	**Moderate Adverse** The Proposed Scheme would alter the local landscape character through the introduction of the viaduct, loss of woodland and the width of the new road (dual carriageway). However, it's impact is limited to the immediate surroundings due to the road being largely in cutting or at-grade and the presence of woodland blocks.

Reference Sources

MAGIC, Google Earth, Ordnance Survey Mapping, Natural England - National Character Area 78: Central North Norfolk, Breckland District LCA (2007), South Norfolk Landscape Assessment (2001), Broadland District Council Local Development framework - Landscape Character Assessment SPD (2013)

Step 5 - Summary Assessment Score

Moderate Adverse

Qualitative Comments

There would be subdivision of fields, disrupting field patterns locally. There would be sections of embankment and cutting through the landscape which would affect the pattern locally but the viaduct would have a wider impact. The viaduct across the River Wensum will introduce a new feature into this landscape and will have a substantial impact on tranquillity in the north. The road will also alter tranquillity locally along its entire length, although more limited than the viaduct due to it largely being at-grade or in cutting. The alignment, which is duelled, is larger than the existing road infrastructure through this landscape and therefore out of character. There will be some loss of woodland and arable farmland altering land cover locally.

Appendix F

HISTORIC ENVIRONMENT TAG WORKBOOK

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
Form	**Designated heritage assets (physically affected by the Scheme)** 1. None. **Designated heritage assets (possible setting impact)** 2. Two Grade I listed buildings. 3. One Grade II* listed building. 4. Fourteen Grade II listed buildings. **Non-designated heritage assets (palaeoenvironmental, prehistoric, Roman and undated/multi-period)** 5. Cropmarks of a possible Roman field system (53485). 6. Post-Roman and undated features and prehistoric finds (63365) 7. Cropmarks of undated and multi-period linear ditches (50605) 8. The findspot of prehistoric flint flakes (18044). 9. Cropmarks of undated and multi-period linear ditches (54356) 10. Cropmarks of possible Iron Age/Roman field boundaries (54357). 11. Cropmarks of possible Iron Age to Roman date enclosures (50610). 12. Cropmarks of possible Iron Age to Roman date enclosures (50615). 13. The cropmarks of undated linear ditches (50619). 14. Cropmarks of undated possible ditches (53625). 15. Cropmarks of undated ditch (53681). 16. **Moderate to high potential** for possible, previously unrecorded remains of these periods 17. **Moderate potential** for palaeoenvironmental remains in the Wensum valley. **Non-designated heritage assets (medieval, post-medieval)** 18. World War Two accommodation and training site at Morton Hall (53474). 19. Cropmarks of field boundaries and trackways of probable post medieval date (50608). 20. Cropmarks of probable post medieval date field boundaries (50609). 21. Cropmarks of probable post medieval former	1. N/A 2-4. The protection of Listed Buildings is a national concern (*Planning (Listed Buildings and Conservation Areas) Act 1990*). 5. The Roman field system is of regional importance. 6. The undated features and prehistoric finds are of local or regional importance. 7. The undated and multi-period linear ditches are of regional importance. 8. The findspot of prehistoric flint flakes is of local importance. 9 . The undated and multi-period linear ditches are of regional importance. 10. Iron Age/Roman field boundaries are of regional importance. 11. Iron Age/Roman enclosures are of regional or national importance. 12. Iron Age/Roman enclosures are of regional or national importance. . The undated linear ditches are of regional importance. 14. The undated possible ditches are of regional importance. 1615. The undated ditch is of regional importance. 16. Previously unrecorded remains are of undetermined importance. 17. Possible palaeoenvironmental remains are of local importance. 18. The World War Two accommodation and training site at Morton Hall are of regional importance.	1. N/A 2. The Grade I listed buildings are of High significance. 3. The Grade II* listed building is of High significance. 4. The Grade II listed buildings are of Medium significance. 5. The Roman field system is of Medium significance. 6. The undated features and prehistoric finds are of Low or Medium significance. 7. Cropmarks of undated and multi-period linear ditches are of Low or Medium significance. 8. The findspot of prehistoric flint flakes is of Low significance. 9 . The undated and multi-period linear ditches are of Medium significance. 10. Iron Age/Roman field boundaries are of Medium significance. 11. Iron Age/Roman enclosures are of Medium or High significance. 12. Iron Age/Roman enclosures are of Medium or High significance. 13. The undated linear ditches are of Low or Medium significance. 14. The undated possible ditches are of Low or Medium significance. 15. The undated ditch is of Low or Medium significance. 16. Previously unrecorded remains are of undetermined significance. 17. Possible palaeoenvironmental remains are of Low significance. 18. The World War Two accommodation and training site at Morton Hall are of	1. N/A 2. Nationally, 2.5% of listed buildings are Grade I, making them rare and of 'exceptional interest.' 3. Nationally, 5.8% of listed buildings are Grade II*, making them rare and of 'more than special interest.' 4. Nationally, 92% of listed buildings are Grade II, making them less rare but still of national importance. 5. Roman field systems are relatively rare. 6. Post-Roman and undated features and prehistoric finds are relatively common. 7. Cropmarks of undated and multi-period linear ditches are common. 8. Findspots of prehistoric flint flakes are common. 9. The undated and multi-period linear ditches are relatively common. 10. Iron Age/Roman field boundaries are relatively rare. 11. Iron Age/Roman enclosures are relatively rare. 12. Iron Age/Roman enclosures are relatively rare. 13. Undated linear ditches are relatively common. 14. Undated possible ditches are relatively common. 15. Undated ditches are relatively common. 16. The rarity of any unrecorded remains is unknown. 17. Palaeoenvironmental	Large or Minor Adverse (Built heritage) Low, Moderate or Major Adverse (Archaeology)

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
	field boundaries (50614). 22. Cropmarks of a linear boundary or trackway of unknown, but possibly later medieval to post medieval date (50616). 23. A possible World War Two military structure (50611). 24. World War One to Two date military training site (50618). 25. Attlebridge World War Two Airfield (3063). 26. Honingham Park, a post-medieval landscape park (44183). 27. Cropmarks of field boundaries of unknown but possible medieval to post-medieval date (54364). 28. World War Two air raid shelter at Attlebridge Airfield (40750). 29. World War Two air raid shelter at Attlebridge Airfield (40754). 30. World War Two air raid shelter at Attlebridge Airfield (40755). 31. World War Two air raid shelter at Attlebridge airfield (40756) 32. World War Two fuel store at Attlebridge airfield (40757). 33. World War Two building at Attlebridge airfield (40758). 34. World War Two structure at Attlebridge Airfield (41342). 35. Undated ditches and a pit (65195). 36. Post-medieval ditch and undated ditches and discrete features (65195). 37. **High potential** for possible, previously unrecorded remains of these periods. 38. Post-medieval Historic Landscape Characterisation areas.	19. The field boundaries and trackways of probable post medieval date are of local importance. 20. The probable post medieval date field boundaries are of local importance. 21. The probable post medieval former field boundaries are of local importance. 22. The linear boundary or trackway of unknown, but possibly later medieval to post medieval date is of local importance. 23. The possible World War Two military structure is of local importance. 24. The World War One to Two date military training site is of regional importance. 25. Attlebridge World War Two Airfield is of regional importance. 26. Honingham Park is of regional importance. 27. The field boundaries of unknown but possible medieval to post-medieval date are of local importance. 28. The World War Two air raid shelter at Attlebridge Airfield is of local importance. 29. The World War Two air raid shelter at Attlebridge Airfield is of local importance. 30. The World War Two air raid shelter at Attlebridge Airfield is of local importance. 31. The World War Two air raid shelter at Attlebridge Airfield is of local importance. 32. The World War Two fuel	Medium significance. 19. The field boundaries and trackways of probable post medieval date are of Low significance. 20. The probable post medieval date field boundaries are of Low significance. 21. The probable post medieval former field boundaries are of Low significance. 22. The linear boundary or trackway of unknown, but possibly later medieval to post medieval date is of Low significance. 23 The possible World War Two military structure is of Low significance. 24. The World War One to Two date military training site is of Medium significance. 25. Attlebridge World War Two Airfield is of Medium significance. 26. Honingham Park is of Medium significance. 27. The field boundaries of unknown but possible medieval to post-medieval date are of Low significance. 28. The World War Two air raid shelter at Attlebridge Airfield is of Low significance. 29. The World War Two air raid shelter at Attlebridge Airfield is of Low significance. 30. The World War Two air raid shelter at Attlebridge Airfield is of Low significance. 31. The World War Two air raid shelter at Attlebridge Airfield is of Low significance. 32. The World War Two fuel	remains are common within alluvial deposits. 18. World War Two accommodation and training sites are relatively rare. 19. Field boundaries and trackways of probable post medieval date are common. 20. Post medieval date field boundaries are common. 21. Post medieval former field boundaries are common. 22. Linear boundaries or trackways are common. 23. World War Two structures are relatively rare. 24. World War One to World War Two military training sites are relatively rare. 25. World War Two airfields are relatively rare. 26. Landscape parks are relatively rare. 27. The field boundaries of unknown but possible medieval to post-medieval date are of Low significance. 28. World War Two air raid shelters are relatively rare 29. World War Two air raid shelters are relatively rare. 30. World War Two air raid shelters are relatively rare. 31. World War Two air raid shelters are relatively rare 32. World War Two fuel stores are relatively rare. 33. World War Two buildings are relatively	

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
		store at Attlebridge airfield is of local importance. 33. The World War Two building at Attlebridge Airfield is of local importance. 34. The World War Two structure at Attlebridge Airfield is of local importance. 35. The undated ditches and a pit are of local importance. 36. Post-medieval ditch and undated ditches and discrete features are of local importance. 37. Previously unrecorded remains are of undetermined importance. 38. N/A.	store at Attlebridge airfield is of Low significance. 33. The World War Two building at Attlebridge Airfield is of Low significance. 34. The World War Two structure at Attlebridge Airfield is of Low significance. 35. The undated ditches and a pit are of low significance. 36. Post-medieval ditch and undated ditches and discrete features are of low significance. 37. Previously unrecorded remains are of undetermined significance. 38. N/A.	rare. 34. World War Two structures are relatively rare. 35. The undated ditches and a pit are relatively common. 36. Post-medieval ditch and undated ditches and discrete features are relatively common. 37. The rarity of previously unrecorded remains is unknown. 38. Post-medieval Historic Landscape Characterisation areas are common.	
Survival	1. N/A. 2-4. The listed buildings are likely to have a good level of survival. Note that the Grade II* listed Church of St Michael is largely a ruin. 5. The level of survival of the Roman field system is unknown. 6. The level of survival of the Post-Roman and undated features and prehistoric finds is unknown. 7. The level of survival of undated and multi-period linear ditches is unknown. 8. No survival, the flint flakes will have been removed. 9. The level of survival of undated and multi-period linear ditches is unknown. 10. The level of survival of Iron Age/Roman field boundaries is unknown. 11. The level of survival of Iron Age/Roman enclosures is unknown. 12. The level of survival of Iron Age/Roman enclosures is unknown. 13. The level of survival of undated linear ditches is unknown. 14. The level of survival of undated possible ditches is unknown. 15. The level of survival of undated ditch is unknown. 16. The level of survival of previously unrecorded	2-37: The level of survival is not directly relevant to the impacts on heritage assets. 38. N/A.	2-37: The level of survival is not directly relevant to the impacts on heritage assets. 38. N/A.	2-37: The level of survival is not directly relevant to the impacts on heritage assets. 38. N/A.	N/A

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
	remains is unknown. 17. The level of survival of palaeoenvironmental remains is unknown. 18. The level of survival of the World War Two accommodation and training site is unknown. 19. The level of survival of field boundaries and trackways of probable post medieval date is unknown. 20. The level of survival of probable post medieval date field boundaries is unknown. 21. The level of survival of probable post medieval former field boundaries is unknown. 22. The level of survival of a linear boundary or trackway of unknown, but possibly later medieval to post medieval date, is unknown. 23. The level of survival of the possible World War Two military structure is unknown. 24. The level of survival of the World War One to Two date military training site is unknown. 25. Attlebridge World War Two Airfield has a good level of survival. 26. Honingham Park has a good level of survival. 27. The level of survival of field boundaries of unknown but possible medieval to post-medieval date is unknown. 28. The level of survival of the World War Two air raid shelter at Attlebridge Airfield is unknown. 29. The level of survival of the World War Two air raid shelter at Attlebridge Airfield is unknown. 30. The level of survival of the World War Two air raid shelter at Attlebridge Airfield is unknown. 31. The level of survival of the World War Two air raid shelter at Attlebridge Airfield is unknown. 32. The level of survival of the World War Two fuel store at Attlebridge airfield is unknown. 33. The level of survival of the World War Two building at Attlebridge Airfield is unknown. 34. The level of survival of the World War Two structure at Attlebridge Airfield is unknown. 35. The level of survival of the undated ditches and pit is unknown. 36. The level of survival of the post-medieval ditch and undated ditches and discrete features is unknown.				

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
	37. The level of survival of previously unrecorded remains is unknown. 38. N/A.				
Condition	1. N/A. 2. The condition of the Grade I listed buildings is unknown. 3. The condition of the Grade II* listed building is unknown. 4. The condition of the Grade II listed buildings is unknown. 5. The condition of the Roman field system is unknown. 6. The condition of the Post-Roman and undated features and prehistoric finds is unknown. 7. The condition of the undated and multi-period linear ditches is unknown. 8. The condition of the flint flakes is unknown. 9. The condition of the undated and multi-period linear ditches is unknown. 10. The condition of the Iron Age/Roman field boundaries is unknown. 11. The condition of the Iron Age/Roman enclosures is unknown. 12. The condition of the Iron Age/Roman enclosures is unknown. 13. The condition of the undated linear ditches is unknown. 14. The condition of the undated possible ditches is unknown. 15. The condition of the undated ditch is unknown. 16. The condition of any previously unrecorded remains is unknown. 17. The condition of any palaeoenvironmental remains is unknown. 18. The condition of the World War Two accommodation and training site is unknown. 19. The condition of the field boundaries and	2-37. The condition is not directly relevant to the impacts on heritage assets. 38. N/A.	2-37. The condition is not directly relevant to the impacts on heritage assets. 38. N/A.	2-37. The condition is not directly relevant to the impacts on heritage assets. 38. N/A.	N/A

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
	trackways of probable post medieval date is unknown. 20. The condition of the probable post medieval date field boundaries is unknown. 21. The condition of the probable post medieval former field boundaries is unknown. 22. The condition of the linear boundary or trackway of unknown, but possibly later medieval to post medieval date, is unknown. 23. The condition of the possible World War Two military structure is unknown. 24. The condition of the World War One to Two date military training site is unknown. 25. The condition of the Attlebridge World War Two Airfield is unknown. 26. The condition of Honingham Park is unknown. 27. The condition of the field boundaries of unknown but possible medieval to post-medieval date is unknown. 28. The condition of the World War Two air raid shelter at Attlebridge Airfield is unknown. 29. The condition of the World War Two air raid shelter at Attlebridge Airfield is unknown. 30. The condition of the World War Two air raid shelter at Attlebridge Airfield is unknown. 31. The condition of the World War Two air raid shelter at Attlebridge Airfield is unknown. 32. The condition of the World War Two fuel store at Attlebridge airfield is unknown. 33. The condition of the World War Two building at Attlebridge Airfield is unknown. 34. The condition of the World War Two structure at Attlebridge Airfield is unknown. 35. The condition of the undated ditches and pit is unknown. 36. The condition of the post-medieval ditch and undated ditches and discrete features is unknown. 37. The condition of any previously unrecorded remains is unknown. 38. N/A.				

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
Complexity	1. N/A. 2. The complexity of the Grade I listed buildings will include their relationships to other heritage assets and to the wider rural landscape. 3. The complexity of the Grade II* listed building will include its relationship to other heritage assets and to the wider rural landscape. 4. The complexity of the Grade II listed buildings will include their relationships to other heritage assets and to the wider rural landscape. 5. The complexity of the Roman field system is unknown. 6. The complexity of the Post-Roman and undated features and prehistoric finds is unknown. 7. The complexity of the undated and multi-period linear ditches is unknown. 8. The complexity of the flint flakes is unknown. 9. The complexity of the undated and multi-period linear ditches is unknown. 10. The complexity of the Iron Age/Roman field boundaries is unknown. 11. The complexity of the Iron Age/Roman enclosures is unknown. 12. The complexity of the Iron Age/Roman enclosures is unknown. 13. The complexity of the undated linear ditches is unknown. 14. The complexity of the undated possible ditches is unknown. 15. The complexity of the undated ditch is unknown. 16. The complexity of any previously unrecorded remains is unknown. 17. The complexity of any palaeoenvironmental remains is unknown. 18. The complexity of the World War Two accommodation and training site is unknown. 19. The complexity of the field boundaries and trackways of probable post medieval date is unknown. 20. The complexity of the probable post medieval date field boundaries is unknown. 21. The complexity of the probable post medieval former field boundaries is unknown. 22. The complexity of the linear boundary or	2-37. The complexity is not directly relevant to the impacts on heritage assets. 38. N/A.	2-37. The complexity is not directly relevant to the impacts on heritage assets. 38. N/A.	2-37. The complexity is not directly relevant to the impacts on heritage assets. 38. N/A.	N/A

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
	trackway of unknown, but possibly later medieval to post medieval date, is unknown. 23. The complexity of the possible World War Two military structure is unknown. 24. The complexity of the World War One to Two date military training site is unknown. 25. The complexity of the Attlebridge World War Two Airfield is unknown. 26. The complexity of the Honingham Park is unknown. 27. The complexity of the field boundaries of unknown but possible medieval to post-medieval date is unknown. 28. The complexity of the World War Two air raid shelter at Attlebridge Airfield is unknown. 29. The complexity of the World War Two air raid shelter at Attlebridge Airfield is unknown. 30. The complexity of the World War Two air raid shelter at Attlebridge Airfield is unknown. 31. The complexity of the World War Two air raid shelter at Attlebridge Airfield is unknown. 32. The complexity of the World War Two fuel store at Attlebridge airfield is unknown. 33. The complexity of the World War Two building at Attlebridge Airfield is unknown. 34. The complexity of the World War Two structure at Attlebridge Airfield is unknown. 35. The complexity of the undated ditches and pit is unknown. 36. The complexity of the post-medieval ditch and undated ditches and discrete features is unknown. 37. The complexity of any previously unrecorded remains of these periods is unknown. 38. N/A.				

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
Context	1. N/A. 2. Grade I listed buildings: relationships to assets in Weston Longville and Ringland. Both Grade I listed buildings will have historic and visual relationships to their churchyards and to the immediate rural landscape. Rural. 3. Grade II* listed building: relationship to Grade II listed buildings at or in the vicinity of Morton Hall. Relationship to immediate rural landscape. Rural. 4. Grade II listed buildings: relationships to assets in Weston Longville and Honingham. Relationships to immediate rural landscapes. Rural. 5 – 38. Rural.	2-4. Potential impacts to the context of the listed buildings through changes to their immediate setting. Setting is the way in which an asset is understood and experienced and is not an asset in itself. Changes to setting could include the loss of surrounding rural and agricultural land, impacts from traffic flow and noise, and impacts from road infrastructure, including road lighting. 5-37. The context is not impacted. 38. N/A	2-4. Potential impacts to the context of the listed buildings through changes to their immediate setting. Setting is the way in which an asset is understood and experienced and is not an asset in itself. Changes to setting could include the loss of surrounding rural and agricultural land, impacts from traffic flow and noise, and impacts from road infrastructure, including road lighting. 5-37. The context is not impacted. 38. N/A.	2-4. Potential impacts to the context of the listed buildings through changes to their immediate setting. Setting is the way in which an asset is understood and experienced and is not an asset in itself. Changes to setting could include the loss of surrounding rural and agricultural land, impacts from traffic flow and noise, and impacts from road infrastructure, including road lighting. 5-37. The context is not impacted. 38. N/A.	N/A
Period	1. N/A. 2. Later medieval. 3. Early and Later medieval. 4. Post-medieval. 5. Roman. 6. Undated/prehistoric. 7. Undated/multi-period. 8. Prehistoric. 9. Undated/multi-period. 10. Iron Age/Roman. 11. Iron Age/Roman. 12. Iron Age/Roman. 13. Undated. 14. Undated. 15. Undated. 16. Unknown. 17. Palaeoenvironmental. 18. Modern. 19. Post-medieval. 20. Post-medieval. 21. Post-medieval. 22. Later medieval/post-medieval. 23. Modern 24. Modern. 25. Modern. 26. Post-medieval.	2-38. The period is not impacted	2-38. The period is not impacted	2-38. The period is not impacted	N/A

Step 2 Feature	Step 2 Description	Step 3 Scale it matters	Step 3 Significance	Step 3 Rarity	Step 4 Impact
	27. Later medieval/post-medieval. 28. Modern. 29. Modern. 30. Modern. 31. Modern 32. Modern. 33. Modern. . Modern. 35. Unknown 36. Post-medieval 35. Unknown. 36. Post-medieval.				

Reference Sources: National Heritage List for England, Norfolk Historic Environment Record, and Norwich Western Link Heritage Constraints Report (WSP, 2019)

Step 5 – Summary Assessment Score: Moderate Adverse (Built heritage); and Low, Moderate or Major Adverse (Archaeology)

Qualitative Comments: The Scheme would have a moderate adverse effect on the setting (context) of nearby listed buildings, and will adversely affect the appreciation and understanding of the characteristic historic environmental resource in the area of proposed road construction.
The Scheme would have a low, moderate or major adverse effect on known non-designated assets. The Scheme would have a low, moderate or major direct impact on previously unrecorded significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised. The heritage significance of such assets would depend on their nature, date, extent and survival but might be local or regional (potentially national if extensive and well preserved). The heritage significance will be determined through future assessment, including preliminary site-based archaeological investigations.

Appendix G

BIODIVERSITY TAG WORKBOOK

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
River Wensum Special Area of Conservation (SAC)	**Biodiversity** Chalk-fed river, designated for: Annex I habitat as a primary reason for selection: - Watercourses of plain to montane levels with a water crowfoot *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. - The Wensum represents sub-type 1 in lowland eastern England. Annex II species as a primary reason for selection: - White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes* Annex II species present as a qualifying feature: - Desmoulin's whorl snail *Vertigo moulinsiana* - Brook lamprey *Lampetra planeri* - Bullhead *Cottus gobio* To date surveys have confirmed the likely absence of white clawed crayfish from the stretch of the River Wensum which was considered relevant to the Scheme and the presence of: Water crowfoot *Ranunculion fluitantis*, Bullhead, Brook lamprey and Desmoulin's whorl snail either within the Wensum or in the supporting ditches within the floodplain.	**International**	**High** Primary habitat: Sub-type 1 has a limited distribution in the UK, being found only in those areas where chalk is present, and is therefore restricted to southern and eastern England. Primary species: White-clawed crayfish. One of only four watercourses in Norfolk that are known to support white-clawed crayfish. Other qualifying feature: Desmoulins's whorl snail. The site supports one of the largest populations in the UK. Other qualifying feature: Brook lamprey. The Wensum has a healthy population of brook lamprey, with clean water and suitable areas of gravels, silt or sand required for spawning. Other qualifying feature: Bullhead. Sites have been selected to encompass the natural geographical range of the species and to represent the range of ecological situations in which it occurs, e.g. both upland and lowland rivers, and both acidic and base-rich situations.	**Target Feature** Anthropogenic influences have had a dramatic effect on the ecology and hydrology of the River Wensum, in particular at sites up and downstream of mill structures, sites affected by channel modification inc. over-widening and deepening, sites affected by excessive silt ingress, sites that are heavily maintained and sites that lack natural riparian vegetation. The following document has been published that includes specific restoration targets for the qualifying features of the SAC: *European Site Conservation Objectives: Supplementary advice on conserving and restoring site features (Natural England 2019).*	**Very high** Internationally important site with limited potential for substitution.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
River Wensum Site of Special Scientific Interest (SSSI)	**Biodiversity** Overlaps with River Wensum SAC (see above cell). Notified for: - Flowing waters - Type I: naturally eutrophic lowland rivers with a high base flow. - Flowing waters - Type III: base-rich, low-energy lowland rivers and streams, generally with a stable flow regime - Population of RDB mollusc – Desmoulin's whorl snail. - S25 - *Phragmites australis* - Eupatorium cannabinum tall-herb fen. - S3 - *Carex paniculata* swamp. - S4 - *Phragmites australis* swamp and reed-beds - S5 - *Glyceria maxima* swamp - S7 - *Carex acutiformis* swamp - White-clawed crayfish To date, surveys have confirmed the likely absence of white clawed crayfish from the stretch of the River Wensum which was considered relevant to the Scheme and the presence of Desmoulin's whorl snail either within the Wensum or in the supporting ditches within the floodplain.	**National**	**High** The River Wensum is a SSSI of national importance, supporting a diverse range of protected habitats and species.	**Unknown** The trend for the SSSI is currently unknown. No assessments within the last five years. Target species - See above for trends regarding white-clawed crayfish and Desmoulin's whorl snail. Of the 36 SSSI units for this site, 6 were considered to be in 'Favourable' condition in 2010, with the remaining 30 considered to be in 'Unfavourable - Recovering' condition.	**High** Nationally important site with no potential for substitution.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
River Wensum Pastures, Ringland Estates County Wildlife Site (CWS)	**Biodiversity:** Predominantly an improved cattle-grazed pasture adjacent to the River Wensum, crossed by a network of drains supporting a species-rich flora associated with aquatic habitats.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown -** The Norfolk BAP does not identify a trend in relation to the habitats associated with this CWS.	**Medium** - County value site with limited potential for substitution.	**Minor negative**	**Slight adverse**
Wensum Pastures at Morton Hall CWS	**Biodiversity:** Predominantly improved cattle-grazed pasture adjacent to River Wensum, crossed by a network of drains supporting a species-rich flora associated with aquatic habitats.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Intermediate negative**	**Moderate adverse**
Land adjoining Foxburrow Plantation CWS	**Biodiversity:** Part of a larger area known collectively as Foxburrow Plantation and The Waterfence. It consists of an extensive area of wet, species-rich grassland situated in the bottom of a spring-fed valley.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Intermediate negative**	**Moderate adverse**
Broom & Spring Hills CWS	**Biodiversity:** Semi-natural deciduous woodland dominated by oak and sycamore.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Intermediate negative**	**Moderate adverse**
Primrose Grove CWS	**Biodiversity:** Structurally varied, predominately consisting of semi-natural broad-leaved and mixed woodland, with some compartments considered to be ancient. Broad-leaved woodland comprised with varying proportions of oak, beech, sycamore and ash.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	Mixed woodland is represented by Douglas Fir and Scot's Pine.						
Attlebridge Hills CWS	**Biodiversity:** Structurally varied, broad-leaved semi-natural woodland. The canopy is dominated by mature oak, sycamore, sweet chestnut with extensive areas of mixed coppice of hazel, sycamore and sweet chestnut.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown -** The Norfolk BAP does not identify a trend in relation to the habitats associated with this CWS.	**Medium** - County value site with limited potential for substitution.	**Minor negative**	**Slight adverse**
Gravelpit Plantation and Church Hill CWS	**Biodiversity:** Closed canopy semi-natural broad-leaved and mixed plantation woodland, with some stands considered to be ancient in origin. Canopy dominated to varying degrees by oak, ash and sycamore, and the shrub layer is comprised of hawthorn, hazel and holly.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Minor negative**	**Slight adverse**
Old Covert, Wood Land CWS	**Biodiversity**: A coppice woodland with standards that are not listed on the Ancient Woodland Inventory, although it may have once been part of a larger, Ancient Woodland. The wood is managed as coppice and for shooting.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Minor negative**	**Slight adverse**
Mouse Wood CWS	**Biodiversity:** Citation refers to an ancient, replanted woodland which is now predominantly a commercially-managed conifer plantation surrounded mainly by arable farmland. The extent	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	of the existing ancient woodland is unknown.						
River Tud at Easton and Honingham CWS	**Biodiversity:** Citation refers to a watercourse supporting a species-rich aquatic, marginal and emergent riverine flora.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Neutral**	**Neutral**
Church Meadow, Alder Carr, Three Corner Thicket and Nursery Plantation CWS	**Biodiversity:** Citation refers to a site comprising mainly cattle grazed, in improve wet pasture, bisected by spring-fed ditches. With areas of wet and dry woodland.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Neutral**	**Neutral**
Taverham Mill CWS	**Biodiversity:** Citation refers to a fishing lake surrounded by marshy and neutral grassland and a mixture of planted and semi-natural woodland on acid soil.	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Neutral**	**Neutral**
Ringland Pits CWS	**Biodiversity:** Citation refers to a flooded disused gravel workings adjacent to the River Wensum .	**County**	**Medium -** Site of county value supporting Habitat of Principal Importance.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this CWS.	**Medium** - County value site with limited potential for substitution.	**Neutral**	**Neutral**
Fakenham Road Roadside Nature Reserve (RNR)	**Biodiversity:** Species: Hoary mullein V*erbascum pulverentum.* Phase 1 habitat surveys of this area have identified the presence of this species.	**County**	**Medium -** Site of county value, with only one qualifying feature behind the designation.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this species.	**Medium** - County value site with limited potential for substitution.	**Major negative**	**Moderate adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
Ancient Woodland	**Biodiversity**: Ancient Woodland is an irreplaceable habitat which is important for many reasons, including its value to wildlife, i.e. bats, birds and fungi. An Ancient Woodland Inventory site within 200m of the scheme forms part of Primrose Grove CWS. In addition, Mouse Wood CWS is also listed as an Ancient Woodland Inventory site. The Scheme is 15m from Primrose Grove ancient woodland (south) and Mouse Wood ancient woodland (west) is located adjacent to the pre-existing Wood Lane, a road considered as a possible access route to the Scheme.).	**National**	**High** - The route has potential to impact on ancient woodland. Ancient woodland is considered one of the richest land-based habitats for wildlife.	**Declining** - Ancient woodland is in significant national decline, with a current UK coverage of only 2%.	**High** - National value habitat with no potential for substitution.	**Minor negative**	**Slight adverse**
Ancient / Veteran Trees	**Biodiversity:** A number of veteran and ancient trees are present within the Scheme, both as stand-alone features or other important habitats. Veteran and ancient trees are considered irreplaceable habitats, and a BS5837 survey has been completed by Arboriculturists to identify trees which are veteran or ancient.	**County**	**High** - The BS5837 survey has identified a number of veteran and ancient trees within the Scheme. Veteran and ancient trees are considered to be an irreplaceable habitat and are of high value to a range of wildlife.	**Declining** - These habitat are listed as a priority under the Natural and Rural Communities Act (2006) due to the declining trend nationally. The Norfolk BAP does not identify a trend in relation to these habitat types locally.	**Medium** - County value species with no potential for substitution.	**Major negative**	**Moderate adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
Important Hedgerows	**Biodiversity:** Ecologically important hedgerows are recognised as hedgerows that are at least 30 years old which support a mixture of native woody species and other associated features such as mature trees, woodlands, parallel/connecting hedges, and important woodland ground flora as stated in the Hedgerow Regulations 1997. Hedgerow surveys have been completed this year which have identified the presence of a number of important hedgerows along the Scheme. Hedgerows are listed as a target species in the Norfolk Biodiversity Action Plan.	**County**	**High -** Hedgerow surveys have identified a number of important hedgerows within the Scheme, which will be impacted. Hedgerows are an important landscape feature and provide habitat connectivity and high value to a range of wildlife.	**Declining** - The lengths of managed hedgerow decreased by 6.1% between 1998 and 2007. Abundance and distribution of hedgerow trees are declining, as recognised by the Countryside Survey 2000.	**Medium** - County value habitat with limited potential for substitution.	**Intermediate negative**	**Moderate adverse**
HPI - Hedgerows	**Biodiversity:** Hedgerows are a Habitat of Principal Importance (HPI habitat), and is a target habitat as part of the Norfolk Biodiversity Action Plan. This habitat is present within the boundaries of the Scheme. Hedgerows provide habitat connectivity for a range of species throughout the landscape.	**Local**	**Medium –** Hedgerow surveys identified that all hedgerows within the Scheme qualified as HPI. The route will impact hedgerows of local value.	**Declining** - The lengths of managed hedgerow decreased by 6.1% between 1998 and 2007. Abundance and distribution of hedgerow trees are declining, as recognised by the Countryside Survey 2000.	**Medium** - Local value species with potential for substitution.	**Minor negative**	**Minor adverse**
HPI – Lowland meadows	**Biodiversity:** Lowland meadows is a Habitat of Principal Importance (HPI habitat), and is a target habitat as part of the Norfolk Biodiversity Action Plan (referred to as 'Lowland meadows and pastures'. This habitat is present within the	**Local**	**Medium** - Detailed habitat surveys undertaken in 2021 identified four areas of Lowland meadows HPI. The route will impact lowland meadows of local value.	**Declining** - most semi-natural grassland has been lost in the latter half of the 20th century, with 73% of the grassland occurring in 1947 disappearing by 1984 (Smyth, 1988). This loss has been accompanied by a loss in subsidiary habitats, such as ponds and hedgerows	**Medium** - Local value species with potential for substitution.	**Major negative**	**Moderate adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	boundaries of the Scheme. These habitats are known to support botanical diversity and provide value to a range of breeding and wintering birds and the great crested newt.						
HPI – Purple moor-grass and rush pasture HPI	**Biodiversity:** Purple moor-grass and rush pasture is a Habitat of Principal Importance (HPI habitat), and is a target habitat as part of the Norfolk Biodiversity Action Plan (referred to as 'fens'. This habitat is present within the boundaries of the Scheme. These habitats support a wide variety of plant and animal species.	**Local**	**Medium** - Detailed habitat surveys undertaken in 2021 identified one area of Purple moor-grass and rush pasture HPI. The route will impact purple moor-grass and rush pasture of local value.	**Declining** - Norfolk is particularly rich in fen habitats, supporting a large proportion of the UK total for some types. Habitat type is declining national due to a decline in traditional management and impacts due to agricultural run-off.	**Medium** - Local value species with potential for substitution.	**Major negative**	**Moderate adverse**
HPI - Rivers and Streams	**Biodiversity:** The Scheme will intersect the River Wensum, an internationally designated site (see site details above) and Foxburrow Stream, a tributary of the River Tud, which flows west to east in the southern aspect of the NWL. Foxburrow Stream is considered to be of County value.	**County**	**High** - More than 85% of all the chalk streams in the world are in England and they are threatened nationally due to impacts from agricultural and urban development. See above for details of River Wensum SAC and SSSI designation.	**Declining -** Increases in population pressure leading to water pumping.	**Medium** - Local value species with potential for substitution.	**Minor negative**	**Slight adverse**
HPI - Lowland Mixed Deciduous Woodland	**Biodiversity**: Lowland mixed deciduous woodland is a Habitat of Principal Importance (HPI). All woodland types are considered ecologically valuable habitat, providing habitat features for a range of species.	**Local**	**Medium -** Detailed habitat surveys undertaken in 2021 identified seven areas of Lowland Mixed Deciduous Woodland HPI. The route will impact lowland mixed deciduous woodland of local value.	**Declining** - HPI habitats (such as lowland deciduous woodlands) are listed as a priority under the Natural and Rural Communities Act (2006) due to the declining trend nationally. The Norfolk BAP does not identify a trend in relation to these habitat types locally.	**Medium** - Local value species with potential for substitution.	**Major negative**	**Moderate adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
HPI - Wet Woodland	**Biodiversity**: Wet woodland is a Habitat of Principal Importance (HPI). All woodland types are considered ecologically valuable habitat, providing habitat features for a range of species.	**Local**	**Medium -** Detailed habitat surveys undertaken in 2021 identified one area of wet woodland HPI. The route will impact wet woodland of local value.	**Declining** - HPI habitats (such as lowland deciduous woodlands) are listed as a priority under the Natural and Rural Communities Act (2006) due to the declining trend nationally. The Norfolk BAP does not identify a trend in relation to these habitat types locally.	**Medium** - Local value species with potential for substitution.	**Neutral**	**Neutral**
Vascular and Non-Vascular Plants	**Biodiversity:** The Scheme supports a diverse range of habitats with the potential to support protected/notable vascular and non-vascular plants. The presence/potential presence of protected and notable flora along the Scheme have been identified through Phase 1 habitat surveys, NVC surveys and desk-based searches. Species of vascular and non-vascular plants are listed as Norfolk Biodiversity Action Plan species.	**Local**	**Medium** - It is anticipated that the Scheme will impact areas of protected and notable vascular and non-vascular plants.	**Unknown** - The Norfolk BAP does not identify a trend in relation to these species locally.	**Medium** - Local value species with potential for substitution.	**Minor negative**	**Slight adverse**
Macrophytes	**Biodiversity:** Macrophyte surveys have identified the water crowfoot species associated with the River Wensum SAC designation. These surveys will be updated in 2022.	**International**	**High** - See SAC information above.	**Unknown** - The Norfolk BAP does not identify a trend in relation to these species locally.	**Very high** - Designated features of SAC only.	**Neutral**	**Neutral**
Fungi	**Biodiversity:** The Scheme supports a diverse range of habitats with the potential to support protected/notable fungi. The presence/potential presence of protected and notable fungi along the	**Local**	**Medium** - A fungal survey undertaken in October 2020 and May 2021 determined the habitats surveyed to be of local ecological importance for fungi. It is anticipated that the Scheme will impact areas of	**Unknown** - The Norfolk BAP does not identify a trend in relation to these species locally.	**Medium** - County value species with potential for substitution.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	Scheme have been identified through Phase 1 habitat surveys and desk-based searches. Species of fungi are listed as Norfolk Biodiversity Action Plan species.		protected and notable flora, fungi, bryophyte and lichen surveys.				
Lichens	**Biodiversity:** The Scheme supports a diverse range of habitats with the potential to support protected/notable lichens. The presence/potential presence of protected and notable lichens along the Scheme have been identified through Phase 1 habitat surveys and desk-based searches. Species of lichen are listed as Norfolk Biodiversity Action Plan species.	**Local**	**Medium** - A lichen survey undertaken in 2021 recorded 22 lichen species, none with formal national conservation status. It is anticipated that the Scheme will impact areas of protected and notable flora, fungi, bryophyte and lichen surveys.	**Unknown** - The Norfolk BAP does not identify a trend in relation to these species locally.	**Medium** - County value species with potential for substitution.	**Neutral**	**Neutral**
Fish	**Biodiversity**: The River Wensum SAC and its tributaries are designated for brook lamprey and bullhead. A fish survey completed in 2020 confirmed the presence of a range of coarse fish on the River Wensum in the vicinity of the Scheme which included pike, chub, dace, roach, gudgeon and minnow. It is also highly likely that other species including bullhead and European eel are also present in the River Wensum. A survey of the connected ditches on the floodplain in the vicinity of	**International**	**High** - See SAC information above. Additionally the route will cross minor watercourses (including drains), that may support fish. The network of connected ditches on the floodplain adjacent to the River Wensum and the marginal sediment beds within them are a particularly important habitat for lamprey.	**Unknown** - No trend has been identified nationally or locally for the two fish for which the SAC is designated.	**Very high** - Designated features of SAC (bullhead and brook lamprey only).	**Neutral**	**Neutral**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	the Scheme highlighted the presence of river/brook lamprey (*Lampetra* spp.), minnow and three-spined stickleback. A survey of the Foxburrow Stream (tributary of the River Tud) resulted in no fish being observed or captured within the survey area.						
Reptiles (common and widespread species)	**Biodiversity**: Areas of rough grassland and scrub present along the length of the Scheme are likely to be suitable to support reptiles. Reptile surveys completed in 2019 and 2020 have confirmed the presence of low numbers of reptiles including grass snake and slow worm.	**Local**	**Medium** - widespread species of reptile, including slow worm and grass snake are known to be present in areas of suitable habitat, and the Scheme is likely to impact reptile populations on a local level.	**Unknown** - The Norfolk BAP does not identify a trend in relation to these species.	**Medium** - reptiles are a species of medium biodiversity value on a national and local level.	**Minor negative**	**Slight adverse**
Great Crested Newt *Triturus cristatus*	**Biodiversity**: Great crested newts are protected under the following legislation: Annexe II and IV of the Habitats Directive Conservation of Habitats and Species Regulations (Schedule 2) Wildlife and Countryside Act (1981) (Schedule 5)	**Local**	**High** - complete baseline survey determined that no breeding ponds will be impacted by the Scheme, but GCN presence confirmed within 500m of the Scheme.	**Target species** - GCN are targeted by the Norfolk BAP due to a major population decline in the Broads. The main objective in Norfolk is to maintain range and viability of the local population.	**High** - GCN are of high biodiversity value on a local and national level.	**Neutral**	**Neutral**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
Birds	**Biodiversity:** Habitats present are suitable for use by birds. The arable fields and grasslands provide potential foraging habitat for passage/over-wintering birds such as mixed thrush flocks, skylarks and other typical species. Arable fields and areas of the flood plain care used by a small number of wetland birds. The Scheme also supports extensive and diverse habitat which are likely to support breeding birds typical of these habitats (e.g. farmland, woodland) and confirmed the use of the habitats on-Site by a range of breeding bird species, including barn owl and king fisher, which are a Schedule 1 species under the Wildlife and Countryside Act (1981).	**Local**	**Medium -** The route will impact breeding and wintering birds at a local level. Several species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), including hobby, kingfisher, barn owl and red kite, were recorded during a breeding bird survey undertaken in 2021.	**Unknown** - The Norfolk BAP identifies a range of bird species in significant decline on a county level.	**Medium** - The site is likely to support a diversity range of breeding and wintering bird species of local importance.	**Minor negative**	**Slight adverse**
Barn Owl	Barn owl *Tyto alba* are a Schedule 1 species under the Wildlife and Countryside Act (1981), and is a Norfolk Biodiversity Action Plan species. Incidental sightings of barn owl were recorded during surveys for other species, and barn owl tree and building roosts were identified during building surveys.	**Local**	**High** - barn owl are a Schedule 1 species and are targeted by the Norfolk Biodiversity Action Plan. The Scheme will result in the disturbance to OBS in the absence of mitigation, and severance and/or loss of foraging habitat.	**Declining**- the Norfolk BAP states that barn owl populations crashed in the 20th century in England and Wales. A more recent study in 1997 indicated that, while still declining, the rate of decline was beginning to slow. The '*State of the UK Barn Owl population - 2019'* report suggests an overall rise in nesting occupancy of known barn owl nest locations across the UK. The surveys completed in Norfolk found that brood sizes of barn owl were small, and hypothesised	**High** - Barn owl are of high biodiversity value on a National and Local level.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
				that this may be due to poor food availability.			
Bats (General)	**Biodiversity**: Habitats present within the Scheme, including woodlands, hedgerows, mature trees, waterbodies and scrub provide suitable habitat for foraging, commuting and roosting bats. Surveys completed since 2019 have confirmed the presence of brown long-eared, common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule, Leisler's, serotine, *Myotis sp***.** and barbastelle. Bat activity surveys have confirmed the use of habitats across the site as commuting routes and foraging areas, and tree emergence/re-entry surveys, radio-tracking and ground level tree assessment (GLTA) and climbing surveys have confirmed the presence of roosting bats within trees and a structure across the Scheme. There are four bat species listed in the Norfolk Biodiversity Action Plan: Noctule brown long-eared *Plecotus auritus,* soprano pipistrelle *Pipistrellus pygmaeus* and barbastelle *Barbastella barbastellus.*	**County**	**High -** Baseline data collected to date indicates that the route will sever bat commuting routes, and result in the loss of foraging and roosting habitat.	**Target species** - The Norfolk BAP targets four species (including barbastelle) to reduce decline.	**High** - Bats are protected under the Conservation of Habitat and Species Regulations 2017 and are notably in decline across the UK due to a range of factors including habitat loss. Barbastelle is an Annex II species of European importance.	**Intermediate negative**	**Large adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
Bats (Barbastelle *Barbastella barbastellus*)	**Biodiversity:** A rare bat species of national importance which is known to roost within the local area. The route is located within the Core Sustenance Zone (CSZ) for barbastelle. Barbastelle are offered specific protection under: Annex II and IV of the Habitats Directive Wildlife and Countryside Act 1981 (Schedule 5) Near Threatened on the IUCN Red List of Threatened species (Piraccini, 2016) Species of Principal Imporance (SPI) under section 41 of the Natural Environment and Rural Communities Act 2006 (NERC). Norfolk Biodiversity Action Plan Species. There is a known presence of barbastelle roosts within the local area, and this has been confirmed through radio-tracking studies in 2019 and in 2021, tree emergence surveys, tree-climbing surveys and various bat activity surveys.	**National**	**High -** Barbastelle are targeted by the Norfolk Biodiversity Action Plan and are protected under Schedule 5 of the Wildlife and Countryside Act (1981) and Annexe II and IV of the Habitats Directive. Baseline surveys completed to-date indicate that the Scheme will sever commuting routes and result in the loss of foraging habitat.	**Target species** - Although a trend in relation to the target species is not known the Norfolk BAP targets barbastelle (as well as three other bat species) to reduce decline.	**Very High** - Bats are protected under the Conservation of Habitat and Species Regulations 2017 and are notably in decline across the UK due to widespread habitat loss. Barbastelle is an Annex II species of European importance.	**Intermediate negative**	**Large adverse**
Badgers *Meles*	**Biodiversity**: Badgers are offered protection under the Protection of Badgers Act 1992. Woodlands, hedgerows and grassland provide suitable habitat for foraging badgers, and suitable locations for sett construction.	**Local**	**High -** Badger surveys identified a single sett in a woodland in the south of the Scheme, and one active main sett and one potential main sett, along with four annex setts, five subsidiary setts, and 16 outlier setts in the northern woodlands.	**Unknown** - The Norfolk BAP does not identify a trend in relation to this species, although nationally badgers have shown a significant increase in numbers (c.88% since the 1980s).	**Medium** - badger are a species of medium biodiversity value on a national and local level.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	Walkover badger surveys completed in between 2019 and 2022 (as well as observations whilst completing other species surveys) have identified a number of badger setts along the Scheme. These setts were further surveyed through bait marking techniques in March 2021.						
Otter *Lutra lutra*	**Biodiversity:** Otter are targeted by the Norfolk Biodiversity Action Plan and are protected under Schedule 5 of the Wildlife and Countryside Act (1981) and the Conservation of Habitats and Species Regulations (2017). Surveys confirmed the presence of Otter within the River Wensum and associated floodplain watercourse, with field signs including spraints, footprints and direct sightings.	**Local**	**Medium** - Otter have been identified as being present in the watercourses to be intersected by the Scheme.	**Target species** - Otter populations are increasing both locally (Norfolk) and nationally.	**High -** Otter are a species of high biodiversity value on a national and local level.	**Minor negative**	**Slight adverse**
Water Vole *Arvicola amphibius*	**Biodiversity:** Water vole are targeted by the Norfolk Biodiversity Action Plan and are protected under Schedule 5 of the Wildlife and Countryside Act (1981). In addition to the River Wensum and Tud a series of small watercourses and drains, in connection with the route may support water vole. Watervole presence has been	**Local**	**Medium** - Water vole are targeted by the Norfolk Biodiversity Action Plan and are protected under Schedule 5 of the Wildlife and Countryside Act (1981).	**Target species** - Water vole decline in Norfolk is mainly due to population fragmentation and isolation.	**Medium -** Water vole are a species of medium biodiversity value on a national and local level.	**Minor negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
	confirmed in the River Wensum. No evidence of water voles was recorded in Foxburrow Stream and therefore water voles have been considered likely absent from this watercourse.						
SPI - Brown Hare *Erinaceus europaeus*	**Biodiversity** Habitats within the Scheme include open arable farmland and fields, which offer value to brown hare Lepus europeaus, and many incidental sightings of brown hare have been recorded within the Scheme.	**Local**	**Low** - brown hare are not a target species in the Norfolk Biodiversity Action Plan and are relatively widespread within the UK.	**Declining -** brown hare have been in decline for the last 30 years, however recent figures suggest that the species is recovering.	**Low** - brown hare are a species of low biodiversity value on a national and local level.	**Minor negative**	**Slight adverse**
SPI - Hedgehog *Erinaceus europaeus*	**Biodiversity** Habitats within the Scheme comprise a mosaic of woodland, grassland, wetland and arable, which offers value to hedgehog *Erinaceus europaeus.*	**Local**	**Low** - hedgehog are not a target species in the Norfolk Biodiversity Action Plan and are relatively widespread within the UK.	**Declining -** it is estimated that hedgehog numbers have declined by almost 40% in the past decade.	**Low** - hedgehog are a species of low biodiversity value on a national and local level.	**Minor negative**	**Slight adverse**
SPI - Common Toad *Bufo bufo*	**Biodiversity** Habitats within the Scheme include floodplains, woodlands, the River Wensum and other watercourses, and a number of ponds are present within proximity of the Scheme. These habitats are likely to support common toads, a UK Biodiversity Action Plan species, and this species has been observed within habitats across the Scheme.	**Local**	**Low** - common toad it not a target species in the Norfolk Biodiversity Action Plan and are relatively widespread within the UK.	**Declining** - recent research by Froglife has identified a decline in toad populations of 68% over the last 30 years, however this is still a widespread species.	**Low** - common toads are a species of low biodiversity value on a national and local level.	**Minor Negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score
Desmoulin's Whorl Snail	**Biodiversity**: Records have been provided of Desmoulin's Whorl Snails in the local area. Survey work in 2019, 2020 and 2021 identified Desmoulin's whorl snail Vertigo moulinsiana within the Scheme. The results indicated the continued presence of a large population within the south-eastern section (south), as well as the continued presence of this species in the central floodplain ditch within the Scheme Boundary.	**International**	**High** - See SAC information above.	**Target species** - Targeted because of its declining in Norfolk due to destruction of wetlands, habitat degradation, particularly as a result of changes in hydrology and possibly the introduction of grazing.	**Very high** - Primary feature of SAC. Internationally important site with limited potential for substitution.	**Minor Negative**	**Slight adverse**
Aquatic Macroinvertebrates	**Biodiversity**: The watercourses and ponds present within the Scheme and the local area are likely to support a range of aquatic macroinvertebrates, which may include notable or protected species. Macroinvertebrate surveys will be updated in 2022.	**County**	**High** - The River Wensum SAC and SSSI is designated for white-clawed crayfish and Desmoulin's whorl snail. The scheme will impact upon aquatic macroinvertebrates at a County level.	**Target species** - the only aquatic macroinvertebrate in decline across Norfolk and is targeted by the Norfolk BAP is the Norfolk hawker *Aeshna isoceles*. The local objective is to maintain the current range in Norfolk by preventing loss of freshwater sites and create new habitat with a view to increase the range in Norfolk by 2020.	**Medium** - freshwater habitats may support notable aquatic macroinvertebrate species.	**Minor negative**	**Slight adverse**
Terrestrial Invertebrates	**Biodiversity**: The diverse range of habitats present along the Scheme, including woodland, scrub and grassland are likely to support a range of terrestrial invertebrates. Invertebrate surveys were completed in 2021.	**Local**	**Medium** - The range of habitats along the route support 43 species currently regarded as Nationally Rare, Scarce, Data Deficient, or Section 41 Species of Principal Importance, as well as terrestrial invertebrates that are widespread and common throughout the UK.	**Target species** - The Norfolk BAP identifies a declining trend in certain invertebrate species. Ground beetle, brush-thighed seed-eater beetle, flixweed flea beetle and silver-studded blue butterfly are all target species of the Norfolk BAP. It is unknown whether these species are present in the vicinity of the route option.	**Medium** - The project has the potential to affect terrestrial invertebrate species.	**Minor Negative**	**Slight adverse**

Step 2 Area	Step 2 Description of feature/ attribute	Step 3 Scale (at which attribute matters)	Step 3 Importance (of attribute)	Step 3 Trend (in relation to target)	Step 3 Biodiversity and earth heritage value	Step 4 Magnitude of impact	Step 5 Assessment Score

Reference Sources: River Wensum European Site Conservation Objectives: Supplementary advice on conserving and restoring site features (Natural England, 2019); Norfolk BAP (Norfolk Biodiversity Action Plan); Wildlife and Countryside Act 1981 Schedule 1 (Wildlife and Countryside Act 1981, Schedule 1); Wildlife and Countryside Act 1981: Schedule 5 (Wildlife and Countryside Act 1981, Schedule 5); NERC Act Section 41 Species of Principal Importance (Natural England: Section 41 Species - Priority Actions Needed (B2020-008); Froglife (Amphibian and reptile declines - UK perspective); and BTO (Kingfisher).

Summary Assessment Score: Large Adverse

Qualitative Comments: Overall the Assessment Score is Large Adverse due to the potential impacts on bats, largely associated with the loss of woodland leading to a reduction in available foraging habitat. Compensation proposals are being developed which will include the enhancement of existing woodlands to benefit bats and the creation of new woodland which, in the long term, will help to compensate for the loss of woodland.

Appendix H

WATER ENVIRONMENT TAG WORKBOOK

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Study area: The study area includes features within 1km of the Red Line Boundary (RLB). **Potential Impacts:** Increased pollution risk to surface water and groundwater Increased sedimentation within watercourses Impacts to the hydromorphological, physio-chemical and ecological quality of watercourses Increased flood risk associated with new structures Impact to groundwater flow pathways	**River Wensum**	**Water supply**	**Medium** - main river, good chemical quality, supports private abstractions.	Regional	Medium	Cannot be substituted	Medium	Negligible	Insignificant
		Biodiversity	**Very High** - channel of the Wensum designated SAC and SSSI.	Regional	High	Cannot be substituted	Very High	Negligible	Low
		Transport and dilution of waste products	**Medium** - large catchment, receives local discharge, WWTW downstream of study area.	Regional	Medium	Limited potential for substitution	Medium	Negligible	Insignificant
		Recreation	**Medium** - flow through urban and public areas	Local	Low	Limited potential for substitution	Medium	Negligible	Insignificant
		Hydromorphology	**Medium** - heavily modified classification but supports good ecological status	Regional	Medium	Cannot be substituted	Very high	Negligible	Low
		Conveyance of flow and material	**High** - main river, large catchment, flows through mix of urban and rural areas	Regional	Medium	Cannot be substituted	High	Negligible	Insignificant
	Floodplain of the River Wensum	**Conveyance of flow and material**	**Medium** - provides local flood flow conveyance route, functional floodplain protecting the local area and downstream Norwich City.	Local	Medium	Cannot be substituted	Medium	Minor Adverse	Insignificant
		Biodiversity	**Very High -** functional floodplain, habitat of principal importance - floodplain grazing marsh.	Local	Medium	Limited potential for substitution	High	Minor Adverse	Low significance
	Tributary of River Tud or Foxburrow Stream	**Water supply**	**Low** - quality unknown, may support agricultural uses although likely to have low flow	Local	Low	Limited potential for substitution	Low	Negligible	Insignificant
		Biodiversity	**Medium** - significantly modified, potential supporting habitat for otter and water vole	Local	Medium	Limited potential for substitution	Medium	Minor Adverse	Insignificant

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
		Transport and dilution of waste products	**Low** - likely to receive runoff from adjacent land	Local	Low	Limited potential for substitution	Low	Negligible	Insignificant
		Recreation	**Low -** no known recreational or amenity value	Local	Low	Limited potential for substitution	Medium	Negligible	Insignificant
		Hydromorphology	**Low** - heavily modified	Local	Low	Limited potential for substitution	Low	Minor Adverse	Insignificant
		Conveyance of flow and material	**Medium** - provides local flood flow conveyance route	Local	Low	Limited potential for substitution	Medium	Minor Adverse	Insignificant
	Combined Groundwater Aquifers (Secondary and Principal Aquifers)	**Groundwater quality**	**Very High** - Groundwater aquifer (Combined Secondary A, Secondary B and Principal Aquifers), Source Protection Zone 3, Multiple Private Abstractions	Regional	High	Limited potential for substitution	High	Minor Adverse	Low significance
		Groundwater flow (conveyance)	**Very High** - Groundwater aquifer (Combined Secondary A, Secondary B and Principal Aquifers), Source Protection Zone 3, Multiple private abstractions, provides River Wensum baseflow, shallow groundwater in the River Wensum floodplain	Regional	High	Limited potential for substitution	High	Minor Adverse	Low significance
		Water resource	**Very High** - Groundwater aquifer (Combined Secondary A, Secondary B and Principal Aquifers), Source Protection Zone 3, Multiple private abstractions, important baseflow contribution to the River Wensum SSSI & SAC, River Tud	Regional	High	Limited potential for substitution	Very High	Negligible	Low significance

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance

Reference Sources: OS mapping, EA Flood Map for Planning, EA Flood Risk from Surface Water mapping, EA Catchment Data Explorer, Defra MAGIC geographical information portal, Geology of Britain Viewer

Summary Assessment Score: Minor Adverse

Qualitative Comments: No structures are proposed within the channel of the River Wensum and the footprint within a 10m zone of River Wensum will be reduced as far as practicable. This is expected to minimise impacts to the river flow and channel morphology of the River Wensum.
Scheme requires the construction of a maintenance access track immediately adjacent to the proposed viaduct to enable inspection of the viaduct over its design life. The track will not require crossing of the River Wensum but will need to be constructed within the floodplain of the River Wensum and cross the land drains located within this area. The access track will be constructed at grade to prevent adverse effect to floodplain storage or flood flow conveyance.
Structures such as culverts into a watercourse can potentially remove natural bed substrate and bank-side habitat, as well as change flow dynamics and sediment transport through the Tributary of the River Tud. Crossings of watercourses and any new watercourse channels are expected to maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB guidance, and be sensitive to ecological requirements.
The Drainage Strategy at this stage of the assessment indicates that infiltration to ground and discharge to nearby watercourses will be utilised to discharge road runoff. A robust surface water drainage system will be expected to ensure discharge from the Scheme does not increase flood risk elsewhere up to and including the 1 in 100-year event and allowing for climate change effects and provides sufficient attenuation to restrict the rate and volume of discharge to those agreed with Norfolk County Council as the Lead Local Flood Authority.
Implementation of a CEMP and passive treatment incorporated into SuDS should be considered and adhered to during construction and operation of the Scheme, to reduce the risk of contamination to the water environment.
Mitigation for reduced groundwater recharge due to the introduction of hardstanding should be considered during detail design stage of the scheme.

62-64 Hills Road
Cambridge
CB2 1LA

wsp.com

APPENDIX H – Delivery Programme Milestones

Norwich Western Link - Scheme Programme Milestones

Task Name	Duration	Start	Finish
Options Selection Report (OSR)	0 days	Completed	Completed
Regional priority status agreement – Transport East meeting	0 days	Completed	Completed
Preferred route established – decision at July Cabinet	0 days	Completed	Completed
Strategic Outline Business Case (SOBC) together with the Regional Evidence Base (REB) submission to DfT	0 days	Completed	Completed
DfT SOBC acceptance / conditional approval	0 days	Completed	Completed
Outline Business Case (OBC) submission	0 days	Completed	Completed
DfT OBC approval / programme entry	0 days	Wed 16/11/22	Wed 16/11/22
OJEU notice (start of procurement process)	0 days	Completed	Completed
Design and Build Contractor appointment	0 days	Completed	Completed
Pre-application Consultation (finalise materials, consultation period and analyse results)	82 days	Wed 20/07/22	Fri 11/11/22
Planning Application Submission	0 days	Wed 29/03/23	Wed 29/03/23
Publication of CPOs	0 days	Fri 12/05/23	Fri 12/05/23
Publication of SROs	0 days	Fri 12/05/23	Fri 12/05/23
Start of CPO Publication Period	0 days	Mon 15/05/23	Mon 15/05/23
Start of SRO Publication Period	0 days	Mon 15/05/23	Mon 15/05/23
End of CPO Publication Period	0 days	Mon 26/06/23	Mon 26/06/23
End of SRO Publication Period	0 days	Mon 26/06/23	Mon 26/06/23
Determination of planning decision – assuming decision is ‘not called in’ by the Secretary of State	0 days	Wed 06/09/23	Wed 06/09/23
Confirmation of Public Inquiry from Secretary of State	0 days	Wed 27/09/23	Wed 27/09/23
Start of Public Inquiry	0 days	Thu 02/11/23	Thu 02/11/23
Completion of Public Inquiry	0 days	Wed 13/12/23	Wed 13/12/23
Completion of Stage 1 work	0 days	Fri 27/10/23	Fri 27/10/23
SoS Decision	0 days	Wed 12/06/24	Wed 12/06/24
Publication Notice of Confirmation of CPO (NCC)	0 days	Wed 26/06/24	Wed 26/06/24
Publication Notice of Confirmation of SRO (NCC)	0 days	Wed 26/06/24	Wed 26/06/24

Start of Statutory Challenge Period	0 days	Thu 27/06/24	Thu 27/06/24
End of Statutory Challenge Period	0 days	Wed 07/08/24	Wed 07/08/24
Confirmation of all statutory orders and consents (includes statutory challenge period)	0 days	Wed 07/08/24	Wed 07/08/24
Submission of pre-commencement planning conditions	0 days	Fri 26/07/24	Fri 26/07/24
Discharge of pre-commencement planning conditions	0 days	Mon 21/10/24	Mon 21/10/24
Full Business Case (FBC) submitted to DfT	0 days	Thu 21/08/24	Thu 21/08/24
DfT approval of Final Business Case	0 days	Thu 14/11/24	Thu 14/11/24
Land acquired	0 days	Thu 14/11/24	Thu 14/11/24
Start of Construction	0 days	Fri 15/11/24	Fri 15/11/24
Scheme open to public	0 days	Thu 17/12/26	Thu 17/12/26

APPENDIX I – Update to the Risk Register

NWL Risk Register

Prepared by (Risk Register Owner) **Brett Rivett**
Date last updated 07/06/2022

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:						
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum £22,334,226**	**Most Likely £37,366,322**	**Maximum £69,162,534**	**Target Resolution Date**	**Status**
Strategic	A - Funding / Third parties	***A04***	18/06/2018	There may be a delay in the funding approval (OBC and/or OBC) from DfT due to a general election being called or other factors impacting the sign off of the business cases.	Delay to scheme development. Programme delay.	2	1	2	LOW	Ensure scheme is high on the political agenda. Council and Business Rate Pool grants funding the scheme so far. Programme to be revised with new anticipated funding announcement date Engagement with DfT to reinforce the need for the scheme	3	1	3	LOW	3	1	3	LOW	35.50%	£127,219	£254,439	£763,316	15/11/2024	Open
Strategic	A - Funding / Third parties	***A05***	18/06/2018	The project may receive a legal challenge based on the planning and environmental processes followed, or if environment factors are encountered during surveys.	Delay to programme and the associated costs of tackling a legal challenge Prolonged public inquiry Judicial review of the scheme	3	2	6	MEDIUM	Keep stakeholders appraised of progress and engaged with the project. Treat all stakeholders fairly and equitably. Stakeholder management plan. Continue to build robust evidence base and ensure all scheme benefits are identified , following webTAG guidance. Provision of a Robust EAST process. Audit trail and evidence base supporting business case. Legal review and guidance at key milestones - vulnerability assessment	4	2	8	MEDIUM	3	2	6	MEDIUM	35.50%	£184,160	£368,321	£552,481	15/11/2022	Open
Strategic	A - Funding / Third parties	***A06***	18/06/2018	The value of the land required for the project may increase above the anticipated costs (inflation or otherwise).	Cost increase. Delays whilst land value negotiations take place.	3	1	3	LOW	Ensure the estimate costs are refreshed at all stages and based on historic costs.	3	1	3	LOW	3	1	3	LOW	35.50%	See 'Adjustment to outturn (Inflation)'			18/11/2024	Open
Strategic	A - Funding / Third parties	***A08***	18/07/2018	The project may fail to secure budget for scheme funding profile from NCC and DfT due to changes in policy, change in MP support, or change in local support.	Depending on the timing of the event, notice to proceed to Stage Two and Stage Three may not be issued or the contract between NCC and Ferrovial may need to be terminated.	2	1	2	LOW	Demonstrate need for scheme so that buy-in and funding is secured. Identify and track bid opportunities inclusion for local funding. Consider opportunities for developer funding. Demonstrate lessons from previous schemes and proven track record of delivery.	3	1	3	LOW	3	1	3	LOW	35.50%				15/11/2024	Open
Strategic	A - Funding / Third parties	***A10***	18/07/2018	Changes to UK relationship with the European Union affecting trading conditions.	Price increase in construction materials due to the value of the pound decreasing. Increased tarrifs and or boarder delays.	2	1	2	LOW	External political uncertainty - difficult to gauge at this stage. Monitor situation and consider financial / programme / procurement of any changes in relationship. Estimates will be calculated in a rigorous manner taking into account inflation along with a realistic delivery programme. Consider alternative materials/construction methods.	2	1	2	LOW	2	1	2	LOW	13.00%	£47,610	£95,221	£142,831	18/12/2026	Open
Operational	A - Funding / Third parties	***A16***	17/01/2020	Reinstatement of temporary land occupied to deliver the project is not acceptable to landowners, as reinstatement fails to meet the standard recorded prior to temporary occupation.	Additional cost to reinstate to original condition or to acquire land.	2	1	2	LOW	Earthworks strategy to ensure suitable materials are retained to reinstate temporary land requirements back to their original condition, i.e. suitable quality and volume of topsoil, subsoils, etc. - Identify areas, produce a plan/sketch, identify landowner/tenant details - Identify the current use of the temporary land. - Collate information about any discussions with affected landowners to date. Future usage? Reinstatement details? - NPS to advise on condition surveys, agree timescales, cost etc. Is this within the scope? - Agree soiling strategy with Ferrovial. Extent of topsoil strip and proposed reinstatement.	3	1	3	LOW	2	1	2	LOW	13.00%	£50,671	£101,342	£202,683	18/12/2026	Open
Operational	A - Funding / Third parties	***A17***	28/01/2021	Addition of new Third Party Agreements or amendment to the existing Third Party Agreements included in the Scope introduces additional or varied constraints.	Additional costs and programme implications.	2	1	2	LOW	Early negotiation and conclusion of TPA's Ensure TPA's do not impose additional constraints which will effect the way the Contractor provides the works.	3	1	3	LOW	3	1	3	LOW	35.50%	£113,415	£226,829	£453,658	18/11/2024	Open
Operational	A - Funding / Third parties	***A18***	06/05/2022	Revenue generated from re-sale of properties acquired may exceed that assumed in the laned estimate.	Increased return to the project.	3	1	3	LOW		3	1	3	LOW	3	1	3	LOW	35.50%		-£177,386	-£225,311	18/11/2024	Open
Strategic	B - Programme / Contract	***B03***	18/06/2018	Legal work may not completed on time.	Delays to statutory notifications required under planning consent requirements. Reputational damage due to loss of confidence in NCC's capability to deliver	2	1	2	LOW	Engage early with NCC legal team and understand timescale - input to delivery programme, lessons learned from NDR	2	1	2	LOW	2	1	2	LOW	13.00%	£62,886	£153,560	£439,294	18/11/2024	Open
Strategic	B - Programme / Contract	***B04***	18/06/2018	The planning process may impose unexpected conditions on the project.	Costs to address the conditions to allow licences to be released. This could include design updates, more land purchase Compression of the programme between the determination of planning and start of works	3	3	9	MEDIUM	Work with LPAs from early stage including programmed share of draft conditions. Consider requirements and lessons learnt from other projects including Broadland Northway.	3	3	9	MEDIUM	3	3	9	MEDIUM	35.50%	£450,751	£901,502	£1,803,003	18/11/2024	Open
Strategic	B - Programme / Contract	***B05***	18/06/2018	The A47 dualling construction programme may change.	Delays to construction programme Cost impact to re-sequence work	3	1	3	LOW	Work with National Highways and understand delivery programme for A47 and key interfaces, programme phasing to minimise impact e.g. southern section for later delivery.	3	3	9	MEDIUM	3	1	3	LOW	35.50%	£27,458	£82,373	£164,745	29/07/2022	Open
Strategic	B - Programme / Contract	***B06***	18/06/2018	Landowners may object to the scheme or to selling their land.	Potential delays or difficulties negotiating during the CPO process. Cost increase to agree a route and mitigation which impacts the BCR. Reputational damage for NCC with local landowners Change of landowner leads to disagreement on proposals	2	1	2	LOW	Work in consultation with landowners from an early stage and use of statutory powers. Delivery programme to allow for inquiry timescales	4	1	4	LOW	3	1	3	LOW	35.50%	£90,235	£180,469	£680,488	15/11/2024	Open
Strategic	B - Programme / Contract	***B12***	02/07/2018	NCC Decisions may not be made in a timely manner due to change of staff, loss of decision making personnel or absence of decision making personnel.	Delay to programme while decisions aren't made	2	1	2	LOW	Programme to include key committee dates and milestones - deliverables to be ready in time for review to aid decision making, member steering group to keep members appraised.	2	3	6	MEDIUM	2	1	2	LOW	13.00%	£33,044	£66,087	£132,175	18/12/2026	Open
Strategic	B - Programme / Contract	***B17***	30/03/2020	Stage One - Pandemic - virus strain known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or the disease known as coronavirus disease 2019 (COVID-19) (including, in both instances any mutation or variant thereof) preventing external meetings being held with stakeholders and public consultation activities from proceeding.	Delay to programme	4	1	4	LOW	Online meetings to be held where possible and further exchange of information electronically. Re-programme liaison groups and public consultations	3	3	9	MEDIUM	3	1	3	LOW	35.50%				18/11/2024	Open
Strategic	B - Programme / Contract	***B18***	12/06/2020	The programme for adoption of the GNLP and LTP are delayed	The NWL programme does not align with the plan making process Reference to these policies would need to consider their stage in development	1	1	1	LOW	Engagement with the GNLP, LTP team and Counsel to understand the programme for inclusion of the NWL. Ensure appropriate 'weight' is given to theses polices at time of submission by working with WSP Planning.	4	3	12	MEDIUM	1	1	1	LOW	2.50%				29/03/2022	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum**	**Most Likely**	**Maximum**	**Target Resolution Date**	**Status**
																				£22,334,226	**£37,366,322**	**£69,162,534**		
Operational	B - Programme / Contract	***B20***	16/09/2020	Stage One - Pandemic - virus strain known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or the disease known as coronavirus disease 2019 (COVID-19) (including, in both instances any mutation or variant thereof) impacts the Client's and Contractor's resource.	Delays to the programme and/or increased cost: Staff availability - infections/self-isolation, Reliance on technologies (resilience), Sufficiency of programme and Stage One deliverables, Local and/or national lockdowns preventing the Contractor obtaining further SI/GI data, Prolonged surveys and or investigations, Consultations and/or inquiry prolonged and Increased inflationary pressures due to delay/prolongation.	3	1	3	LOW	Compliance with guidance. Contractor's risk under the contract, unless events directly associated with the pandemic prevent the Contractor's from completing the whole of the works by the planned Completion date or stop the work in totality … clause 19. Client risk if laws change by comparison to the las known at the contract date.	3	1	3	LOW	3	1	3	LOW	35.50%	£63,610	£146,430	£292,861	18/11/2024	Open
Operational	B - Programme / Contract	***B21***	16/09/2020	Stage Two - Pandemic - virus strain known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or the disease known as coronavirus disease 2019 (COVID-19) (including, in both instances any mutation or variant thereof).	Delays to the programme and/or increased cost: Staff availability - infections/self-isolation, Reliance on technologies (resilience), Sufficiency of programme and Stage One deliverables, Local and/or national lockdowns preventing the Contractor obtaining further SI/GI data, Prolonged surveys and or investigations, Consultations and/or inquiry prolonged and Increased inflationary pressures due to delay/prolongation.	2	2	4	LOW	Compliance with guidance - Construction Leadership Councils Site Operating Procedures to be introduced. Client risk if events directly associated with the pandemic prevent the Contractor's from completing the whole of the works by the planned Completion date or stop the work in totality or laws change by comparison to the las known at the contract date. Shared risk under the contract if the PWDD exceeds the total of the Prices, prior to the PWDD exceeding the total of the Prices the risk is retained by the Contractor.	2	2	4	LOW	2	2	4	LOW	13.00%	£200,696	£401,497	£802,995	18/12/2026	Open
Operational	B - Programme / Contract	***B22***	16/09/2020	Inflationary factors impacted by: 1) Increased national infrastructure delivery programme, 2) Pandemic - virus strain known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or the disease known as coronavirus disease 2019 (COVID-19) (including, in both instances any mutation or variant thereof) and 3) Brexit. 4) Invasion of Ukraine.	Inflation in excess of historic trends used for the purpose of the forecast, driven by: 1) Supply and demand 2) Increases in aggregate tax, fuel levies, road tax, landfill tax, etc.	3	3	9	MEDIUM	Oustide of the Client's and Contractor's control … can only monitor. Contractor risk under the contract … other than recovery through X1. Shared risk under the contract if the PWDD exceeds the total of the Prices, prior to the PWDD exceeding the total of the Prices the risk is retained by the Contractor.	4	3	12	MEDIUM	4	3	12	MEDIUM	65.50%	See 'Adjustment to outturn (Inflation)'			18/12/2026	Open
Strategic	B - Programme / Contract	***B23***	29/03/2021	The delivery of the Sustainable Transport Strategy is outside of the main D&B contract	Late changes to the D&B Contractors scope of work Potential programme implications subject to STS delivery timescales	3	3	9	MEDIUM	Work with other departments in NCC to determine the best delivery route for the STS. Once confirmed, ensure the work is included in the forward plan.	3	3	9	MEDIUM	3	3	9	MEDIUM	35.50%				20/03/2025	Open
Strategic	C - Scope Change / Change	***C01***	18/06/2018	Early assumptions made for engineering design found to be insufficient following receipt of further information. Note: Risk considers the adequacy of the Tender Design where the engineering solution deviates from the Reference Design (accepted deviations).	Design changes required, Cost increases during design due to increased design requirements (more concrete, greater level of excavation etc) Reputational damage Delivery delays	2	2	4	LOW	Undertake sensitivity testing on key design parameters and assumptions. Consider robust/resilient case. Carry out desk study, ground investigation and topographical survey	1	2	2	LOW	1	2	2	LOW	2.50%	£23,542	£50,349	£97,433	29/06/2023	Open
Strategic	C - Scope Change / Change	***C03***	18/06/2018	National Highways may change the A47 junction design, requiring an update to the NWL alignment.	Additional cost, in both design and construction Delay to the design programme Increased land take Increased land costs Significant change may require additional environmental surveys Change in scheme design may have an increased environmental impact	2	1	2	LOW	Regular co-ordination with National Highways to ensure that the NWL aligns and ties in with the A47 scheme.	1	1	1	LOW	1	1	1	LOW	2.50%	£13,230	£26,459	£52,918	29/06/2023	Open
Strategic	C - Scope Change / Change	***C05***	18/06/2018	DfT standard departures may not be approved without changes or adjustments. Note: Risk considers the transition from NCC/Contractor design to National Highways design at interface with A47.	Redesign to meet the standards at the tie in point with the A47 (Contractor design at/to the tie will need National Highways approval (transition)). Increased costs to overall scheme to meet acceptable standards. Delays while negotiating the departures.	1	1	1	LOW	Design the interface with National Highways network at the A47 and the NWL approach to DMRB standards. Confirm the impact of DfT's updates to DMRB standards on the previous outline designs. Carry out preliminary designs to meet requirements of DMRB/national standards wherever possible - and minimise need for Departures.	1	1	1	LOW	1	1	1	LOW	2.50%	£13,230	£26,459	£52,918	29/06/2023	Open
Strategic	C - Scope Change / Change	***C06***	18/06/2018	There may be a variation between actual site conditions and assumptions used in design, such as the GI and topographical survey. Note: Risk considers the adequacy of the revised Tender Design (Route Refinement) where the engineering solution deviates from the Tender Design.	Ground works costs increase Land take may increase, The drainage design may need revision	3	2	6	MEDIUM	Intrusive ground investigation surveys to be undertaken sufficiently soon in programme (including ground water monitoring and infiltration testing). Ensure surveys are robust to minimise unknown changes in conditions. Review Ferrovial GI Factual report and identify the differences. Identify implications i.e. impact on viaduct, other structures, drainage, earthworks, etc.	3	4	12	MEDIUM	3	4	12	MEDIUM	35.50%	£387,077	£951,654	£2,854,962	18/12/2026	Open
Strategic	C - Scope Change / Change	***C08***	18/07/2018	Design departures subject to NCC approval may not be granted. Note: Risk considers the deviations accepted through dialogue and the acceptability as part of the planning process.	Approvals not achieved so scheme cannot proceed. Designs require modification to address approval issues.	2	3	6	MEDIUM	Engage with NCC technical approval team and seek early advice on any potential departures. Confirm design freeze date with NCC, and seek NCC's early input to design decisions.	2	3	6	MEDIUM	1	3	3	LOW	2.50%	£47,605	£114,448	£228,896	29/06/2023	Open
Strategic	C - Scope Change / Change	***C10***	02/07/2018	The DfT may make updates which affect traffic modelling.	The cost of re-modelling or re-working of models based on new data Programme delay whilst outputs are revised Effect on scheme benefits	1	1	1	LOW	Early assessment of any DfT updates.	1	3	3	LOW	1	1	1	LOW	2.50%	£26,980	£73,198	£146,396	29/06/2023	Open
Strategic	C - Scope Change / Change	***C13***	08/05/2019	The scope of the works to introduce cycle and footway provision is yet to be fixed in relation to the preferred route.	Additional scope and costs to provide Delays if stakeholder consultations lead to changes	2	2	4	LOW	Carry out further investigation to determine existing trails, links and PROW, and understand desire line. Liaise with NCC and local stakeholders to gauge their views on measures being proposed.	2	2	4	LOW	2	2	4	LOW	13.00%	£54,494	£108,987	£217,975	29/06/2023	Open
Strategic	C - Scope Change / Change	***C15***	12/08/2020	Changes to technical standards and guidance on which the design/assessment of the scheme are based.	Design changes lead to programme delay. Cost increases for additional/improved provisions. Challenge to funding application if compliance cannot be demonstrated.	2	1	2	LOW	Assess any changes in guidance and incorporate into the emerging proposals	2	1	2	LOW	2	1	2	LOW	13.00%	£65,219	£130,437	£260,875	05/09/2023	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum £22,334,226**	**Most Likely £37,366,322**	**Maximum £69,162,534**	**Target Resolution Date**	**Status**
Operational	C - Scope Change / Change	C16	25/01/2021	Reduction or increase in the permanent land requirements over that shown on the tender design drawings. Note: Contemplates changes from land requirements considered for the revised Tender Design (Alignment Refinement).	Cost associated with the requirement to take additional land or reduce the requirements. Delays to scheme due to the requirement to survey and review the additional land. Requirement for further consultation	2	1	2	LOW	Permanent land requirements to be discussed with the Contractor during Stage One, objective is to: Reduce the permanent land requirements, Minimise future maintenance liabilities for retained and Reduce the over-all cost burden.	2	1	2	LOW	2	1	2	LOW	13.00%	£11,983	£23,966	£47,931	05/09/2023	Open
Operational	C - Scope Change / Change	C17	25/01/2021	Reduction or increase in the temporary land requirements over that shown on the tender design drawings. Note: Contemplates changes from land requirements considered for the revised Tender Design (Alignment Refinement).	Cost associated with the requirement to take additional land or reduce the requirements. Delays to scheme due to the requirement to survey and review the additional land. Requirement for further consultation	2	1	2	LOW	Temporary land requirements to be discussed with the Contractor during Stage One, objective is to: Reduce the temporary land requirements, Provide sufficient land to remove constraints that are impeding efficient design/delivery, Reduce the over-all cost burden.	2	1	2	LOW	2	1	2	LOW	13.00%	£29,957	£59,914	£119,828	05/09/2023	Open
Strategic	C - Scope Change / Change	C18	25/01/2021	Design change required to maintain connectivity for walking and cycling. The A47 scheme includes a new walking and cycling route towards Hockering which passes to the north of the Wood Lane junction, across the proposed NWL.	Additonal crossing or other design changes to accommodate the re-routing of the new route leading to Additional costs Objection to proposals from stakeholders	2	2	4	LOW	Discussions with National Highways to consider design solution. Consider alternative routing of NMU's on the NWL	5	2	10	MEDIUM	2	2	4	LOW	13.00%	£121,996	£243,998	£399,030	05/09/2023	Open
Operational	C - Scope Change / Change	C19	25/01/2021	'Stopping Up' of Weston Road and Breck Road is opposed.	Construction of Weston Road and Breck Road Overbridges, including all design costs, construction costs and programme implications.	1	3	3	LOW	Maintain doalogue with key supporters of the change to minimise risk of objectotion gaining momentum.	1	3	3	LOW	1	3	3	LOW	2.50%				05/09/2023	Open
Operational	C - Scope Change / Change	C20	27/01/2021	Early access to land which has not been acquired to carry out ecological mitigation works is not possible. Note: Risk considers access to 'off-site' areas required for mitigation purposes.	Delay and disruption to the programme for Stage Two Work and Stage Three Work. Increase in Contractors costs	2	2	4	LOW	Identification of alternative areas for mitigation works. Advance negotiation with landowners. Increase compensatory payments.	3	3	9	MEDIUM	2	2	4	LOW	13.00%	£93,848	£187,696	£563,087	19/10/2023	Open
Strategic	C - Scope Change / Change	C21	29/01/2021	Sustainable transport strategy - provisions. Development of the shortlisted wider measures (1, 3, 4, 5 and 7E).	Additional design, construction and programme implications.	2	3	6	MEDIUM	As designs develop further, continue to monitor costs and implications of the proposals.	2	3	6	MEDIUM	2	3	6	MEDIUM	13.00%	£244,837	£400,300	£666,537	30/06/2022	Open
Strategic	C - Scope Change / Change	C22	19/02/2021	Sufficiency of the Contractor's Budget for Stage Two Work	Increases the difference between the Price of Work Done to Date and the total of the Prices for Stage Two, hence increasing the amount the Client pays. Programme effects, works not included in the Accepted Programme.	4	3	12	MEDIUM	Subject to Budget Events being raised and assessed.	4	3	12	MEDIUM	4	3	12	MEDIUM	65.50%	£1,872,469	£3,898,262	£5,879,708	18/11/2024	Open
Operational	C - Scope Change / Change	C23	19/02/2021	Value engineering opportunities.	Reduces the total of the Prices for Stage Two. Programme effects, works included in the Accepted Programme omitted.	3	2	6	MEDIUM	Drive through proposed opportunities.	3	2	6	MEDIUM	2	2	4	LOW	13.00%	-£91,085	-£303,778	-£516,471	18/11/2024	Open
Operational	C - Scope Change / Change	C25	30/11/2021	Changes to the Scope instructed by the Project Manager (not covered by specific risks detailed herein), including any ambiguities or inconsistencies as previously noted under risk K05.	Ambiguity in requirements/site information, access issues, late issue of information, unforeseen ground conditions, STATS and traffic management issues may all give rise to disputes and claims	5	2	10	MEDIUM	Change will be subject to full scrutiny to enure it is kept to an absolute minimum.	4	2	8	MEDIUM	4	2	8	MEDIUM	65.50%	£561,575	£1,534,756	£2,200,713	18/12/2026	Open
Operational	C - Scope Change / Change	C27	04/05/2022	Additonal Ground Investigation works required over that set out in the GISR.	Additional works attracting cost and time.	3	1	3	LOW	Norfolk Labs to review GISR.	3	1	3	LOW	3	1	3	LOW	35.50%	£232,075	£464,151	£928,302	05/09/2023	Open
Operational	C - Scope Change / Change	C28	04/05/2022	Failure to agree the assessment of events that can change the Budget for Stage Two Work (Clause X22.6 refers).	Escalation to the Senior representatives for resolution (X22.6(5)). Escalation to the Project Board Members for resolution (X22.6(6)). If the above steps do not resolve the matter, the notice to proceed to Stage Two and Stage Three cannot be issued (X22.5(3)). Procurement of Stage Two and Stage Three Work.	4	1	4	LOW	Contractor and or Project Manager to comply with the conditions of contract when assessing events that can change the Budget for Stage Two Work. Procurement of the Stage Two and Stage Three Works to maintain programme.	4	3	12	MEDIUM	4	3	12	MEDIUM	65.50%	£6,293,864	£3,918,001	£7,733,430		Open
Operational	C - Scope Change / Change	C29	04/05/2022	On-going design development linked with the alignment refinement works. Note: Risk considered the on-going development of bat mitigation measures between chainage 2200 and the south abutment of the viaduct (hop-over or green bridge).	Cost and programme implications resulting from changes to the revised Tender Design.	4	1	4	LOW	Options: 1) Delay commencment of detailed design of revised Tender Design between chainage 2200 and South abutment until feedback from stakeholders obtained as to preferential solution. 2) Proceed with detailed design of revised Tender Design between chainage 2200 and South abutment (potential abortive work/cost and programme impact if green bridge found to be preferential option). 3) Proceed with alternative Tender Design (Green Bridge) between chainage 2200 and South abutment (potential abortive work/cost and programme impact if hop-over found to be preferential option). 4) Proceed with detailed design of revised Tender Design between chainage 2200 and South abutment and develop Tender Design for alternative green bridge through to selection of prefential solutions (abortive works/costs but possible mitigation through mitigation of programme effects).	4	1	4	LOW	4	1	4	LOW	65.50%	£801,235	£935,723	£1,070,212	05/09/2023	Open
Strategic	D - Weather Events	D01	18/06/2018	Adverse weather conditions e.g. high winds, flooding, extremes of temperature. Note, this risk considers the effect adverse weather conditions would have on the works to be carried out by the Client and/or Others. Risk D02 and D03 consider the effect on the works to be provided by the Contractor.	Delays to surveys and provision of data by the Client or Others.	3	1	3	LOW	Time works to minimise risk, contingency in delivery programme/budget	2	1	2	LOW	2	1	2	LOW	13.00%		£46,587	£69,881	05/09/2023	Open
Operational	D - Weather Events	D02	10/08/2020	Adverse weather conditions greater than 1 in 10 year event.	Delay and disruption to Stage One and Stage Two. Client liability (compensation event) if the event is a consequence of rainfall, air temperature or snow. Shared liability if the event is a consequence of other weather events such as wind. Likelihood increased due to occurrence of more adverse weather patterns.	3	2	6	MEDIUM	Time works to minimise risk, contingency in delivery programme/budget. Best practice to be adopted, ensuring earthworks are sealed with adequate and appropriate run-off to avoid scouring and pollution. Other protective works to be considerred during the development of the method statements. Maintain original programme, i.e. provide the works witin the same timescales as set out in the first Accepted Programme, thus not changing the Client's risk profile.	3	2	6	MEDIUM	3	2	6	MEDIUM	35.50%	£411,240	£822,480	£1,644,960	18/12/2026	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum**	**Most Likely**	**Maximum**	**Target Resolution Date**	**Status**
																				£22,334,226	**£37,366,322**	**£69,162,534**		
Operational	D - Weather Events	***D03***	10/08/2020	Adverse weather conditions less than 1 in 10 year event.	Delay and disruption to Stage One and Stage Two. Shared liability, regardless of the weather event. Traditional construction methodology more suspetable to delay due to wind speeds.	4	1	4	LOW	Time works to minimise risk, contingency in delivery programme/budget. Best practice to be adopted, ensuring earthworks are sealed with adequate and appropriate run-off to avoid scouring and pollution. Other protective works to be considered during the development of the method statements. Risk profile unchanged if tender construction programme can be maintained.	4	1	4	LOW	4	1	4	LOW	65.50%	£379,383	£758,767	£1,517,534	18/12/2026	Open
Strategic	E - Design Risk Products / Materials	***E04***	18/06/2018	Change in structure type, appearance and span arrangement - Viaducts.	Redesign works and possible delay Increase in costs May impact on land requirements	2	3	6	MEDIUM	Investigate various structure types, appearance and span arrangements. Consider input from architectural advisers. Allow margin in preliminary sizing of bridge elements so later minor changes in parameters don't require significant redesign. Seek agreement from all stakeholder prior to proceeding with design.	1	3	3	LOW	1	3	3	LOW	2.50%	£38,134	£95,506	£191,012	05/09/2023	Open
Strategic	E - Design Risk Products / Materials	***E05***	02/07/2018	RSA may require changes in the later design stages.	Late design changes impact on programme The cost implication of reviewing and updating designs	3	1	3	LOW	Where possible design to conform to technical standards, within known constraints. Confirm the recommendations of the road safety auditors and adjust designs if required. Programme audits between design stages to allow for updates to be captured at subsequent design stage. Seek early review/ input from Road safety team at NCC.	3	2	6	MEDIUM	3	1	3	LOW	35.50%	£161,678	£323,357	£646,714	18/12/2026	Open
Strategic	E - Design Risk Products / Materials	***E08***	08/05/2019	The assumption that the wildlife overbridges will be a standard width may change. Note: Relates to GB1, GB2 and GB4.	Additional costs for design and construction will be incurred if it is established that wider or more complicated structures are required.	4	2	8	MEDIUM	Confirm number, location and requirement for Wildlife bridges from Ecology team. Design and include proposals in works package to Contractor.	4	2	8	MEDIUM	4	2	8	MEDIUM	65.50%	£706,912	£1,599,478	£2,696,332	05/09/2023	Open
Strategic	E - Design Risk Products / Materials	***E09***	08/05/2019	The scope to address the supplementary measures to the NWL may increase following full investigation and local traffic issues.	Additional costs for design and construction to provide supplementary measures Possible delays if further consultation is required.	1	1	1	LOW	An allowance has been made as part of the cost plan. Confirm during the OBC risk phase to ensure this is sufficient/ updated in Cost Risk assessment Carry out further investigation to appreciate local traffic issues that could be addressed - weight restriction, vehicle restrictions, traffic calming etc. Liaise with NCC and local stakeholders to gauge their views on measures being proposed.	3	1	3	LOW	3	1	3	LOW	35.50%	£124,250	£177,500	£230,750	05/09/2023	Open
Strategic	E - Design Risk Products / Materials	***E11***	29/11/2019	NMU and land access strategy may fail to gain support of LPA, PRoW and landowners.	Redesign work and possible programme delay Additional structures required to cross NWL - cost and programme delay Additional compensation to landowners PRoW objection - planning and programme delay	3	1	3	LOW	Carry out a detailed assessment of the existing PRoW routes, including user surveys on affected routes that cross the NWL Engage with PRoW team and landowners to understand existing arrangement for land access and use of PRoW network. Develop a considered strategy that minimised severance and preserves access. Coordinate with National Highways for A47 works and access arrangements - Honningham Restricted Byway and Easton Estate.	3	1	3	LOW	3	1	3	LOW	35.50%	£117,110	£187,860	£375,719	05/09/2023	Open
Strategic	E - Design Risk Products / Materials	***E12***	31/03/2020	Additional structures needed to cross the IDB drains to facilitate maintenance access track for viaduct inspection/maintenance and another structure to facilitate NMU route east of Tud Tributary culvert.	Additional scope and costs to design Potential hydrological / ecological constraints EA or NE objection poses risk to planning	3	1	3	LOW	Agree requirements with IDB/EA/NE.	3	1	3	LOW	3	1	3	LOW	35.50%	£234,220	£285,485	£570,969	05/09/2023	Open
Strategic	E - Design Risk Products / Materials	***E13***	21/05/2020	The highway and junction layouts indicated in the Reference Design are based on 2015 base year traffic survey data. More current traffic survey information is being obtained from 2019 surveys that will be used as basis for updating the traffic model in 2020. There is a risk that the difference in the data may result in geometric design changes. Note: Risk considers the sufficiency of the forecast allowance for design changes required to accommodate the revised forecast flows.	Late design changes impact on programme The cost implication of reviewing and updating designs Change to the Contractors Tender Price	4	1	4	LOW	Undertake a sensitivity check of the existing 2015 base year model. Identify possible capacity issue with current design with possible change scenarios. Expedite modelling based on 2019 base survey data to ensure that information is available for any design reviews prior to the planning submission.	3	2	6	MEDIUM	3	1	3	LOW	35.50%	£163,300	£326,600	£653,200	05/09/2023	Open
Strategic	E - Design Risk Products / Materials	***E14***	03/05/2022	Proceeding with the revised tender design in the absence of GI data and/or additonal GI data. Note: Relates to the revised Tender Design which incorporates the refined route.	Potential change to foundations if GI does not confirm assumptions. Late design changes once survey information becomes available Cost and programme impact. Conservative assumptions stifle contractor efficiencies	3	2	6	MEDIUM		3	2	6	MEDIUM	3	2	6	MEDIUM	35.50%	£218,117	£413,055	£826,109	29/06/2023	Open
Operational	F - Environmental	***F01***	18/06/2018	During construction protected species not previously identified may be found to be present in location of project.	Make area safe for protected species Relocate where applicable Schedule relocation at suitable time Delays to project and associated cost for rehoming and delays	2	2	4	LOW	Maintain survey data and ensure it is up to date, time ecology species surveys to maximise shelf life An ecological watching brief could be maintained prior to the start of construction. Integration between Ecology and Environment teams - any new information to be escalated.	2	2	4	LOW	2	2	4	LOW	13.00%	£69,521	£139,041	£258,582	18/12/2026	Open
Operational	F - Environmental	***F02***	18/06/2018	Contamination and/or fly tipping is discovered on the land during the site surveys or identified/occurs during Stage One and Stage Two.	Additional cost in the procurement process for testing, treating and removal of material. Disposal of fly tipping and/or treatment of contaminated land.	3	1	3	LOW	Undertake desk based assessment and intrusive investigation of appropriate areas pre-submission of the application to target these areas. If appropriate, align Contaminated land testing with GI's scheduled to reduce costs.	3	1	3	LOW	3	1	3	LOW	35.50%	£35,500	£88,750	£177,500	18/12/2026	Open
Strategic	F - Environmental	***F03***	18/06/2018	Lack of access to undertake environmental surveys until CPO process completed (Stage Two access date).	Incomplete surveys and hence assessments may not be suitable for submission to the determining authority Delay to programme while surveys are undertaken A complete survey season of baseline information required to determine mitigation	4	1	4	LOW	Work with landowners to agree access and undertake worst case assessment if suitable to do so. Ensure programme has sufficient time for access and seasonal surveys (including statutory powers notifications). Use of entry notices to gain access	4	1	4	LOW	4	1	4	LOW	65.50%	£166,489	£166,489	£332,979	04/08/2023	Open
Operational	F - Environmental	***F04***	18/06/2018	Invasive species may be found to be present in location of project.	Additional cost for testing and treating and removal prior to construction commencing	2	1	2	LOW	When full access is granted to the entire route the presence or likely absence of invasive species will be able to be confirmed. Woking towards full land access.	2	1	2	LOW	2	1	2	LOW	13.00%	£66,271	£132,541	£248,832	18/12/2026	Open
Operational	F - Environmental	***F05***	18/06/2018	Archaeological remains that require significant intrusive investigation may be found to be present.	Risk to pre-construction programme and cost from survey requirements pre-application Re-route scheme to avoid known sites of archaeological value. Will also result in increased costs and delays to activities/ programme	3	2	6	MEDIUM	Work with Historic England and the archaeological officer of NCC to agree scope of the assessment. Identify a suitable WSI in advance of intrusive works to ensure that archaeological matters are appropriately addressed at all suitable stages. Archaeological desk study, Geotech surveys, trial trenching along preferred route, avoid any nationally significant archaeology. Geophysics post PRA	3	2	6	MEDIUM	3	2	6	MEDIUM	35.50%	£207,595	£374,384	£622,784	02/09/2022	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum £22,334,226**	**Most Likely £37,366,322**	**Maximum £69,162,534**	**Target Resolution Date**	**Status**
Strategic	F - Environmental	***F06***	02/07/2018	Failure to reach agreement with relevant consultees with regard to significant environmental impacts and mitigation. E.g. SAC/SSSI. This could include NE not accepting the design e.g. of the viaduct and/or bat mitigation measures - underpasses/green bridges.	Potential objectors to the project that could jeopardise delivery	3	1	3	LOW	Regular meetings and progress updates with NE and the EA so an agreement can be reached. Produce technical notes on specific impacts for agreement with NE/EA.	3	1	3	LOW	3	1	3	LOW	35.50%	£194,989	£389,979	£779,958	08/12/2022	Open
Strategic	F - Environmental	***F08***	02/07/2018	Noise impacts are deemed to require mitigation.	Mitigation required such as acoustic fencing or false cutting; this could lead to additional land take or visual impacts. Cost increases	3	1	3	LOW	Noise assessment in EIA - seek adequate buffer zone from nearest receptors. Incorporate bunding in areas in closest proximity to residential receptors at outline design phase. Flexibility in highway fencing arrangements to incorporate a solid acoustic barrier if required. Modelling to inform noise assessments and mitigation design.	3	**1**	3	LOW	3	1	3	LOW	35.50%	£139,047	£278,094	£556,189	30/06/2022	Open
Strategic	F - Environmental	***F09***	02/07/2018	Significant adverse environmental effects identified in the application.	This may be deemed unacceptable the determining authority compared to the scheme benefits Increased mitigation costs Programme delay to refine application	1	1	1	LOW	See F10 with regard to ensuring that the mitigation is not wholly inappropriate. Work with engineers to try and 'design out' significant effects so that they don't arise in the first place. Emphasise scheme benefits.	3	3	9	MEDIUM	2	1	2	LOW	13.00%	£68,794	£137,587	£275,175	30/08/2022	Open
Strategic	F - Environmental	***F10***	02/07/2018	Unconfirmed scope of mitigation required for environmental impacts. Note: Risk considers the sufficiency of the ecological mitigation plan (TN037) and any subsequent revisions.	Increase in land take Increase in costs	3	2	6	MEDIUM	Undertake environmental assessment as soon as practicable to do so, such that measures can be incorporated into the design at an early stage. Work with engineers and attend workshops/meetings. Mitigation to be agreed in principle with regulators and key stakeholders as early as practicable. Early discussion with LPA and other regulators / stakeholders during pre-application period.	3	2	6	MEDIUM	3	2	6	MEDIUM	35.50%	£90,235	£488,917	£977,834	30/08/2022	Open
Strategic	F - Environmental	***F13***	02/07/2018	Aboricultural surveys identify ancient or veteran trees that requires mitigation.	Land take impacts Design changes to retain ancient/veteran trees where possible, leading to programme delays	1	1	1	LOW	Minimise impact through design	2	1	2	LOW	2	1	2	LOW	13.00%				30/08/2022	Open
Strategic	F - Environmental	***F14***	18/06/2018	The project may require extra mitigation to avoid listed building effects.	1.Costs associated with the additional landscaping/ change the scheme to avoid impacts	1	1	1	LOW	Work with Historic England and the heritage officer of NCC to agree scope of the assessment. Review listed buildings and map re proximity for each options seeking to select lower risk options.	4	1	4	LOW	4	1	4	LOW	65.50%	£135,094	£180,125	£225,156	30/08/2022	Open
Strategic	F - Environmental	***F15***	18/07/2018	The project may have inadequate pollution control solution and management and control of the volume of runoff during flood events designed into scheme.	Adverse effects on SAC/SSSI	1	1	1	LOW	Work with EA to ascertain suitable pollution control mechanisms and location/capacity/Design of attenuation ponds. Maintain regular correspondence with Natural England and the Environment Agency with regard to any survey information and emerging assessment conclusions. Work with both consultees to identify mitigation measures.	1	1	1	LOW	1	1	1	LOW	2.50%	£13,057	£26,114	£52,227	30/08/2023	Open
Strategic	F - Environmental	***F17***	18/07/2018	The shadow analysis shows that the project impacts the integrity of the River W even at 12m high.	Increased scheme height mitigation/design change. Worst case scenario additional compensation will be needed in the River Wensum to reduce the impact. Impact to NCC's reputation in the area	1	1	1	LOW	Undertake shadow analysis to fully understand shading impacts. Look at changing the design to ensure shading is not unacceptable in HRA terms. Extra consultation with NE. NE approval in advance of planning application submission	2	2	4	LOW	2	1	2	LOW	13.00%	£68,794	£137,587	£275,175	31/08/2022	Open
Strategic	F - Environmental	***F20***	18/06/2018	Additional flood risk mitigation required.	More land take Increased costs	3	1	3	LOW	Design to minimise land take, identify and agree mitigation with EA and land take requirements. Design robust mitigation for 1:100 year + CC (2016 allowances) with level for level flood plain compensation. Early assessment of impacts in hydraulic model to understand likely land take requirements.	2	1	2	LOW	2	1	2	LOW	13.00%	£85,044	£170,087	£340,175	31/08/2022	Open
Strategic	F - Environmental	***F24***	18/06/2018	River Wensum SAC prevents crossing of R Wensum (Natura 2000 site).	Increased land take for mitigation - ponds outside extents of extreme flood with conveyance system. The proposals will need to meet the tests as set out in the habitats directive. Should the tests not be met, then consent for the scheme would be in jeopardy	1	1	1	LOW	Maintain regular correspondence with Natural England and the Environment Agency with regard to any survey information and emerging assessment conclusions. Work with both consultees to identify mitigation measures that draw upon their specialist knowledge.	1	1	1	LOW	1	1	1	LOW	2.50%				31/08/2022	Open
Strategic	F - Environmental	***F26***	18/12/2018	Adverse visual impacts created onto the Golf course and other sensitive receptors within view of the viaduct options may require mitigation.	Cost to implement greater than expected mitigation of the visual impacts from the viaduct and other sections of the scheme.	2	1	2	LOW	Consider earth bunding for visual screening in the design and maximise length of alignment in cutting.	2	1	2	LOW	2	1	2	LOW	13.00%	£54,381	£108,763	£217,526	31/08/2022	Open
Strategic	F - Environmental	***F31***	29/01/2019	Long term groundwater monitoring may be requiring prior to construction.	Programme delay. Cost implication.	3	1	3	LOW	Consultation with statutory authorities on requirements.	3	1	3	LOW	3	1	3	LOW	35.50%	£40,381	£80,763	£161,525	31/03/2022	Open
Strategic	F - Environmental	***F33***	04/04/2019	The scheme may not pass the NPPF Sequential Test that requires development to first be directed to lower risk flood zones.	Application of Exception Test will be required to justify that location in flood zones provides wider sustainability benefit that outweighs flood risk and does not increase flood risk else where. Sustainability benefits of scheme to be confirmed by planning team. Impact on flood risk to be assessed in the FRA.	1	1	1	LOW	Continue to show how flood risk has been considered in the design and next stages of work, using evidence base information.	1	4	4	LOW	1	1	1	LOW	2.50%		£31,423	£62,846	03/02/2023	Open
Strategic	F - Environmental	***F34***	06/08/2019	The project may incur costs due to the lack of a design freeze early enough in advance of work on the OBC, Scoping Report and the ES.	The risk could be a delay in programme and deliverables due to re-doing of environmental assessment work. Abortive work if it changed halfway through the environmental assessment work for all stages, Continuous request for changes to completed designs	3	2	6	MEDIUM	Agree a definition and deadlines for design freezes of the route with all members of the team (Highways, environment etc) and with the client so it is clear what design everyone is working to. A new version of the design should not be used by any member of the team until next design freeze even if it is being updated by design team in between. To agree scope of allowable design changes and design freeze dates for design and build Contractor to comply with, and allocate clear responsibility for planning and EIA deliverables between WSP and Contractor as early as possible.	4	2	8	MEDIUM	3	2	6	MEDIUM	35.50%	£90,235	£453,658	£907,317	29/06/2023	Open
Strategic	F - Environmental	***F35***	06/08/2019	Additional wildlife structures become required further to the new or additional information becoming available from surveys (i.e. bats and wildlife underpasses, or additional species being identified that require additional wildlife structures).	The cost associated with designing and implementing the structures Cost associated with addressing the highways alignment issues raised by the introduction of the new structures. Particularly the road profile which impacts on the land take.	2	3	6	MEDIUM	Allow a risk amount in the cost estimates to cover the additional cost of providing the underpass. Maintain wildlife bridge near the viaduct, even if it may not be required, as if it is not required but other wildlife structures become necessary this may balance the cost. Engagement between ecology team and design teams to identify as early as possible any potential additional wildlife structures needed. Use bat data from static detectors to evaluate requirement of bat structures	2	3	6	MEDIUM	2	3	6	MEDIUM	13.00%	£231,371	£462,742	£727,156	29/06/2023	Open
Strategic	F - Environmental	***F37***	11/09/2019	The project red line boundary may increase due to ecology mitigation or the release of further requirements for constructability.	Programme delays to reach agreement with landowns/CPO additional land Cost and programme implications of increasing the project red line.	2	1	2	LOW	Confirm 'potential' compound areas in procurement process. Ensure the worst case scenario is captured and Ecology and other teams have input	3	4	12	MEDIUM	2	1	2	LOW	13.00%	£47,931	£119,828	£239,656	05/09/2023	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum**	**Most Likely**	**Maximum**	**Target Resolution Date**	**Status**
																				£22,334,226	**£37,366,322**	**£69,162,534**		
Strategic	F - Environmental	***F38***	02/12/2019	Large amount of badger activity identified within northern woodlands (November 2019). Main sett location provided by NCC but no further details as access denied. Impacts to a main badger sett expected and therefore mitigation could involve creation of artificial sett. This will have to be located within the same territory as the existing sett, not within a neighbouring territory. Badger bait marking surveys therefore proposed.	Cost and programme and design implications.	1	1	1	LOW	Proposal for badger bait marking surveys in these woodlands. This will allow for the ecology team to map badger territories and identify a potential location for an artificial badger sett.	2	1	2	LOW	1	1	1	LOW	2.50%				30/08/2022	Open
Strategic	F - Environmental	***F39***	03/12/2019	The exact areas required for biodiversity net gain (BNG) delivery is unknown at this stage.	Sufficient off-site land not available or secured. Increased land costs Programme delay for land negotiations and challenge at inquiry	4	2	8	MEDIUM	High level BNG assessment being undertaken based on available survey data and aerial imagery. Update once the BNG assessment is complete following confirmation of RLB and subsequent habitat survey updates.	4	2	8	MEDIUM	4	2	8	MEDIUM	65.50%	£440,488	£880,975	£1,761,950	31/07/2022	Open
Strategic	F - Environmental	***F40***	02/12/2019	The planning application is "called in" by the Secretary of State for a decision. This is done for particularly controversial or technically challenging planning applications, and is a possibility for NWL.	Programme delay and cost increase for scheme development	4	1	4	LOW	Allow for public inquiry in scheme programme and budget Ensure submission documents are fit for future processes, in conjunction with WSP Planning, Pinsents and NNC Planners.	4	2	8	MEDIUM	4	1	4	LOW	65.50%				06/09/2023	Open
Strategic	F - Environmental	***F42***	02/12/2019	The planning application takes longer than 18 weeks to determine.	Programme delay	2	1	2	LOW	Early engagement with LPA ensure sufficient resource available for determination. Offer Member's briefings at appropriate stages within determination period.	4	3	12	MEDIUM	3	1	3	LOW	35.50%	£90,235	£180,469	£360,939	06/09/2023	Open
Strategic	F - Environmental	***F43***	29/01/2020	The planning application is viewed by NCC (acting as the Local Planning Authority) as being 'contrary to the development plan'.	This would make getting planning permission more difficult. The Scheme would have to be justified based on 'material considerations', which is a higher bar than getting planning permission for a scheme that is in accordance with the development plan. Also increase the risk that the Secretaty of State calls the application in.	3	3	9	MEDIUM	Early engagement with the LPA. Ultimately accordance with the development plan is a mattter of judgement, and the planning statement be used to seek NCC's feedback on the approach that has been taken to the issue.	4	1	4	LOW	4	1	4	LOW	65.50%	£166,489	£332,979	£665,957	06/09/2023	Open
Strategic	F - Environmental	***F44***	26/02/2020	Ecology and environment survey data becoming 'out of date' in relation to the planning application date. This is dependant upon the type of flora/fauna and associated habitat.	Cost implications of repeating surveys Delay to planning application Design changes as a result of further information	2	1	2	LOW	Plan re-surveying in case of programme slippage.	4	4	16	MEDIUM	4	1	4	LOW	65.50%	£252,027	£330,239	£660,479	03/02/2023	Open
Strategic	F - Environmental	***F47***	12/08/2020	Objectors disrupt environmental surveys (Protestor action, see risk P01). Note: Risk considers the impact on the Stage One Work which is reliant on the output from environmental surveys and other exploratory works.	Incomplete surveys and hence assessments may not be suitable for submission to the determining authority Delay to programme while surveys are rescheduled Increase in survey costs Impact on staff physical and mental wellbeing	3	1	3	LOW	Monitor social media and assess whether disruption to surveys is likley. If disruption is likley, take additional measures such as increasing staff numbers, informing the police and other security measures	3	4	12	MEDIUM	3	1	3	LOW	35.50%		£117,938	£235,877	31/08/2022	Open
Strategic	F - Environmental	***F48***	08/09/2020	A47 and NWL could have different results, assessment and conclusions from environmental surveys, e.g. ecology surveys. Different approaches may be taken for the required ecology mitigation e.g. for barbatselle bats	Implications for dialogue with statutory and non statutory consultees. Possible confusion over differnet reuslts and approaches to the management of ecological features	1	3	3	LOW	Regular dialogue with National Highways Sweco Ecologist and NCC Ecologist to understand A47 emerging ecology results and approaches to mitigation.	3	3	9	MEDIUM	1	3	3	LOW	2.50%				03/02/2023	Open
Strategic	F - Environmental	***F49***	09/10/2020	Late receipt of data or feedback from stakeholders relating to EIA/ES.	Delay to submission of the planning application Costs associated with updating assessments and planning documents Challenge to submission based on new evidence	2	1	2	LOW	Bring forward surveys as much as possible. Ensure comprehensive early engagement with stakeholdrs and the public to minimise unexpected late changes.	3	4	12	MEDIUM	2	1	2	LOW	13.00%	£50,021	£52,939	£105,877	03/02/2023	Open
Strategic	F - Environmental	***F50***	10/06/2021	Changes to existing tools, or development of new tools to calculate biodiversity net gain or environmental net gain	Changes to design required to compley with requirements, leading to programme delays and increased costs Planning application rejected as not compliant with policy	2	2	4	LOW	Agree assessment tools to be used with the LPA/Statutory Environmental Bodies and Understand future developments and implement appropriate methodology	2	2	4	LOW	1	3	3	LOW	2.50%				08/12/2022	Open
Strategic	G - Third Parties / Statutory Undertakers	***G01***	18/06/18	Utility diversion cost/risk/timescale/access. Note, this risk considers the sufficiency of the allowances in the forecast (based on C3 Estimates), the programme effects and whether further constraints are placed on the statutory undertaker whilst diverting the services.	Increased costs as a result of change to design / construction works and Planned STATS maintenance work conflicts with the proposed scheme construction	3	1	3	LOW	Undertake consultations with utility owners to understand proposals at an early stage. Ensure utility information is kept up to date.	3	1	3	LOW	3	1	3	LOW	35.50%	£167,776	£351,142	£702,283	20/07/2023	Open
Strategic	G - Third Parties / Statutory Undertakers	***G02***	18/06/2018	Conflict of potential route with Orsted and Equinor cable routes.	Feasibility/safety issues leading to redesign of scheme - extra costs and delays	2	2	4	LOW	Undertake consultations with Orsted and Equinor to understand proposals for routing the cables at an early stage. Consult with the HSE to understand the critical hazard zones with input from the LPA.	3	2	6	MEDIUM	3	2	6	MEDIUM	35.50%	£383,110	£1,039,408	£2,078,817	08/12/2022	Open
Operational	G - Third Parties / Statutory Undertakers	***G03***	18/06/2018	Utility company diversions not given sufficient planning lead in-time. Note, this risk considers the sufficiency of operations to ensure the statutory undertaker is fully acquainted with the project, has received the required orders / confirmations / consents / etc and has the required resource to carry out the diversionary works in the required timescales.	Materials and resourcing scheduling compromised leading to design and/or build change/disruption.	1	1	1	LOW	Identify utility constraints and liaise with statutory undertakers at an early stage to seek advice on diversion and protection requirements and timescales. Related to G0	1	1	1	LOW	1	1	1	LOW	2.50%	£9,619	£19,239	£38,477	20/07/2023	Open
Operational	G - Third Parties / Statutory Undertakers	***G04***	18/06/2018	Unknown buried services may be discovered on site above the levels assumed in the estimate. Note, this risk considers the sufficiency of the searches and identification of existing services the are effected by the project.	Increased cost Delays to activities whilst services are addressed	4	1	4	LOW	Undertake asset record searches and consult statutory undertakers	4	1	4	LOW	4	1	4	LOW	65.50%	£395,854	£791,709	£1,583,418	30/09/2021	Open
Operational	G - Third Parties / Statutory Undertakers	***G07***	11/09/2019	The HSE, LPA or National Grid may object to the project on grounds of works within proximity to a high pressure gas installation, and impose restrictions on the proposed land-use within the vicinity of the pipeline. Note, this risk considers any constraints that may be imposed due to the proximity of nationally important services and the potential safety implications.	Increased construction costs to manage requirements. Design changes to address concerns Diversion of gas main	2	1	2	LOW	Liaise with the HSE and NG to confirm the gas main consultation zones and agree limitations of work within these zones. Ensure works classified as Level 2 or Level 3 sensitivity are located beyond the Inner and Middle Consultation Zones. Ensure compounds, crossing roads and all works avoid the gas main. Where conflicts arise, confirm if NCC accept a Departure from Standard for the side road designs.	3	2	6	MEDIUM	2	1	2	LOW	13.00%	£50,021	£66,087	£132,175	06/09/2022	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum £22,334,226**	**Most Likely £37,366,322**	**Maximum £69,162,534**	**Target Resolution Date**	**Status**
Operational	G - Third Parties / Statutory Undertakers	***G08***	11/09/2019	National Highways … Contribution to junction up-grade on A47 (over and above what would be required in the abcense of the NWL)	Increased Scope of work to be provided by the Contractor (Assumes instruction to incoporate into the contract due to delays impacting programme alignment etc.)	3	1	3	LOW	Liaise with National Highways to establish what enhancement is required to accommodate the NWL and the associated contribution	5	1	5	LOW	5	1	5	LOW	90.00%	£697,005	£929,339	£1,161,674	31/07/2022	Open
Operational	H - Flooding	***H01***	18/06/2018	River or ground water levels may rise leading to flooding during construction (weather). Note, this risk considers the effect of flooding on construction activities and the liability for the associated costs should a flooding event occur.	Costs to the project for enhanced flood mitigation Delays while mitigations are enacted Cost and time delay if flooding occurs while in construction	3	2	6	MEDIUM	Programme to include sufficient contingency, consider potential protection/interventions and minimise scheme footprint in flood plain. Requirement for contractors to sign up to the flood warning service.	3	3	9	MEDIUM	3	2	6	MEDIUM	35.50%	£168,141	£649,384	£939,306	18/12/2026	Open
Strategic	H - Flooding	***H02***	18/06/2018	Flood level design to FZ2 assumptions may change once detailed flood modelling is carried out - this may change the extents of viaduct required.	This may change the extent of the required viaduct. Increased design and construction costs, Impact on Programme	1	3	3	LOW	Review flood levels on receipt of flood modelling from EA (35years+CC and 65 years+ CC sensitivity test) versus assumed FZ2 levels used in current design.	2	3	6	MEDIUM	1	3	3	LOW	2.50%	£107,088	£150,840	£301,680	03/02/2023	Open
Strategic	H - Flooding	***H03***	25/01/2019	Infiltration and groundwater test results may indicate that discharge via infiltration is not viable.	There will be a change to design that requires discharge to watercourses, with subsequent pollution risks to Wensum. It will change the design for the drainage basins	2	2	4	LOW	Tests to be undertaken at an early stage to mitigate impact. A sufficient amount of tests to be undertaken. Alternative discharge options to be explored as early as possible.	4	2	8	MEDIUM	2	2	4	LOW	13.00%				29/06/2023	Open
Strategic	H - Flooding	***H04***	25/01/2019	The EA and NE may raise concerns with the proposed discharge options of the project.	This will result in a change to design that requires additional treatment to be installed. Potential requirement for additional land take may be required.	1	1	1	LOW	Early engagement with the EA. Summary of strategy to be sent to groundwater team at EA to review.	2	4	8	MEDIUM	2	1	2	LOW	13.00%		£204,701	£409,402	03/02/2023	Open
Strategic	H - Flooding	***H05***		Infiltration rates on site may be poorer than originally specified/determined resulting in larger infiltration lagoons and land take.	Larger land take required to support the infiltration lagoons Survey required of the additional land take	3	1	3	LOW	Tests to be undertaken at an early stage to mitigate impact. A sufficient amount of tests to be undertaken.	3	1	3	LOW	3	1	3	LOW	35.50%		£524,358	£1,048,717	29/06/2023	Open
Strategic	H - Flooding	***H06***	29/01/2019	Delays getting approval of the hydraulic model by the EA. The EA's hydraulic models may not be not suitable to inform detailed assessment and the design of mitigation.	Cost associated with additional modelling required Programme implication associated with further modelling Gaining EA's approval for the updated model	2	1	2	LOW	Early review of available model data. Consultation with EA. If issues noted during detailed assessment and design, raised as soon as possible and remedial actions discussed.	2	3	6	MEDIUM	2	1	2	LOW	13.00%		£75,837	£151,675	03/02/2023	Open
Operational	H - Flooding	***H07***	29/01/2019	The EA may require additional modelling of the temporary works solutions around the watercourse crossing.	Cost impact of additional modelling Programme impact of additional modelling	3	1	3	LOW	Early contractor engagement to understand temporary works requirements. Consultation with EA.	4	1	4	LOW	3	1	3	LOW	35.50%				03/02/2023	Open
Strategic	H - Flooding	***H11***	08/07/2019	There are low points within cuttings along the alignment – this means that the infiltration lagoons need to be lower than the lowest point. Since the lagoons are lowered this is defined as 'deep infiltration' in the eyes of NCC LLFA and is not a preferred form of discharge (there may also be issues with groundwater at the deeper depths).	Solution will not be accepted by the LLFA requiring design changes Increased costs/delivery programme of alternative solutions	1	1	1	LOW	Liaise with Highways to try and reduce impact of low points within cuttings once route has been selected Engage and liaise with LLFA with regards to their policy memo.	3	3	9	MEDIUM	2	1	2	LOW	13.00%				03/02/2023	Open
Strategic	H - Flooding	***H12***	01/11/2019	Changes to the alignment and accommodation of ecology and side road structures may necessitate the need for pumped drainage. This will require a power supply to be procured from the nearest point of connection.	Increased Costs Programme delay for power supply	1	1	1	LOW	Liaise with Highways designers to try and reduce likelihood of pumped drainage.	2	3	6	MEDIUM	1	1	1	LOW	2.50%				29/06/2023	Open
Strategic	H - Flooding	***H13***	09/01/2020	The amount of floodplain compensation required to compensate for the viaduct piers may extend the Scheme red line boundary and land requirements. This may arise following 1D-2D flood modelling and confirmation of the number and location of viaduct piers and within the flood plain.	Affect the extent of other assessments (e.g. ecology surveys) required, and subsequently the EIA and planning application programme. Additional land required, increasing costs	3	1	3	LOW	Engage with contractor to determine likely viaduct pier and abutment design at earliest opportunity AND/OR utilise worse case reference structures design.	3	1	3	LOW	3	1	3	LOW	35.50%				03/02/2023	Open
Strategic	F - Environmental	***H15***	28/10/2020	The Environment Agency are undertaking restoration measures along the River Wensum. The scope and programme for this work is unclear.	Inaccurate baseline for flood modelling and geomorphology assessment. Amendments to ES if further information becomes available at a later date, potential porgramme delays.	1	1	1	LOW	Ongoing consultation and as the design progresses will know more. More updates when data is available.	2	3	6	MEDIUM	2	1	2	LOW	13.00%				03/02/2023	Open
Strategic	J - Resources	***J01***	18/06/2018	There may be a change to employer/ designer team members.	Lack of continuity of project knowledge within the NCC and WSP teams	3	1	3	LOW	Succession planning identified within action list and team hand over at key milestones.	3	1	3	LOW	3	1	3	LOW	35.50%		£90,235	£180,469	18/12/2026	Open
Strategic	J - Resources	***J02***	18/06/2018	There may be insufficient resource to maintain current programme. Note, Risk P16 considers the wider issue in respect of the Contractor's resources.	Potential to delay the project (increasing cost or damaging reputation) Errors which impact quality of work and undermine the statutory processes.	3	1	3	LOW	Ensure adequate budgets and resources in place to cover required input.	3	1	3	LOW	3	1	3	LOW	35.50%	£136,595	£453,658	£680,488	18/12/2026	Open
Strategic	J - Resources	***J03***	02/07/2018	The project may be impacted by the shortage of specialist labour skills.	Shortage of specialist subcontractor or labour skills will have an adverse affect on cost and programme	3	1	3	LOW	Use standard construction methods where possible - minimise need for specialist skills. Suppliers to be engaged early in the project and procurement process started as early as possible. Sufficient contingency time to be included in construction/delivery programme.	3	1	3	LOW	3	1	3	LOW	35.50%	£13,275	£303,099	£606,197	18/12/2026	Open
Strategic	J - Resources	***J04***	27/01/2021	Completeness of tasks required for the successful delivery of the project in accordance with the master programme.	Additonal tasks introduced, increasing cost and programme implications.	2	1	2	LOW	Ensure task required are given sufficient consideration and resourced.	3	1	3	LOW	2	1	2	LOW	13.00%	£769,074	£1,198,527	£1,438,263	08/08/2024	Open
Strategic	L - Approvals	***L01***	18/06/2018	There may be further changes in legislation or regulation which impact the project.	Increased costs to absorb changes during the design Delays to schedule	2	1	2	LOW	Keep appraised of legislation changes, learn lessons from other schemes.	2	1	2	LOW	2	1	2	LOW	13.00%		£85,439	£170,877	18/12/2026	Open
Strategic	L - Approvals	***L02***	18/06/2018	Failing to address objections prior to submission.	The impact of the risk is additional resource requirements addressing and agreeing issues. Risk is also that programme for determination is extended and changes to the scheme may be needed or additional conditions imposed	2	2	4	LOW	Stakeholder management plan, early engagement via multiple forums such as Local Liaison Group, Ecology Liaison Group, Local Access Forum, and public consultation. Additional traffic management discussions to be undertaken with local parishes as appropreriate. Pre-application public consultation will be undertaken prior to planning application submission.	3	2	6	MEDIUM	2	2	4	LOW	13.00%	£6,074	£9,111	£12,148	29/03/2023	Open
Strategic	L - Approvals	***L04***	02/07/2018	The project may not give sufficient consideration to planning policy.	The proposed scheme is not compliant with national networks / local planning policy resulting in it not being granted.	2	3	6	MEDIUM	Review of policy at each stage and updates, EIA scoping will assist with identifying relevant policies to consider but local plan emerging in parallel.	2	4	8	MEDIUM	2	3	6	MEDIUM	13.00%	£12,148	£24,296	£36,443	16/05/2023	Open
Strategic	L - Approvals	***L05***	02/07/2018	The scheme submitted for consultation or examination may not be sufficiently developed in terms of design.	Greater support required at the examination as more questions will be asked by the examining authority Additional mitigation/planning conditions /s106 agreements may be required Increased exposure to a legal challenge (A05)	2	2	4	LOW	Robust design process, peer review and benchmarking, EIA, liaising closely with National Highways re A47 junction, additional stakeholder and local access public consultation held in Summer 2020. Pre-application consultation will be undertaken prior to planning application submission.	3	3	9	MEDIUM	2	2	4	LOW	13.00%	£33,044	£66,087	£132,175	05/09/2023	Open
Strategic	L - Approvals	***L07***	02/07/2018	Changes to designations (e.g. ecology within study area).	Resulting in an insufficient assessment and a subsequent challenge to the scheme.	1	1	1	LOW	Work with landowners and their consultants, site surveys for ecology ground truthing and liaison with NCC ecology	2	1	2	LOW	2	1	2	LOW	13.00%	£6,074	£9,111	£12,148	03/02/2023	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum** **£22,334,226**	**Most Likely** **£37,366,322**	**Maximum** **£69,162,534**	**Target Resolution Date**	**Status**
Strategic	L - Approvals	***L09***	02/07/2018	Land interests do not return requested information in time.	Vital interests are therefore excluded and not notified.	1	2	2	LOW	Early engagement with affected parties	1	2	2	LOW	1	2	2	LOW	2.50%	£23,682	£44,099	£132,297	03/02/2022	Open
Strategic	L - Approvals	***L11***	04/05/2022	Natural England may not sign off a protected species licence due to failure to meet the Favourable Conservation Status (FCS) test and/or No Satisfactory Alternatives (NSA) and Purpose tests.	Cost and programme implications. Mitigation measures changed.	3	1	3	LOW	Ensure mitigation measure are appropriate and robust.	3	1	3	LOW	2	1	2	LOW	13.00%	£123,146	£229,314	£687,943	31/12/2023	Open
Strategic	M - Planning / DCO	***M03***	02/07/2018	Local Plan for 2036 is emerging - key developments in study area not confirmed.	Future model forecast results may change - may affect scheme economics	2	2	4	LOW	Constrained to totals for HH and jobs to Local Plan extent of need for 2036 emerging LP and use tempro to assign spatial distribution. Agree approach with NCC planning officers.	3	3	9	MEDIUM	2	2	4	LOW	13.00%	£12,148	£24,296	£36,443	29/03/2023	Open
Strategic	M - Planning / DCO	***M04***	18/06/2018	DfT may not accept traffic modelling used for assessment, economic appraisal or are not forth-coming with technical reviews.	Inability to support the findings Extra modelling work Delay associated with additional modelling	2	2	4	LOW	Follow webTAG guidance. Produce local model validation report at the OBC stage. Engage with DfT throughout traffic modelling development.	3	3	9	MEDIUM	3	2	6	MEDIUM	35.50%	£33,173	£66,345	£99,518	31/07/2021	Open
Strategic	M - Planning / DCO	***M05***	02/07/2018	The traffic modelling could show the scheme does not have sufficient benefits for a business case resulting from the updated traffic model, NH changes on the A47 or alternative developments emerge as part of the Local Plan 2036.	Insufficient BCR to progress scheme. Project costs (including mitigation) may outweigh benefits Model forecasts change	1	1	1	LOW	Update traffic modelling and undertake scenario testing. Consider mitigation costs. Regular engagement with Local Plan team. Engagement with National Highways as schemes develop so they are coordinated.	3	4	12	MEDIUM	4	1	4	LOW	65.50%	£183,618	£244,824	£306,030	30/08/2022	Open
Strategic	M - Planning / DCO	***M07***	03/03/2021	NCC are unable to enter into sufficient land agreements for the off-site environmental mitigation.	Programme delays while agreements are finalised Increases in costs if uptake is low Increased risk of unsuccessful CPO if off-site land is included Changes to the scheme boundary	1	2	2	LOW	Early discussion with landowners Develop a comprehensive agreement with legal team/LPA Determine the minimum requirement for planning purposes	3	3	9	MEDIUM	1	2	2	LOW	2.50%				31/07/2022	Open
Strategic	M - Planning / DCO	***M08***	10/06/2021	Traffic modelling undertaken for the Transport Assessment (TA) identifies issues on the wider road network as a result of the Scheme.	Changes required to the existing road network, leading to cost increases Reputational damage to NCC Increased objection to the planning application	4	2	8	MEDIUM	Undertake modelling for the TA early in the programme Work with stakeholders to identify acceptable solutions if changes to the local road network are required	4	2	8	MEDIUM	4	1	4	LOW	65.50%				30/08/2022	Open
Strategic	M - Planning / DCO	***M09***	04/05/2022	Neutrient Neutrality impacts design … local planning authorities have learned from Natural England that development in some catchments cannot proceed if it increases levels of nutrients.	Design changes required to ensure the project is neutrient neutral.	2	3	6	MEDIUM	Determine whether the project is impacted by the recent change in legislation.	2	3	6	MEDIUM	2	3	6	MEDIUM	13.00%	£32,500	£65,000	£97,500	05/09/2023	Open
Operational	N - Procurement	***N01***	18/06/2018	The project may encounter unexploded ordinance while conducting surveys or construction.	Removal costs which include further investigations and specialist resource for the removal Stand down while the site is investigated	3	1	3	LOW	Desk study to review historic use of land, review county archive bomb map etc, geophysics surveys and scans prior to construction	3	1	3	LOW	3	1	3	LOW	35.50%	£189,845	£379,689	£759,378	18/12/2026	Open
Strategic	N - Procurement	***N02***	18/06/2018	Potential effects on the Source Protection Zone (SPZ).	May require redesign of drainage solution	2	2	4	LOW	Apply lessons learnt from NDR & Postwick Hub.	2	4	8	MEDIUM	2	2	4	LOW	13.00%				03/02/2023	Open
Operational	N - Procurement	***N04***	29/01/2019	The project may encounter the presence of a layer of not previously identified soft and/or organic soil.	Necessity to carry out ground improvement and a need for strengthened construction platform results in cost escalation.	2	1	2	LOW	Targeted ground investigation to allow advance notice and appropriate design.	1	1	1	LOW	2	1	2	LOW	13.00%				18/12/2026	Open
Operational	N - Procurement	***N05***	29/01/2019	The project may encounter the presence of solution features in Chalk (e.g. sinkholes and geotech issues).	Necessity to carry out grouting of solution features results in cost escalation	3	1	3	LOW	Targeted ground investigation may not encounter this. Thus allowance should be provided for this to be addressed by the Contractor during the construction	3	1	3	LOW	3	1	3	LOW	35.50%				18/12/2026	Open
Operational	N - Procurement	***N06***	29/11/2019	As a result of the alignment changes and access difficulties the GI may not cover the exact locations of the proposed structures and earthworks.	Delay to programme while addition GI is undertaken Cost increase/programme increases if poorer round conditions are encountered in areas that have not be assessed	1	1	1	LOW	Main GI be carried out by the Contractor on the basis of agreed frozen design	5	1	5	LOW	5	1	5	LOW	90.00%				05/09/2023	Open
Operational	P - Construction	***P01***	18/06/2018	Protestors to the project may physically stop work. Note: Risk considers the impact on the Stage Two Work.	Delays to project while the police remove protestors The project needs to enhance site security	3	1	3	LOW	Public consultation to identify objection risk, work with key stakeholders and landowners and keep informed of scheme benefits. Seek solution which minimises environmental effects, EIA, Stakeholder management plan, local liaison group	3	1	3	LOW	3	1	3	LOW	35.50%	£273,189	£546,378	£1,092,756	18/12/2026	Open
Operational	P - Construction	***P03***	02/07/2018	Supplier may underperform.	Delays Renegotiation Increased cost to meet conditions	3	1	3	LOW	Use appropriate contract terms and supervision. A suitably experience Project Manager with prior experience of project managing a major project under the NEC will drive performance.	3	1	3	LOW	3	1	3	LOW	35.50%	£164,847	£295,488	£556,770	18/12/2026	Open
Operational	P - Construction	***P05***	18/06/2018	The project may disrupt the river sediment during construction.	Objections from the EA Project on hold or activities curtailed while mitigations and plans are put in place Increased costs to address potential claims Reputational impact to NCC	2	1	2	LOW	Robust industry best practice method statements to be in place and adhered to. Construction Environmental Management Plan (CEMP) to be prepared and adhered to.	2	5	10	MEDIUM	2	1	2	LOW	13.00%	£31,801	£63,603	£127,205	31/12/2025	Open
Operational	P - Construction	***P08***	18/06/2018	Noise nuisance, Dust and Vibration limits exceeded	Restrictions placed on planned work, increasing costs and programme	2	1	2	LOW	Management plan to be in place and followed. Construction allowances to consider any restrictions.	2	1	2	LOW	2	1	2	LOW	13.00%	£40,660	£81,320	£162,639	29/06/2023	Open
Operational	P - Construction	***P10***	02/07/2018	Poor management of temporary works / traffic management / diversions.	Adverse impact of temporary work on the local highway network.	2	1	2	LOW	Industry best practice to be followed in planning and execution.	3	1	3	LOW	2	1	2	LOW	13.00%	£31,801	£63,603	£190,808	18/12/2026	Open
Operational	P - Construction	***P11***	02/07/2018	The project may not provide the agreed construction access routes and site compound for storage / assembly / site office.	Difficulties gaining access to sites/site compounds not arranged in time for construction. Cost claims from contractors for extra planning, costs and project delays	2	1	2	LOW	Early discussions with land owners to include access requirements. Contractor to adequately consider available access.	1	1	1	LOW	2	1	2	LOW	13.00%				29/03/2023	Open
Operational	P - Construction	***P12***	02/07/2018	Water and land pollution risk during piling works.	Pollution of river and ground water during piling works. Mitigation and corrective work costs. Reputational impact for NCC	2	1	2	LOW	Industry best practice to be followed in order to minimise risk of pollution including seeking specialist guidance.	2	1	2	LOW	2	1	2	LOW	13.00%	£50,021	£100,041	£200,082	18/12/2026	Open
Operational	P - Construction	***P16***	28/02/2019	Supply chain capacity. Note. This risk merely considers the risk associated with the Contractor's resource. Risk J02 considers the wider issue in respect of the Client's resource.	Other projects in the local area/the country increase demand for supply chain expertise, capacity and raw materials, pushing up costs and/or increasing lead times causing delay.	4	1	4	LOW	Sufficient contingency time to be included in construction/delivery programme. Suppliers to be engaged early in the project and procurement process started as early as possible.	4	1	4	LOW	4	1	4	LOW	65.50%	£251,887	£1,008,924	£2,017,848	18/12/2026	Open
Operational	P - Construction	***P17***	28/02/2019	Bespoke construction equipment required.	Bridge construction equipment such as incremental launching system, launching gantries, and large cranes may incur additional costs. Not standard/commodity products, so price could be difficult to estimate accurately. Five retaining walls are now included in the updated design and one of them is a tall structure.	2	2	4	LOW	Sufficient contingency cost to be included in construction/delivery cost estimate, or uncertainty of cost stated/communicated appropriately. Suppliers to be engaged early in the project and procurement process started as early as possible.	2	2	4	LOW	2	2	4	LOW	13.00%	£154,430	£308,860	£617,720	18/12/2026	Open

						Opening Risk Assessment					Current Status				Mitigated Risk Assessment:				Mitigated Risk Assessment:					
Risk A Category	**Risk B Category**	***QRA Ref***	**Date added**	**Risk Description (lack of, failure to…)**	**Impact of Risk**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Risk Mitigation Measures**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Likelihood**	**Impact**	**Risk Score**	**Risk Level**	**Probability**	**Minimum** **£22,334,226**	**Most Likely** **£37,366,322**	**Maximum** **£69,162,534**	**Target Resolution Date**	**Status**
Operational	P - Construction	***P20***	10/08/2020	Temporary works provision in the forecast is found to be insufficient for the Contractor's design and construction methodology, subject to obtaining further GI in Stage One.	Increased temporary works over and above that envisaged in the tender pricing and forecast.	2	2	4	LOW	Sufficient contingency cost to be included in construction/delivery cost estimate, or uncertainty of cost stated/communicated appropriately.	2	2	4	LOW	2	2	4	LOW	13.00%	£168,372	£218,393	£318,434	18/12/2026	Open
Strategic	Q - Stakeholders	***Q01***	02/07/2018	There may be a change in NCC's political landscape which affects support for the scheme.	Lack of support / political will reduce support for funding	2	1	2	LOW	Ensure all stakeholders are engaged and monitor political changes.	2	4	8	MEDIUM	2	1	2	LOW	13.00%		£39,790	£79,580	18/12/2026	Open
Strategic	Q - Stakeholders	***Q02***	02/07/2018	Lack of stakeholder support.	Scheme redesign resulting in additional cost / programme delays	1	1	1	LOW	Ensure all stakeholders are engaged and monitor political changes.	2	1	2	LOW	1	1	1	LOW	2.50%				18/12/2026	Open
Operational	Q - Stakeholders	***Q03***	02/07/2018	Poor data safety control.	Hard copies of returned land owners information lost or stolen. Reputational impact and commercially unfavourable.	1	1	1	LOW	Define and follow a robust process	2	2	4	LOW	1	1	1	LOW	2.50%				18/12/2026	Open