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Table of Contents**

Executive Summary	13
1 Introduction	15
1.1 Background	15
1.2 Project Control Framework	16
1.3 The Identified Problem	17
1.4 Purpose of the Report	17
1.5 Overview of Timeline of PCF Stages and the Document	18
2 Planning Brief	20
2.1 Introduction	20
2.2 National Policy	20
2.3 Local Policy	24
3 Existing Conditions	27
3.1 Description of Locality	27
3.2 Existing Highway Network	28
3.3 Traffic	30
3.4 Collision Data	35
3.5 Topography, Land Use, Property and Industry	36
3.6 Climate	37
3.7 Drainage and Flooding	37
3.8 Geology	39
3.9 Unexploded Ordnance	42
3.10 Mining Operations (Current and Historical)	42
3.11 Public Utilities	42
3.12 Technology	43
3.13 Maintenance Access	44
4 Environment including Environmental Status Stage 1	45
4.1 Introduction	45
4.2 Air Quality	45
4.3 Cultural Heritage	47
4.4 Landscape and Visual	49
4.5 Nature Conservation and Biodiversity	56
4.6 Materials	60
4.7 Geology and Soils	62
4.8 Noise and Vibration	66
4.9 People and Communities	67
4.10 Road Drainage and Water Environment	70
5 Accessibility and Integration	73

5.1	Existing NMU Provision	73
5.2	Existing Access to Transport Systems	73
5.3	Existing Severance	74
5.4	Integration	74
6	Maintenance	75
6.1	Repair Statement	75
6.2	Asset Condition	75
6.3	Planned Maintenance	75
6.4	Strategic Diversion Routes	76
7	Planning Factors	77
7.1	Developments	77
8	Other Relevant Factors	78
9	Description of Route Options	79
9.1	Route Option Development	79
9.2	Option 1 Online Dualling plus Free flow Slip from A1 Southbound	80
9.3	Option 2 Part online part offline to the North plus free flow slip road from the A1 Southbound	81
9.4	Option 3 Offline to the South plus free flow slip road from the A1 Southbound	82
9.5	Option 4 Offline to the South of the River	83
9.6	Option 5 Offline to the North plus Free flow slip road from the A1 Southbound	84
9.7	Option 6 Offline to the North plus Free flow slip road from the A1 Southbound	85
9.8	Option 7 Offline to the North plus Free flow slip road from the A1 Southbound	86
9.9	Option 8 Part Offline to the North Part Offline to the South plus Free flow slip road from the A1 Southbound	87
9.10	Option 9 Part Online Part Offline to the South plus Free flow slip road from the A1 Southbound	88
10	Initial Assessment of Options	89
10.1	Introduction	89
10.2	EAST (Early Assessment Sifting Tool)	89
10.3	Highways England KPI Assessment	89
10.4	Further Sifting Assessment	90
10.5	Environmental Assessment for Initial Options Review	90
10.6	Transportation Assessment for Initial Options Review	92
10.7	Engineering Assessment for Initial Options Review	93
10.8	Comparative Economic Assessment for Initial Options Review	96
11	Options Ranking, Sifting and Review	98
11.1	Options Review Meeting	98
11.2	Initial Options Review Conclusions and Recommendations	99
11.3	Options Selected for Further Assessment	102
12	Traffic Analysis of Sifted Options PCF Stage 1	105
12.1	Introduction	105
12.2	Modelling Approach	105
12.3	Model Validation	108

12.4	Forecasting Methodology	112
12.5	Modelling Outputs	113
12.6	Conclusions	114
13	Engineering Overview of Sifted Options (PCF Stage 1)	116
13.1	Introduction	116
13.2	Highways Alignment	116
13.3	Departures from Standard	118
13.4	NMU Provision	119
13.5	Side Roads, Access and Accommodation Works	120
13.6	Drainage and Flooding	121
13.7	Geotechnical Considerations	123
13.8	Structures – High Level Structures Strategy	124
13.9	Public Utilities	125
13.10	Topography, Land Use, Property and Industry	127
13.11	Buildability	128
13.12	Effective Construction Management – Construction (Design and Management) Regulations 2015	130
14	Operational, Technology and Maintenance Assessment of Sifted Options	131
14.1	Operational Assessment	131
14.2	Technology Assessment	131
14.3	Maintenance Assessment	131
15	Safety Assessment of Sifted Options	133
15.1	Introduction	133
15.2	Summary of Safety Assessment	133
16	Environmental Assessment of Sifted Options PCF Stage 1	135
16.1	Introduction	135
16.2	Option 1	135
16.3	Option 8	142
16.4	Option 10	149
17	Detailed Cost Estimate of Sifted Options	158
17.1	Introduction	158
17.2	The Options Estimate	158
17.3	Review of the Estimate	158
17.4	Summary of Estimate	158
17.5	Relative Estimates for other Options	159
18	Economic Assessment of Sifted Options (Stage 1)	162
18.1	Introduction	162
18.2	Methodology	162
18.3	Assessment Results	163
18.4	Economic Summary Tables	167
18.5	Non-Monetised Benefits	168

18.6	Value for Money	169
18.7	Non-Monetised Benefits	169
19	Assessment Summary of Sifted Options	170
19.1	Introduction	170
19.2	Appraisal Summary Table (ASTs)	170
19.3	Engagement with Public Bodies.	170
20	Stage 1 Conclusions and Transition to Stage 2	172
20.1	Stage 1 Conclusions	172
20.2	Transition to Stage 2	173
21	Scheme Value Management Deep Dive	174
21.1	Introduction	174
21.2	Value Management Deep Dive Process	174
21.3	Review Outcomes and Impact on Previous Assessments	175
21.4	Options for Stage 2 Assessment	175
22	Option Renumbering for Consultation	176
23	Engineering Overview of Affordable Options Stage 2	177
23.1	Introduction	177
23.2	Highways Alignment	177
23.3	Departures from Standard	178
23.4	NMU Provision	178
23.5	Side Roads, Access and Accommodation Works	179
23.6	Drainage and Flooding	180
23.7	Geotechnical Considerations	181
23.8	Structures – High Level Structures Strategy	181
23.9	Public Utilities	182
23.10	Topography, Land Use, Property and Industry	182
23.11	Effective Construction Management – Construction (Design and Management) Regulations 2015	182
23.12	Operational, Technology, Safety and Maintenance Assessment	183
24	Non-Statutory Public Consultation	184
24.1	Introduction	184
24.2	Public Consultation Process	184
24.3	Public Consultation Material	186
24.4	Public Consultation Exhibition	187
24.5	Meetings with affected parties	188
24.6	No. of Responses	188
25	Assessment of Consultation Responses	189
25.1	Introduction	189
25.2	Key Response Statistics	189
25.3	Key Stakeholder Responses	193
25.4	Main Response Themes	200

25.5	How Responses were taken Forward	203
26	Detailed Cost Estimate of Affordable Options (PCF Stage 2)	204
26.1	Introduction	204
26.2	Summary of Estimate	204
26.3	Derivation of Costs for Economic Assessment	204
27	Preferred Route Decision Process	206
27.1	Introduction	206
27.2	Preferred Route Decision Workshop	206
27.3	Key Constraints	207
27.4	Alignment to Highways England Strategic Objectives	208
27.5	Traffic and Economic Assessment Pre-PRD	208
27.6	Environmental Assessment Pre-PRD	209
27.7	PIE Summary	216
27.8	Buildability Analysis	217
27.9	Key Risks and Opportunities	217
27.10	Cost and BCR	218
27.11	Overall Assessment Summary at PRD	219
27.12	Preferred Route Decision	220
27.13	Preferred Route Viability	221
27.14	Interim SGAR 2	221
28	Traffic Analysis	223
28.1	Introduction	223
28.2	Modelling Approach - SATURN	223
28.3	Modelling Approach – S-Paramics	229
28.4	Validation – SATURN	230
28.5	Validation – S-Paramics	230
28.6	Forecasting Methodology	233
28.7	Modelling Outputs	234
28.8	Impact of dualling between dumbbell roundabouts at the A1/A47 interchange	238
28.9	Conclusions	240
29	Economic Assessment	241
29.1	Introduction	241
29.2	Methodology	241
29.3	Assessment Results	244
29.4	Summary Tables	246
29.5	Non-Monetised Benefits	248
30	Environmental Assessment PCF Stage 2	250
30.1	Introduction	250
30.2	Assessment Methodology	250
30.3	Environmental Assessment of Proposed Options	250
30.4	Air Quality	250

30.5	Cultural Heritage	252
30.6	Landscape and Visual	253
30.7	Nature Conservation and Biodiversity	255
30.8	Noise and Vibration	257
30.9	Road Drainage and Water Environment	258
30.10	People and Communities	260
30.11	Geology and Soils	261
30.12	Materials and Waste Management	263
30.13	Conclusions	263
30.14	Next Steps and Potential Mitigation	264
31	Additional Assessment of Public Consultation	268
31.1	Introduction	268
31.2	Filtered Route Comments	268
31.3	Review of Comments	268
32	Other Relevant Factors considered in PCF Stage 2	270
32.1	Summary of Engagement with Public Bodies in PCF Stage 2	270
32.2	Assessment of Planning Requirements, National and Local Policy	270
32.3	Assessment of Options against Planning Factors	272
33	Appraisal Summary Table	273
34	Programme	274
35	Validation of Preferred Route	275
35.2	Environmental	275
35.3	Economics	276
35.4	Overall Validation	276
36	Conclusion and Recommendations	277
36.1	Introduction	277
36.2	Conclusions	277
36.3	Recommended PRA Route	277
36.4	PCF Stage 3	278
37	List of Appendices	279

Tables

Table 1-1: Major Projects Lifecycle	17
Table 2-1: Road Investment Strategy – Performance Specification and Key Performance Indicators	22
Table 3-1: Strategic Saturn Models covering the A47 Corridor	30
Table 3-2: Bedrock Geology	39
Table 3-3: A47 Existing Embankments	41
Table 3-4: A47 Ceased Opencast Pits.....	42
Table 4-1: Approximate Counts of Human Receptors within the Study Area	45
Table 4-2: Designated Ecological Sites Vulnerable to Nitrogen Deposition	46
Table 4-3: Scheduled Ancient Monuments within the Study Area.....	47
Table 4-4: Conservation Areas within 1.5km of the A47	48
Table 4-5: Designated sites	56
Table 4-6: Non-statutory Designated Sites	57
Table 4-7: Habitats	58
Table 4-8: Ecological Features	59
Table 4-9: Key Constraints Materials and Waste	60
Table 4-10: Nearest Waste Infrastructure.....	61
Table 4-11: Key Constraints Geology and Soils	65
Table 10-1: KPI Assessment	90
Table 10-2: Ranking of Options from Environmental Assessment	92
Table 10-2: Ranking of Options from Transportation Assessment.....	93
Table 10-3: Ranking of Options from Engineering Assessment.....	95
Table 10-4: Summary of Economic Ranking	97
Table 11-1: Overall Ranking from Initial Assessments	98
Table 11-2: Initial Options Review Conclusions and Recommendations	99
Table 11-3 Option Grouping.....	100
Table 12-1: Wansford to Sutton scheme MCCs	108
Table 12-2: Link flow validation against PTM base model.....	109
Table 12-3: Link flow validation against PTM 2016 forecast model	110
Table 12-4: The origins/destinations of traffic on the A47 between Wansford and Sutton.....	111
Table 12-5: Journey times for vehicles using A1 and A47.....	114
Table 13-1: Structures for Option 1, 8 and 10.....	124
Table 17-1: Option Estimates.....	158
Table 17-2: Stage 0 Order of Magnitude Estimate	159
Table 17-3: Derivation of Scheme Costs	160
Table 18-1: Calculation of annualisation factors for each time period	163
Table 18-2: Scheme benefits resulting from reduction of accidents	165
Table 18-3: Economic benefits by origin and destination sector	167
Table 18-4: Transport Economic Efficiency (TEE).....	167
Table 18-5: Public Accounts	168
Table 18-6: Analysis of Monetised Costs and Benefits	168

Table 18-7: Value for Money Categories	169
Table 21-1 VM Workshop Dates	174
Table 21-2 Cost Estimates for Value Engineered Solution.....	175
Table 22-1 Option Re-numbering	176
Table 23-1: Structures for all Options	181
Table 24-1 Public Information Exhibition Details	188
Table 25-1 Key Stakeholder Option Preference	200
Table 26-1: Option Estimates PCF Stage 2.....	204
Table 26-2: Option Estimates PCF Stage 1.....	204
Table 26-3: Estimated costs for Wansford to Sutton scheme at 2010 values and prices	205
Table 27-1 KPI Assessment.....	208
Table 27-2 Environment Assessment Summary (7 point scale).....	209
Table 27-3 Environment Assessment Summary (based on Rankings)	210
Table 27-4 Receptor Counts*.....	211
Table 27-5: Noise Sensitive Receptor Counts	214
Table 27-6: Draft Cost Estimates.....	219
Table 27-7: Indicative BCR values using Paramics.....	219
Table 27-8: Pros and Cons of Options.....	221
Table 28-1: MCCs Procured by PCC within Scheme’s Area of Influence	225
Table 28-2: Additional MCCs procured for PCF Stage 2.....	228
Table 28-3: Journey time validation results	231
Table 28-4: ATC validation results.....	232
Table 28-5: Surveyed journey time routes for operational assessment	235
Table 29-1: Estimated costs for Wansford to Sutton scheme at 2010 values and prices	241
Table 29-2: TTM models used in construction assessment	242
Table 29-3: Active durations for each TTM model.....	243
Table 29-4: Core scenario scheme disbenefits due to TTM during construction	244
Table 29-5: Core scenario scheme benefits due to reduction in accidents	245
Table 29-6: Transport Economic Efficiency (TEE) Tables.....	246
Table 29-7: PA tables.....	247
Table 29-8: Core scenario AMCB tables	247
Table 29-9: Value for Money Categories	248
Table 30-1 Sensitive Receptors.....	251
Table 30-2: Noise Sensitive Receptors.....	257
Table 30-3: Environmental Ranking of Options	263
Table 33-1: Summary of Key Milestones	274

Figures

Figure 3-1: Location Plan	27
Figure 3-2: Locality of Scheme	28
Figure 3-4: 2015/16 Daily Flows by Month Diagram.....	32

Figure 3-5: Relationship of average weekday flow to theoretical capacity on A47 eastbound, typical weekday 2015/16	33
Figure 3-6: Relationship of average weekday flow to theoretical capacity on A47 westbound, typical weekday 2015/16	34
Figure 3-7: Flow Diagram Schematic for Existing Traffic data	35
Figure 9-1: Option 1	80
Figure 9-2: Option 2	81
Figure 9-3: Option 3	82
Figure 9-4: Option 4	83
Figure 9-5: Option 5	84
Figure 9-6: Option 6	85
Figure 9-7: Option 7	86
Figure 9-8: Option 8	87
Figure 9-9: Option 9	88
Figure 11-1: Option 10 Offline to the North	101
Figure 11-2: Options selected for Further Assessment	102
Figure 11-3: Option 1A Online Dualling with Grade Separation at Nene Way roundabout	103
Figure 11-4: Online Dualling without free flow slip road from A1 south	104
Figure 12-1: Extents of the Peterborough Transport Model	106
Figure 12-2: Wansford to Sutton scheme MCCs	108
Figure 12-3: Routes used in journey time analysis	113
Figure 16-1: Option 1	135
Figure 16-2: Option 8	143
Figure 16-3: Option 10	151
Figure 25-1 Types of Road User	189
Figure 25-2 Frequency of Travel along the A47 Wansford to Sutton Route	190
Figure 25-3 Purpose of Travel along the A47 Wansford to Sutton Route	190
Figure 25-4 Proximity to the Wansford to Sutton Route	191
Figure 25-5 The need for Improvement on the Wansford to Sutton Route	191
Figure 25-6 Responses on the provision for pedestrians, cyclists, equestrians and/or other users	192
Figure 25-7 Comparison of Support and Opposition to Proposed Options	193
Figure 28-1: Wansford to Sutton scheme Area of Influence	224
Figure 28-2: Strategic model link structure	225
Figure 28-3: MCCs Procured by PCC in 2014 and 2015 within Scheme's Area of Influence	227
Figure 28-4: Additional MCCs procured by Amey for PCF Stage 2 in 2016	228
Figure 28-5 Wansford to Sutton microsimulation model link structure	229
Figure 28-6: Observed journey times on A47 and A1	231
Figure 28-7: Junction-to-junction link flows at 2021 traffic levels	237
Figure 28-8: Junction-to-junction link flows at 2036 traffic levels	238
Figure 28-9: Impact of dualling between dumbbell roundabouts at the A1/A47 interchange	239
Figure 29-1: Wansford to Sutton construction plan work sites	242

List of Acronyms

AADT	Annual Average Daily Traffic
APTR	All Purpose Trunk Roads
AQMA	Air Quality Management Area
ASR	Appraisal Specification Report
AST	Appraisal Summary Table
BCR	Benefit Cost Ratio
BGS	British Geological Survey
CCTV	Closed-circuit Television
CDM	Construction Design and Management Regulations
COBA	Cost Benefit Appraisal
CPO	Compulsory Purchase Order
CSR	Client Scheme Requirements
CWS	County Wildlife Site
DCO	Development Consent Order
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EAR	Environmental Assessment report
EcAR	Economic Assessment Report
EAST	Early Assessment and Sifting Tool
HA	Highways Agency (replaced by Highways England on 1 April 2015)
HADDMS	Highways Agency Drainage Data Management System
HAGDMS	Highways Agency Geotechnical Data Management System
HCA	Homes and Communities Agency
KPI	Key Performance Indicator
LEP	Local Enterprise Partnership
LWS	Local Wildlife Site
NMU	Non-Motorised User
NPPF	National Planning Policy Framework
NPSNN	National Policy Statement for National Networks
NSIP	Nationally Significant Infrastructure Project
OME	Order of Magnitude Estimate
ORM	Options Review Meeting
PCF	Project Control Framework
PERA	Preliminary Environmental Risk Assessment
PSSR	Preliminary Sources Study Report
RAG	Red, Amber, Green
RIS	Roads Investment Strategy
SPB	Strategic Business Plan
SRN	Strategic Road Network
SSSI	Sites of Special Scientific Interest
SSD	Stopping Sight Distance
TAME	Traffic Appraisal, Modelling & Economics
TAR	Technical Appraisal Report
TEE	Transport Economic Efficiency
TM	Traffic Management
TRADS	Traffic Flow Data System
TUBA	Transport appraisal and modelling tools
VM	Value Management
WebTAG	Web based Transport Analysis Guidance
WFD	Water Framework Directive
WSI	Written Scheme of Investigation

Executive Summary

The A47 and A12 trunk roads form part of the strategic road network and provide for a variety of local, medium and long distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich and Peterborough, the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft and a succession of villages in what is largely a rural area.

Highways England is responsible for planning the long-term future and development of the Strategic Road Network and has identified through previous route feasibility study key investment needs on the A47 corridor. The A47 Wansford to Sutton Dualling scheme was identified as one such location in the Department for Transport's Road Investment Strategy (RIS) which was published in March 2015.

This report summarises the work done in PCF Stages 1 and 2, building on work completed in PCF Stage 0.

In PCF Stage 1 ten options were identified for consideration. An initial assessment was made of these options to identify their performance against environmental, engineering, transportation and economic criteria so that they could be compared to allow the most appropriate options to be taken forward. Three options were selected for further assessment in PCF Stage 2 and non-statutory public consultation. Cost estimate was received for one representative option.

Early in PCF Stage 2, a Value Management Deep Dive exercise was undertaken due to the high costs associated with the representative shortlisted option, meaning it was over the RIS budget and not economically viable. The results from the Value Management Deep Dive exercise reduced the costs to be economically viable and the measures were implemented on all three route options to allow fully assured estimates to be developed for each of the options.

These three options were further assessed with regard to traffic modelling, environmental impact and engineering suitability, along with economic performance and buildability to ensure suitability for solving the identified transport problem.

The process resulted in the preferred route being a re-aligned version of Option 2 and will progress to PCF Stage 3. Key concerns raised in the public consultation have influenced an amendment to the original proposed Option 2.

Based on the evidence reviewed assessed and presented, there is a clear rationale for dualling the section of the A47 between Wansford to Sutton and the report concludes:

- There is a current transport issue caused by the restriction of highway network capacity by the existing single carriageway section of the A47 Wansford to Sutton.
- Dualling of the A47 Wansford to Sutton provides a feasible potential solution to the identified transport problem.
- Journey time benefits and accident reduction from each of the options give a clear case for the improvement works.
- The solutions assessed at this stage appear feasible to design and construct. Although feasible, careful consideration is needed in regards to engineering solutions to minimise impacts on local conditions.
- The result of the non-statutory public consultations was overall positive, with local people expressing their support for the scheme.

- Indications based on economics assessment in PCF Stage 2 were that Option 1 would likely deliver high VfM (BCR between 3 and 4), whereas Options 2 and 3 would likely deliver very high VfM with BCRs in excess of 4.0.
- Further development of the design, in particular the provision for non-motorised users (NMU's) is required as the Scheme progresses.
- The construction methodology needs careful consideration to ensure disruption is minimised for the local area and users of the A47.
- The programme remains challenging, taking into consideration the required statutory processes.

1 Introduction

1.1 Background

1.1.1 Highways England (previously the Highways Agency) is responsible for planning the long-term future and development of the Strategic Road Network (SRN) including its maintenance, operation and improvement. Highways England published its Strategic Business Plan (SBP) in response to the Government's Road Investment Strategy (RIS) in 2014. The SBP sets out Highways England's main activities and strategic outcomes and sets how they will deliver the Investment Plan. Highways England's Delivery Plan builds on the SBP, setting out in detail how strategic outcomes will be delivered and success measured, while identifying future goals and plans. Highways England's strategic outcomes are:

- Supporting Economic Growth
- A Safe and Serviceable Network
- A More Free-Flowing Network
- Improved Environment
- An Accessible and Integrated Network

1.1.2 Highways Agency developed a Route Based Strategy approach to identify key investment needs on the SRN.

1.1.3 The Route Based Strategy brought together both national and local priorities which have been captured in 18 Route-Based Strategy Evidence Reports, used to inform the RIS.

1.1.4 In 2014 AECOM carried out feasibility studies for Highways Agency and the Department for Transport (DfT) to identify issues on the Strategic Road Network on the A47/A12 Corridor between the A1 west of Peterborough and Lowestoft (south of the A47's junction with the A12). The study was completed in three stages that, overall, broadly aligned with Steps 5 to 9 of the DfT's Transport Analysis Guidance (WebTAG).

1.1.5 Twenty-two locations were identified that were considered to have current or imminent problems and these were considered further at high level using criteria from the DfT's Early Assessment and Sifting Tool (EAST). AECOM developed the Options Assessment Report (OAR) for each scheme and from this concluded there was a case for investment in the A47 corridor.

1.1.6 As a result of this work, an initial case was made to carry out the following improvements:

- A47 Wansford to Sutton Dualling
- A47 Guyhirn Junction Improvements
- A47 North Tuddenham to Easton Dualling
- A47 Thickthorn Interchange Improvements
- A47 Blofield to North Burlingham Dualling
- A12 Junction Improvements¹

¹ This combines the schemes previously known as A47/A12 Vauxhall Junction improvements and A12 package of roundabout improvements

1.1.7 This study was published on the DfT website and can be found at:

<https://www.gov.uk/government/publications/a47-and-a12-corridor-feasibility-study-technical-report>

1.1.8 In December 2014, the DfT published the RIS for 2015-2020. The RIS sets out the list of schemes that are to be developed by Highways England over the period of April 2015 to March 2020). The RIS confirmed their commitment to the schemes listed above for the A47/A12 Corridor.

1.1.9 Following the publication of the RIS, AECOM produced a high-level appraisal of benefits for the identified schemes on behalf of the DfT. This work was summarised in the A47 & A12 Corridor Feasibility Study (March 2015).

1.1.10 In April 2015 Highways England assumed responsibility for the SRN and for delivering the Government's vision for that network as set out in the RIS. As a result, Highways England took ownership of the previously DfT led Strategy, Shaping and Prioritisation phase of scheme development.

1.1.11 Amey, supported by AECOM were appointed to lead on the work to be carried out on the A47 and A12 in Norfolk in March 2015, to jointly progress the six schemes which comprise the A47 Improvements Programme through Project Control Framework (PCF) Stage 0. This was completed in October 2015 and the Amey/AECOM team were retained to complete PCF Stage 1 for all six schemes.

1.1.12 At PCF Stage 2, Amey and AECOM were appointed separately to progress specific schemes through the stage. Amey would progress A47 Wansford to Sutton, A47 Guyhirn Junction, A47 Tuddenham to Easton and A47 Blofield to North Burlingham. AECOM would progress A47 Thickthorn Interchange and A12 Junction Improvements (later renamed A47 Great Yarmouth junctions).

1.1.13 Each of the six schemes has been progressed separately but collaboratively under this approach.

1.1.14 This report will focus on:

A47 Wansford to Sutton Dualling

1.1.15 Hereafter A47 Wansford to Sutton will be known as the Scheme.

1.2 Project Control Framework

1.2.1 Highways Agency, introduced PCF for their Major Projects directorate in 2008. The framework sets out how major highways schemes should be managed and delivered with consistent products and a well-defined and consistent approach to project governance. The PCF stages are broken down in Table 1-1 below.

1.2.2 This Scheme Assessment Report covers the work done in the Options Phase and covers both PCF Stage 1 and PCF Stage 2 (the stages highlighted orange in Table 1-1 below).

Table 1-1: Major Projects Lifecycle

PCF Stage	Delivery Item	Phase
PCF Stage 0	Strategy, Shaping and Prioritisation	Pre-project
PCF Stage 1	Option Identification	Options Phase
PCF Stage 2	Option Selection	
PCF Stage 3	Preliminary Design	Development Phase
PCF Stage 4	Statutory Procedures and Powers	
PCF Stage 5	Construction Preparation	
PCF Stage 6	Construction, Commissioning and Handover	Construction Phase
PCF Stage 7	Close Out	

1.3 The Identified Problem

- 1.3.1 The section of A47 between Wansford and Sutton acts as a bottleneck, resulting in congestion and leading to longer and unreliable journey times. This section of the A47 also has a poor safety record.
- 1.3.2 The A1 to Sutton section of the A47 has Annual Average Daily Traffic (AADT) flows above the congestion reference flow. For both east and west bound traffic substantial stress is being shown on many sections of the A47, most notably from the A1 to Sutton Roundabout. Significant levels of growth along the route including housing and employment development are unlikely to come forward without improvements to the A47.
- 1.3.3 Road safety should improve by dualling the single carriageway between Wansford and Sutton by building to design standards for a dual carriageway.

1.4 Purpose of the Report

- 1.4.1 The purpose of this Scheme Assessment Report (SAR) is to:
- present the unpublished PCF Stage 1 Technical Appraisal Report (TAR);
 - report on the options development work completed during PCF Stage 2;
 - review the non-statutory public consultation responses; and
 - recommend a Preferred Route.

- 1.4.2 One of the outputs of PCF Stage 1 is the Technical Appraisal Report (TAR) which brings together technical, operational, safety, traffic, economic and environmental assessments and forms the basis for recommendations for which option(s) should be taken forward for Public Consultation during PCF Stage 2.
- 1.4.3 In PCF Stage 2 the Scheme Assessment Report is produced which normally includes a summary of the TAR (from PCF Stage 1) along with reporting on the non-statutory public consultation and consultation results and on any further surveys investigations and assessment work undertaken on the scheme. The SAR also recommends a Preferred Route.
- 1.4.4 In order to meet the RIS target date for start of works on the scheme in March 2020, Highways England took the decision, that where it was necessary to maintain programme, that PCF Stages could be overlapped. This has allowed overall progress on the programme to be achieved by allowing formal technical assessment and completion of reporting from PCF Stage 1 to continue into PCF Stage 2. At the start of PCF Stage 1 it was also assumed that PCF Stage 3 would commence whilst PCF Stage 2 reporting and close out work was being completed.
- 1.4.5 In line with the decision to keep the project on schedule and overlap PCF Stages, Highways England decided to not complete the TAR prior to the start of PCF Stage 2. As a result, the PCF Stage 1 TAR had an incomplete status at the end of PCF Stage 1. Although incomplete, the TAR had been completed as much as possible with information available at the time. To ensure the history and development of the Options Phase is reported in full, this document includes a more detailed report of PCF Stage 1 than might usually be included in a Scheme Assessment Report. This document has therefore been structured as follows;

Chapter 1	Introduction (this Section)
Chapters 2 – 19	reports on the PCF Stage 1 work and includes the majority of the incomplete TAR document, presenting the information as it was known at the time, including any limitations and recognition of unknown factors.
Chapter 20	reports the conclusions of PCF Stage 1 and transition to PCF Stage 2
Chapter 21 - 35	reports on the PCF Stage 2 work including the determination of the preferred route
Chapter 36	reports the conclusions of PCF Stage 2 and recommendations for next steps

1.5 Overview of Timeline of PCF Stages and the Document

Chapter 2-19 (December 2015 to November 2016)

- 1.5.1 PCF Stage 1 commenced in December 2015 and continued until November 2016. As described in Chapter 9 of this report, the Option Identification stage (PCF Stage 1) included developing and expanding new designs based on those that were determined at PCF Stage 0 (completed October 2015). PCF Stage 1 included a sifting of these options at an Options Review Meeting (ORM) (see Chapter 11) in (June 2016). These options were then assessed in terms of performance from a technical, operational, safety, traffic, economic and environmental perspective.
- 1.5.2 The assessment work undertaken following the ORM informed the recommendations for the options that should progress to PCF Stage 2 and be presented at the non-statutory public consultations. The assessments of the information available supported the depth and quality

of work undertaken during stage 1 to allow Highways England to proceed to PCF stage 2. The available qualitative and quantitative information was robust enough to provide a clear decision on the options being taken forward. This information has since been produced and further validates that decision.

- 1.5.3 The first section of the report (Chapters 2 -19) captures PCF Stage 1 as it was at the end of the stage (Nov 2016) including the limitations imposed by programme constraints. Therefore, some elements may have progressed / evolved / changed and these are reflected in the second part of this report.

Chapter 20 (December 2016)

- 1.5.4 The conclusion of PCF Stage 1 and the transition to PCF Stage 2 is reported in Chapter 20 and includes the governance process that was followed to ensure the scheme could progress to the next stage.

Chapter 21 to Chapter 27 (January 2017 to June 2017)

- 1.5.5 Following a review of the commercial information available at the end of PCF Stage 1, it was determined that all the sifted options from PCF Stage 1 were unaffordable when compared to the scheme budgets allocated as part of the RIS 1 commitments. PCF Stage 2 therefore commenced with a value management review of the sifted options to determine if a viable affordable option could be promoted. The value management exercise is described in Chapter 21. In parallel, although limited by the value management exercise, PCF Stage 2 commenced in January 2017. Early PCF Stage 2 activities included the engineering development of the sifted option assessments (Chapter 23) as well as preparing for the Non-Statutory Public Consultation; the latter is covered in Chapters 24 and 25.
- 1.5.6 A further review of the programme pressures and requirements to meet the March 2020 deadline led to Highways England bringing forward the programmed date for the Preferred Route Announcement. The determination of the preferred route and a summary of the available information at the time of the decision, is presented in Chapter 27.

Chapter 28 to Chapter 35 (June 2017 to October 2017)

- 1.5.7 In order to validate the early preferred route decision, assessment work continued beyond the Preferred Route Announcement; this is reported in Chapters 28 to 35. Any variance from previous assumptions or issues associated with the early determination of the Preferred Route are captured in these sections.

Chapter 36 (November 2017).

- 1.5.8 Chapter 36 presents conclusions from PCF Stage 2 and recommendations for future stages.

2 Planning Brief

2.1 Introduction

- 2.1.1 This section summarises relevant national and local policies which have been considered during PCF Stage 1 of the Scheme.
- 2.1.2 Subsequent changes to National and Local policies are picked up in Chapter 32 of this report during PCF Stage 2.

2.2 National Policy

National Policy Statement for National Networks

- 2.2.1 The National Policy Statement for National Networks (NPSNN) sets out the need for Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England, and the Government's policy to deliver these projects. The National Policy Statements supplement the National Planning Policy Framework. NPSNN sits alongside the Road Investment Strategy.
- 2.2.2 There is an assumption within NPSNN that significant improvements to the road network will be necessary in order to support the Government's vision for the national networks. Paragraph 2.21 of the document sets out a range of alternatives to major improvements to the network including Maintenance and Asset Management, Demand Management and Modal Shift. However, it is concluded that at a strategic level there is a compelling need for development of the national road network.
- 2.2.3 The NPSNN states that the assessment of the proposed scheme should consider the balance of potential benefits and adverse impacts (paragraph 4.3). Benefits to be considered include the facilitation of economic development, job creation, housing and environmental improvement, and any longer-term or wider benefits. Assessment of adverse impacts should include longer-term and cumulative adverse impacts, as well as planned mitigation of these impacts.
- 2.2.4 The NPSNN requires environmental, safety, economic and social impacts should be considered at a national, regional and local level. The information provided will be proportionate to the development (paragraph 4.4).
- 2.2.5 All projects should be subject to an options appraisal. The options appraisal should consider viable modal alternatives and may also consider other options (paragraph 4.27). Section 6 of the Wansford to Sutton Evidence Review (July 2015) responds to this requirement.
- 2.2.6 Section 5 of NPSNN gives guidance for decision making relating to impacts on environment, habitat, landscape, accessibility and existing infrastructure. In relation to environmental impacts, the guidance is clear that planning permission should not be granted for schemes which will have a detrimental impact on irreplaceable habitats, including ancient woodland (paragraph 5.32).
- 2.2.7 It is expected that schemes subject to a Development Consent Order (DCO) will be examined against criteria set out in Section 5 of NPSNN.
- 2.2.8 It is assumed that the Wansford to Sutton dualling scheme will meet the criteria for a National Significant Infrastructure Project and will therefore be subject to the Development Consent Order (DCO) process. In this case, the planning application will be judged primarily against the National Planning Statement for National Networks (NPSNN), according to the decision-

making framework set out in the Planning Act 2008. Further detail is discussed in Chapter 32 of this report.

The Road Investment Strategy

- 2.2.9 The DfT's Road Investment Strategy (RIS) defines a national programme of improvements to the SRN.

Strategic Vision

- 2.2.10 The RIS introduces long-term strategic planning and funding for the SRN, underpinned by a significant increase in investment in the SRN. It is the ambition of Highways England to substantially modernise the SRN within 25 years.
- 2.2.11 127 major schemes will be undertaken over the course of the first Road Period (2015-2020), in order to deliver benefits quickly.
- 2.2.12 In the longer term, up to 2040, Highways England look to achieve an upgraded network which makes use of the latest technology in order to fulfil the Performance Specification.

Investment Plan

- 2.2.13 The RIS sets out a number of specific locations for improvements to the SRN.
- 2.2.14 As part of the Spending Review announcement made in June 2013, the Department committed to undertaking six feasibility studies to help identify and fund solutions to tackle some of the most notorious and long-standing road hot spots in the country. These studies included work at six locations within the A47/A12 corridor.
- 2.2.15 The study considered and analysed the evidence available on the current problems faced at each location and the potential issues or future pressures that may arise. The work identified the priority needs for investment and reviewed a number of potential investment options and their performance in tackling those issues. Further work and analysis looked at the strength of the economic case for the investment and the degree to which they demonstrated value for money, and their deliverability within the first Road Period.
- 2.2.16 An investment package worth over £300 million on the A47/A12 corridor is outlined in the RIS Part 2: Investment Plan, Page 25.
- 2.2.17 It lists "A47 Wansford to Sutton – dualling of the A47 between the A1 and the dual carriageway section west of Peterborough" as one of the schemes for improvement.

Performance Specification

- 2.2.18 The RIS provides a Performance Specification and Key Performance Indicators (KPIs) for Highways England.
- 2.2.19 **Table 2-1** summarises the Key Performance Indicators as they apply to each point of the Performance Specification. The KPIs were used as one of the tools for sifting the developed options – this is discussed in detail in Section 10.3.
- 2.2.20 The RIS requires Highways England to develop detailed Performance Indicators (PIs) to provide further detail on how the Company is progressing on each KPI.

Table 2-1: Road Investment Strategy – Performance Specification and Key Performance Indicators

Topic	Measure	Key Performance Indicator Target	Performance Indicator
Making the Network Safer	The number of KSIs on the SRN	Ongoing reduction of at least 40% by end of 2020 against 2005-09 average baseline	Suite of PIs to illustrate the impact of activities undertaken by the Company, and the influence of external factors with regard to making the SRN safer. These should include: Incident numbers and causation factors for motorways; Casualty numbers and causation factors for APTRs; and IRAP based road safety investigations, developed in conjunction with the Department, to feed into subsequent Route Strategies.
Improving User Satisfaction	The percentage of NRUSS respondents who are Very or Fairly Satisfied.	Achieve a score of 90% by 31 March 2017 and then maintain or improve it.	Suite of PIs to provide additional information about the performance of factors that influence user satisfaction.
Supporting the Smooth Flow of Traffic	Network availability: the percentage of the SRN available to traffic.	Maximise lane availability so it does not fall below 97% in any one year	Suite of PIs to illustrate the impact of the activities undertaken by the Company, and the influence of other external factors, on traffic flow. This should include, at a minimum, reliability of journey times.
	Incident Management: percentage of motorway incidents cleared within one hour.	At least 85% of all motorway incidents cleared within 1 hour	
Encouraging Economic Growth	Average Delay (time lost per vehicle)	No Target Set	Suite of PIs to help demonstrate and evaluate what activities have been taken to support the economy. These should, at a minimum, include metrics on: Being an active and responsive part of the planning system; Supporting the business, and freight and logistics sectors; and Helping the government support small and medium sized enterprises.
Deliver Better Environmental Outcomes	Noise: Number of Noise important areas mitigated	At least 1,150 Noise Important Areas over RP1	Suite of PIs to provide additional information about environmental performance. These should, at a

Topic	Measure	Key Performance Indicator Target	Performance Indicator
	Biodiversity: Delivery of improved biodiversity as set out in the Company's Biodiversity Action Plan	Publish Biodiversity Action Plan by 30 June 2015 & report annually against the Plan to reduce net biodiversity loss on ongoing annual basis	minimum, include: Air quality; and Carbon dioxide, and other greenhouse gas emissions for the Company and its supply chain that occur as they carry out work on the SRN.
Helping Cyclists, walkers and other vulnerable users	The number of new and upgraded crossings	No Target Set	Suite of PIs to demonstrate the safety of the SRN for cyclists, walkers, and other vulnerable users.
Achieving Real Efficiency	Cost savings: savings on capital expenditure	At least £1.212 billion over RP1 on capital expenditure.	Suite of PIs to demonstrate that the portfolio is being developed and the Investment Plan delivered in a timely and efficient manner. These should include the progress of major schemes and programmes in construction through reporting CPI and SPI for schemes at Project Control Framework Stage 5 and beyond.
	Delivery Plan progress: progress of work relative to forecasts set out in the Delivery Plan, and annual updates to the Plan, and expectations at the start of RP1	Meet or exceed expectations	

Highways England Strategic Business Plan (2015-2020)

- 2.2.21 Highways England's Strategic Business Plan (SBP) responds directly to the Road Investment Strategy and describes how Highways England will "go about delivering the requirements of a demanding Performance Specification".
- 2.2.22 The SBP defines KPIs against which the performance of Highways England will be measured, based on the Performance Specification included in the RIS.
- 2.2.23 Section 4 of the SBP gives the background to the subsequent publication of the Route Strategies for the entire national network, the relevant Route Strategy for the A47 Corridor being the East of England Route Strategy.

Highways England Delivery Plan (2015-2020)

- 2.2.24 Highways England's Delivery Plan builds on the SBP and sets out in detail how the strategic outcomes and the Investment Plan will be delivered.
- 2.2.25 The A47 Wansford to Sutton dualling is listed under the "Major Improvements Investment Plan Scheme Schedule 2015-2020" as one of the "Schemes identified following the outcomes from the six feasibility studies". The Feasibility Study relevant to the A47 corridor being The A47/A12 Corridor Feasibility Study (February 2015).

2.3 Local Policy

Greater Cambridge Greater Peterborough Enterprise Partnership Strategic Economic Plan

- 2.3.1 The Greater Cambridge Greater Peterborough Local Enterprise Partnership (LEP) Strategic Economic Plan is produced by a partnership between Greater Cambridge and Greater Peterborough and provides a plan for growth in Cambridge and Peterborough.
- 2.3.2 The plan highlights that the A47 is the most important east-west route in the north of the LEP area, and carries up to 42,000 vehicles a day around Peterborough, and around 22,000 vehicles a day on the single carriageway stretch around Wisbech. The mix of functions and the varying quality of the route leads to delay and to unreliable journey times.
- 2.3.3 The A47 Wansford to Sutton dualling is listed as an improvement needed on the trunk/motorway network. The plan states that dualling of the A47 between Wansford and Sutton improves access between the A1, Peterborough, Wisbech and Norfolk to the strategic transport network, and addresses capacity issues on the route which will be exacerbated by planned growth. It states the Government has committed funding to “Dualling the A47 between Wansford and Sutton East, connecting this formerly single carriageway road with the dual carriageway section west of Peterborough”
- 2.3.4 The plan also states “The improvements to the A47 are a welcome start to help overcome some of the challenges this key East-West route currently presents to the growth of our local economy. This funding, coupled with that secured via the first round of our Growth Deal, marks an important step forward in the future of the A47.”

Peterborough City Council, Peterborough Long Term Transport Plan and Integrated Development Plan 2011 to 2026

- 2.3.5 This is a 15 year transport plan assessing the key transport issues in the area. The council have a large focus on promoting green sustainable transport alternatives which falls in line with the local Sustainable Community Strategy. The list of key issues and challenges the plan aims to tackle regarding public transport and the strategic road network include:
- Improve availability and types of public transport information;
 - Improve surface access, integration and interchange arrangements at and between all modes of travel;
 - Provision of infrastructure to allow integration between cycles, taxi, private hire vehicles (PHV) and the public transport network of modes;
 - Improve public transport opportunity/coverage/affordability;
 - Tackle congestion and improve journey time reliability particularly for traffic (including buses) on the parkway system;
 - Improve resilience of network to the impact of accidents, roadworks and weather;
 - Improve journey time reliability for movement of goods and business users; and
 - Reduce productivity impacts of congestion by improving journey time reliability (including buses) and reducing delays.
- 2.3.6 A47 Dualling between Wansford and Sutton is listed as being a trunk road improvement in the long term (2021 to 2026).

Peterborough Draft Local Plan January 2016

- 2.3.7 Peterborough City Council (PCC) prepared a new Local Plan in January 2016 outlining what Peterborough and the surrounding villages will look like in the future and how it will become an even better place to live, work and visit.
- 2.3.8 The Preliminary Draft version of the Local Plan, which sets out the emerging planning policies and proposals for growth and regeneration identifies the following developments:
- Continued development of Hampton, Stanground South and Paston Reserve is a key part of the overall spatial strategy.
 - A new urban extension at Norwood, adjacent to Paston Reserve is included in the current Core Strategy and Site Allocations Development Plan Document (DPD) for 1600 dwellings.
 - A further urban extension at Great Haddon was also identified in the Core Strategy. This scheme includes approximately 5,350 new homes and other facilities.
- 2.3.9 The Homes and Communities Agency (HCA) owns some land in the area and is promoting two landholdings to the north of the A47, the eastern landholding which is outside scheme and the western landholding which is within the scheme. They have put the following proposal to PCC for housing and re-generation:
- There is an ambition to create up to 4 villages in the vicinity of the scheme.
 - The western landholding is within the A47 Wansford to Sutton scheme in the parcel of land between Sutton Heath Road and Lower Lodge Farm just north of the existing A47 carriageway. This may be a combination of residential – comprising 1000 to 1200 units and some Industrial units.
 - The other 3 villages within the eastern landholding are just East of Nene Way roundabout to the north and south of the existing carriageway. This would comprise of 800-1600 units each plus a possibility of some area for a green park. These would be outside the A47 scheme. In total 5000 residential homes are planned for the 4 villages. Phasing is likely to run east to west.
- 2.3.10 The proposals have been submitted to PCC as part of the local plan review and include Primary and Secondary Schools. This development is over and above what is identified in the current adopted PCC local plan.
- 2.3.11 Public Consultation by PCC was expected to take place in September 2017 with a view to the local plan being adopted by summer 2018.
- 2.3.12 Subsequent update to the plan is picked up in Chapter 32.

Cambridgeshire and Peterborough East Anglia Devolution Proposal 2016

- 2.3.13 The Cambridgeshire and Peterborough East Anglia Devolution Proposal 2016 includes forming a Combined Authority that would include the following organisations – Peterborough City Council, Cambridgeshire County Council, Fenland District Council, Huntingdonshire District Council, East Cambridgeshire District Council, South Cambridgeshire District Council, Cambridge City Council and the Greater Cambridge Greater Peterborough Local Enterprise Partnership and has been submitted to Government.
- 2.3.14 Key areas of the proposal include a £20m annual fund for 30 years to support economic growth, development of local infrastructure and job creation; £170m for affordable housing and providing new homes across Cambridgeshire and Peterborough including affordable homes in Greater Cambridge; supporting the delivery of the Wisbech Garden Town and the Wisbech-Cambridge rail connection and transport infrastructure improvements such as A14/A142 junction and upgrades to the A10 and the A47.

2.3.15 Subsequent developments to this proposal are picked up in Chapter 32.

2.3.16 Details of key stakeholder engagements completed during PCF Stage 1 and PCF Stage 2 can be found in Chapters 19 and 32 respectively.

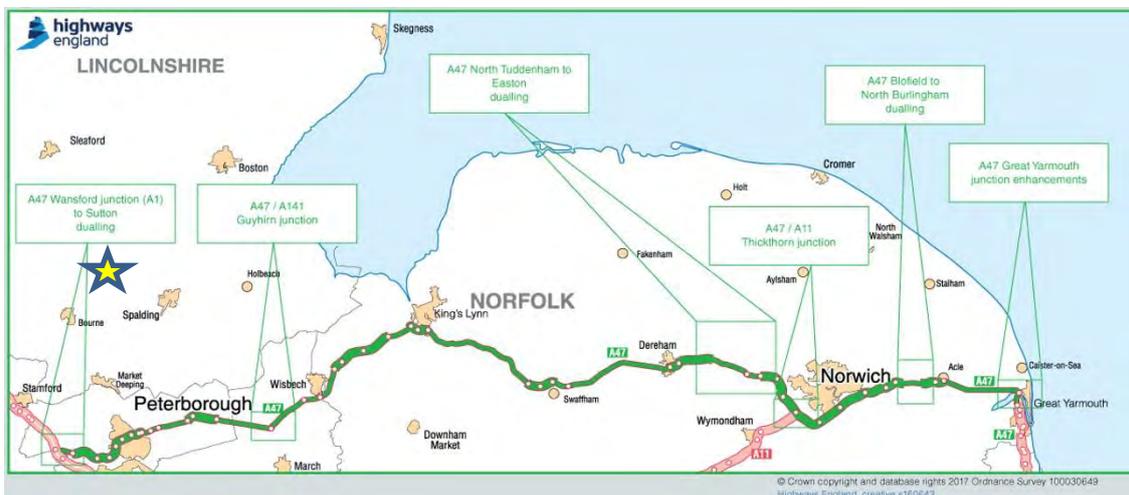
3 Existing Conditions

3.1 Description of Locality

A47 Corridor

- 3.1.1 The A47 trunk road forms part of the strategic road network and provide for a variety of local, medium and long distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich (population over 210,000) and Peterborough (population over 180,000), the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft and a succession of villages in what is largely a rural area. The route also passes through the Broads National Park. The plan is shown in **Figure 3-1** and the scheme location is shown by a yellow star.

Figure 3-1: Location Plan

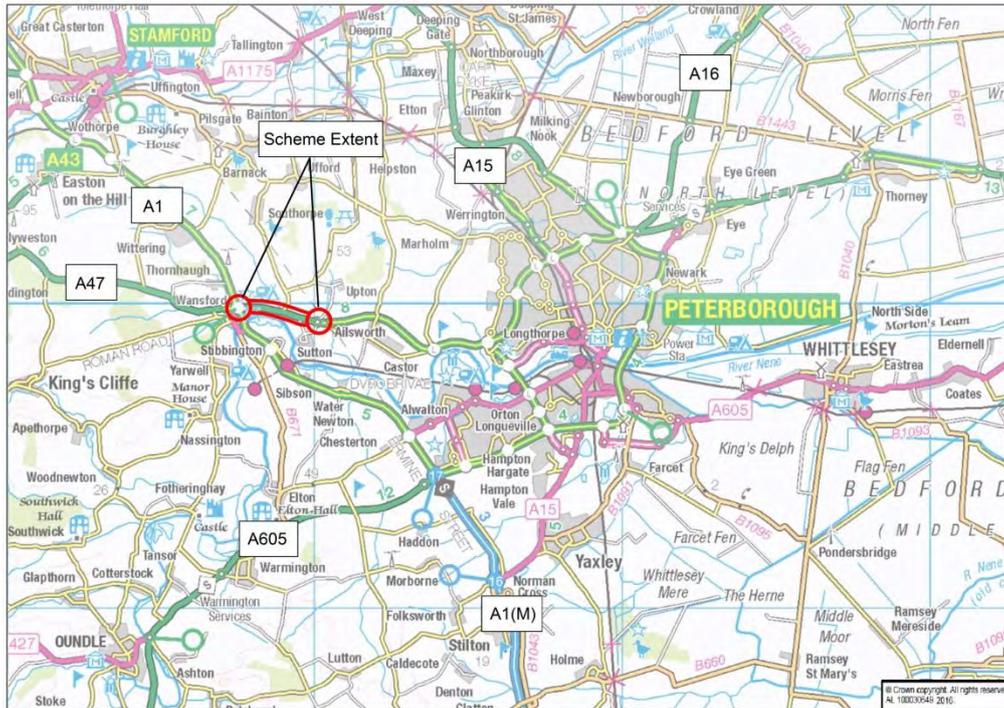


- 3.1.2 Norwich and Peterborough have developed service-based economies and the towns along the route have retained market town and other functions including agricultural-related industry. In recognition of the potential on the eastern coast, the Chancellor announced in the 2011 budget the establishment of the Great Yarmouth and Lowestoft Enterprise Zone particularly for energy related businesses to maximise support for the offshore energy sector. In December 2013, the Government announced a Greater Norwich City Deal to enable knowledge based industries to develop.
- 3.1.3 There has been a rapid growth over the past decade and the area is expected to continue to grow. The cities of Peterborough and Norwich attract additional traffic along the route, particularly during the morning and evening peak periods.
- 3.1.4 The route is around 115 miles long; 54 miles (47%) is dual carriageway while 61 miles (53%) is single carriageway. Previous studies have proposed dualling a number of sections of the A47 in the short and long term, together with a number of junction improvements.
- 3.1.5 Comprehensive improvement of the A47 is a strategic aspiration of local MPs, local government, business and other stakeholders who have organised themselves to form the A47 Alliance. The aim is to capitalise on the potential economic benefits of improved accessibility to the Midlands and the North as well as address safety issues.

Locality of Scheme

- 3.1.6 The link is the single carriageway section of the A47 that runs from the A1 in the west (near Wansford) to the dual carriageway section near the village of Sutton in the east as shown in **Figure 3-2 below**. It is 2.5 km in length. Peterborough lies approximately 9km east of the link. Beyond Peterborough the A47 continues to Norwich and the east coast at Great Yarmouth. The corridor intersects with key strategic routes including the A1, A10 and A11. These strategic roads provide links to other urban centres including Cambridge, Ely and London.

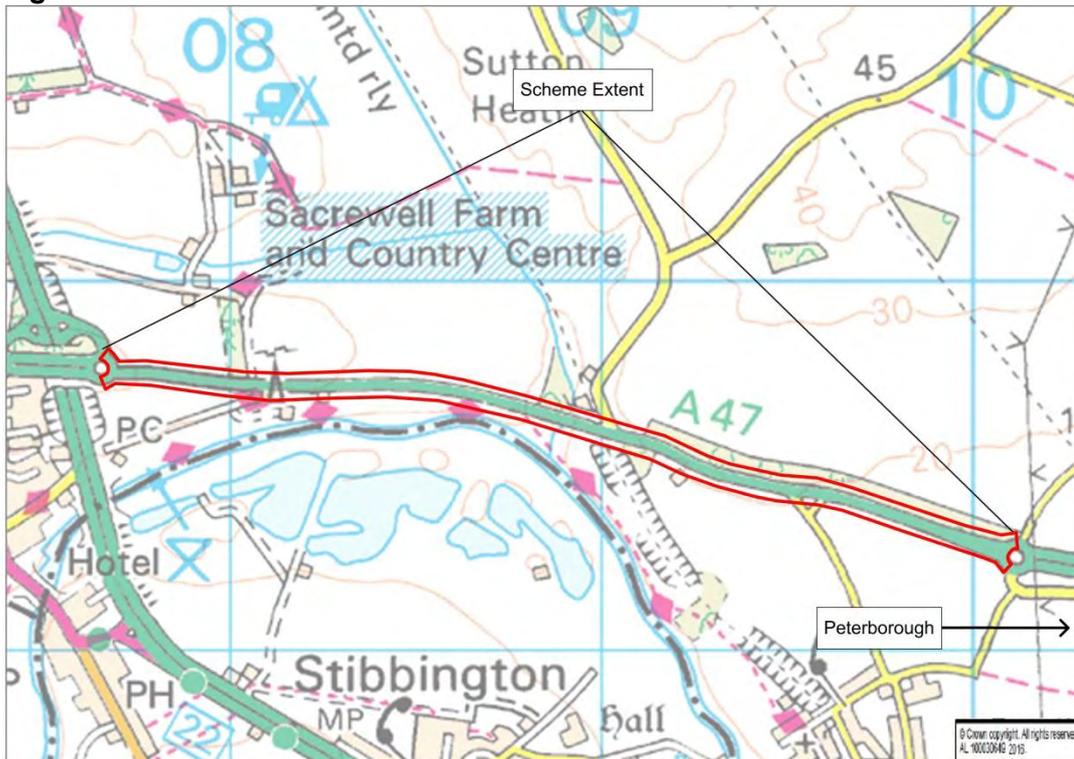
Figure 3-2: Locality of Scheme



3.2 Existing Highway Network

- 3.2.1 The scheme begins where the A47 meets the A1 at Wansford west of Peterborough and continues 2.5 km east to the Nene Way roundabout as shown in **Figure 3-3 below**.

Figure 3-3: Scheme Location Plan



- 3.2.2 The following sections describe the existing highway network; the drawings in **Appendix A** highlight some of the key features of this section of road.
- 3.2.3 To the west, the A1 and A47 are connected via a half cloverleaf signalised dumbbell arrangement, with the A47 crossing over the A1 dual carriageway. The junction provides access to the village of Wansford via the A6118. Limited cycleway provision is made through the junction. Additional capacity is provided at the junction via two lane entries on the A47 arms.
- 3.2.4 Continuing eastwards from the A47/A1 junction the A47 is a single carriageway road. The existing road has not been assessed against current standards for its horizontal and vertical geometry, however in general terms the alignment is made up of large radius curves with limited lengths of straight carriageway.
- 3.2.5 This length of the A47 is generally at existing ground level running on shallow gradients. The road does however rise to cross a disused rail line immediately west of Sutton Heath Road.
- 3.2.6 For the first kilometre, the A47 runs adjacent to the navigable River Nene, being some 50m from it at its closest point. Thereafter the River deviates southwards away from the road.
- 3.2.7 This section of the A47 is subject to a national speed limit of 60mph.
- 3.2.8 There are a number of side roads joining the A47 along the scheme length, via at grade priority, simple and right turn lane T junctions. From west to east the following side roads and junction types are noted:
- Access to Sacrewell Farm and Country Centre – T junction;
 - Access to Truck stop/Picnic area and Wansford pumping station – ghost island junction;
 - Petrol filling station – ghost island junction;
 - Sutton Heath Road – ghost island junction; and

- The Drift – double T-junction.
- 3.2.9 There are a number of farm and field accesses and direct property accesses present on both sides of the A47.
- 3.2.10 To the east, the A47 connects to the Nene Way via a roundabout. The roundabout provides connections to the villages of Sutton and Ailsworth to the south and Upton to the north. There is road lighting local to the roundabout. To the east of the roundabout the A47 is a dual two-lane carriageway and is not lit.
- 3.2.11 There are a number of public rights of way (PRoW) in the study area. The most notable one - the “Hereward Way”, joins the A47 from the south at a lay-by 280m west of the bridge over the disused railway. The trail then runs east along the A47, crossing it and continuing up Sutton Heath Road. There are no pedestrian facilities on this section of the A47.
- 3.2.12 There is pedestrian provision at Nene Way. There is a bus stop on the eastbound side of Peterborough Road about 180m from its roundabout junction with the A47 at Nene Way. A kerbed footpath runs from the bus stop towards the roundabout, crossing to the westbound side of Peterborough Road just after its junction with Nene Way. There are no dropped kerbs or tactile paving on this crossing. The footway continues to the roundabout where it stops.

3.3 Traffic

- 3.3.1 A review was undertaken of available strategic models which may inform the study. Strategic models covering the A47 corridor are summarised in **Table 3-1** below.

Table 3-1: Strategic Saturn Models covering the A47 Corridor

Model	Geographical Scope	Model Base Year	Status
East of England Regional Model (EERM)	A47 and A12 routes	2006	Strategic SATURN model Age of base year data exceeds desirable time limit. The 2006 re-validation was based on additional RSI surveys in parts of Norfolk and Suffolk.
Peterborough Transport Model (PTM)	A47 (A1 to Thorney)	2003/ 2006	Strategic SATURN model Age of base year data exceeds desirable time limit.
Wisbech Area Transport Study (WATS) model	A47 (A141 Guyhirn to B198 Lynn Road junction NE of Wisbech)	2008	Strategic SATURN model Base data is reaching time limit.
King’s Lynn Transport Model (KLTM)	A47 (A17 to A149)	2007	Strategic SATURN model Base data is reaching time limit.
Norwich Area Transportation Strategy (NATS)	A47 from Dereham to Acle	2006/ 2012	Strategic SATURN model 2006 Base data is reaching time limit. Status of 2012 recalibration unclear.
Great Yarmouth Area Transport Strategy (GYATS)	Short section of A47 approaching Great Yarmouth. A12 from A47 to Gorleston Golf Club on south edge of Great Yarmouth	2003	Strategic SATURN model Age of base year data exceeds desirable time limit.
Lowestoft	A12 – From B1375 north of Lowestoft to B1437 junction south of Lowestoft.	2001	Strategic SATURN model Age of base year data exceeds desirable time limit.

- 3.3.2 The Peterborough Transportation Model (PTM) covers the area around Wansford to Sutton. This model was developed by Atkins on behalf of Peterborough City Council in 2006 to analyse the effects of growth and to provide information on the impact of both transport and development proposals on the highway network. The PTM was a combination of a spreadsheet based Trip Generation, Trip Distribution and Modal Choice model and a SATURN highway model. This model was calibrated to a 2006 base year.
- 3.3.3 Although the PTM was not WEBTAG compliant due to it being ten years old, TAME (now Transport Planning Group) granted a relaxation of this requirement as documented in the Appraisal Specification Report (Document reference A47 IMPS1-AME-WS-ZZ-DO-J-0013).
- 3.3.4 The PTM SATURN consists of four component parts:
- The **Land Use Model** uses a combination of generic and specific land use information to calculate the likely vehicle trip generation from a particular site. This takes into account the land use mix (e.g. housing, offices, industrial units, leisure, or retail) and the spatial location.
 - The **Forecasting Model** calculates the expected growth in vehicular trips across Peterborough based on land use changes, changes in fuel prices and economic growth. Traffic growth based on the “Road Traffic Forecast 2008” is applied to all other traffic. Further information on future travel patterns in Peterborough was established and forecast through the Northern Gateway Multi-Modal Study (NGMMS).
 - The **Mode Choice Model** is a spreadsheet model that uses information from the travel behaviour study “Peterborough: Sustainable Travel Demonstration Town. Travel Behaviour Research, Baseline Survey 2004” to determine how and why people used certain modes to travel. The results of this report (known locally as “Travelchoice”), along with travel demand data from the 2001 Census, is used to calculate changes in walking, cycling and public transport use. These changes are calculated at a census ward level. The percentage change in car journeys is then calculated and converted from ward to zone level.
- 3.3.5 The Highway Model assigns the traffic onto a representation of the Peterborough road network using the SATURN traffic assignment programme. This is a macroscopic traffic simulation model that predicts the average hourly flow of traffic on individual roads, as well as journey times and delays, and queue lengths at junctions by predicting traffic assignment (i.e. route choice) within the modelled area. This is appropriate for the A47 Wansford to Sutton scheme as the improvements to the A47 may attract traffic from nearby routes that is currently deterred by existing congestion on this part of the A47.
- 3.3.6 The traffic modelling for this scheme was carried out using the Highway model. This consists of two main elements:
- **A representation of the road network.** This includes appropriate speed-flow curves on each link within the model to simulate the delays that can occur due to congestion. It also includes appropriate capacities and lane use at each junction so that the delays that can be caused at junctions are simulated. The model includes priority junctions, signalised junctions, roundabouts, and slip roads.
 - **Road traffic Demand Matrices** are created from the outputs of the PTM Land Use model, the Forecasting Model, and the Mode Choice model. These demands enter the model via 189 origin-destination zones. Appropriate generalised-cost functions and a sophisticated traffic assignment algorithm are then used to allocate the traffic to the most appropriate routes through the road network. PTM traffic demand matrices are available for the years 2006, 2016, 2021 and 2026.
- 3.3.7 The outputs from the Highway model predict the traffic volumes, traffic speeds, and journey times on each direction of each link within the model.

3.3.8 Each SATURN model only models the average traffic flows over a single hour. Therefore, to cover the most important types of traffic flow three PTM SATURN models were used to model the following three representative weekday single hours:

- 08:00 to 09:00 AM Peak
- 14:00 to 15:00 Interpeak
- 17:00 to 18:00 PM Peak

3.3.9 In the PTM SATURN model traffic is represented by two user classes:

- User Class 1: Cars and light goods vehicles (Cars and LGVs) assigned a PCU factor of 1.0
- User Class 2: Heavy goods vehicles (OGV1, OGV2 and PSV) assigned a PCU factor of 2.0

3.3.10 Enhancements to the 2006 Base model were carried out by Atkins in 2008 and details of these are contained in the Local Model Validation Report: “Peterborough Transportation Model, Local Model Validation Report”, by Atkins (June 2009).

Existing Traffic Conditions

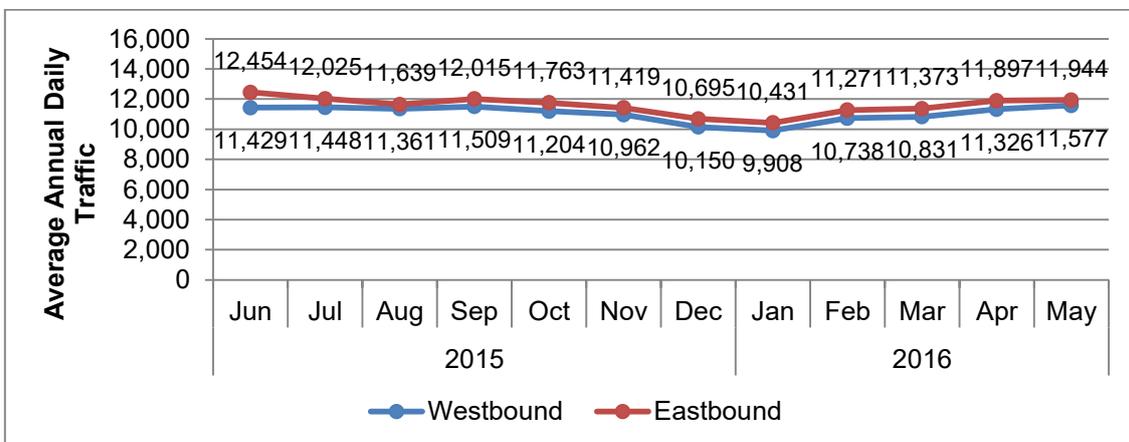
3.3.11 Data describing the existing traffic conditions on the A47 between Wansford and Sutton was available from both a permanent automatic traffic counter (ATC) site and from a manual junction turning count survey that was carried out in June 2015, commissioned by AECOM. The Annual Average Daily Traffic (AADT) flows on the link encompassed by the scheme were obtained from the most recent available 12 consecutive months of TRADS ATC data from the permanent traffic counter site, spanning the period June 2015 to May 2016:

- Westbound AADT: 11,037
- Eastbound AADT: 11,557

3.3.12 This showed approximately 4.5% higher flow in the eastbound direction compared to the westbound.

3.3.13 **Figure 3-4** shows how the daily total flows vary during each month of the year. This data was extracted from the TRADS permanent traffic counter data and shows higher flows in the period from April to October.

Figure 3-4: 2015/16 Daily Flows by Month Diagram



3.3.14 The theoretical capacity of the existing single carriageway was calculated as 1,226 vehicles per hour per lane based on WebTAG Unit M3.1.

3.3.15 The theoretical capacity of the existing single carriageway A47 is a function of the carriageway width and the percentage of heavy vehicles on the carriageway at any one time, as per the relationship described in WebTAG Unit M3.1, Appendix D.2:

3.3.16 Capacity per lane per hour = $(2400 \times (CWID-3.65))/CWID \times ((92-PHV))/80$

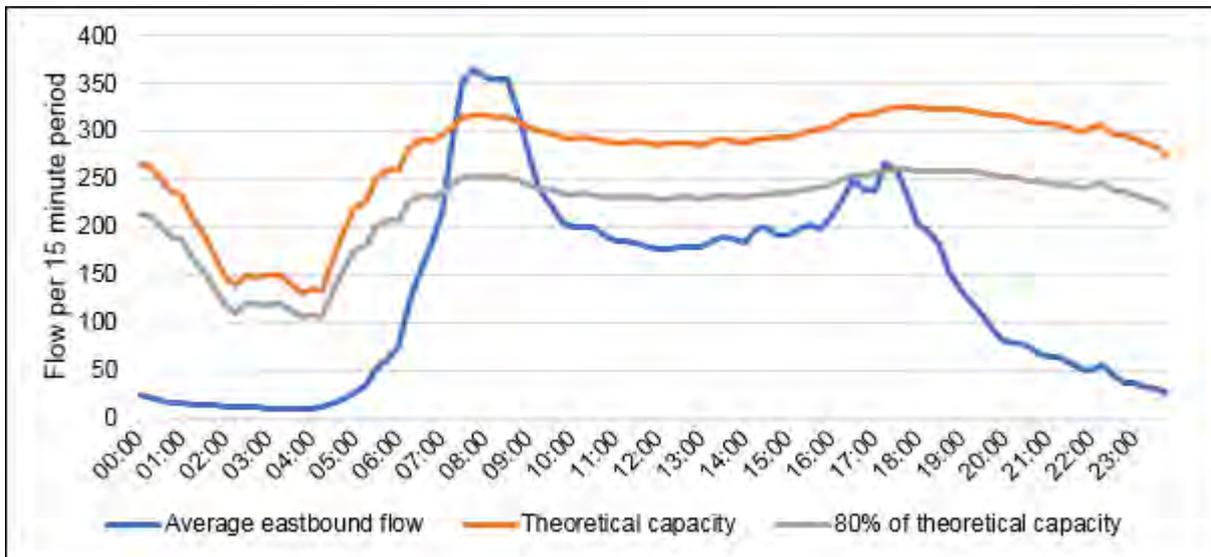
- CWID is the carriageway width in metres; an average width of 7 metres has been assumed for the A47;
- PHV is the percentage of heavy vehicles (classes OGV1, OGV2 and PSV) in that lane.

3.3.17 Using the traffic flow data from the TRADS counters, the flow in each direction on the A47 and the theoretical capacity were calculated for a typical weekday over the period June 2015 to May 2016, i.e. the average of all weekday data excluding Saturdays, Sundays and bank holidays. The observed average flow and the theoretical capacity each 15-minute time period given the percentage of heavy vehicles on the road is shown in Figure 3-2 for eastbound traffic and Figure 3-3 for westbound.

3.3.18 WebTAG Unit M3.1, paragraph D.2.7 indicates that the speed-flow relationship changes (the rate at which speed decreases with increased flow changes) if traffic volumes are at 80% of theoretical capacity. This level has also been indicated on Figures 3-5 and 3-6 below.

3.3.19 **Figure 3-5** shows the relationship of an average weekday flow to theoretical capacity on the A47 eastbound.

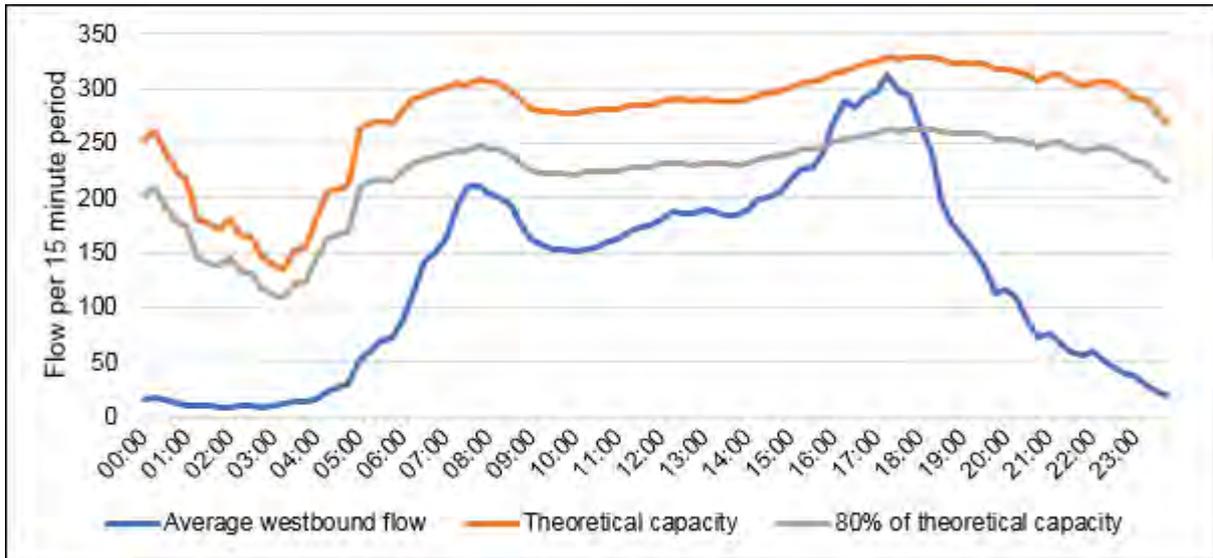
Figure 3-5: Relationship of average weekday flow to theoretical capacity on A47 eastbound, typical weekday 2015/16



3.3.20 Eastbound traffic levels exceed the theoretical capacity by up to 15% in the AM peak period on a typical weekday, which is likely to result in significant congestion and delay on the link. This effect is independent of junction delay on the A47 and does not take account of local factors such as horizontal and vertical curvature and poor forward visibility that may further reduce capacity.

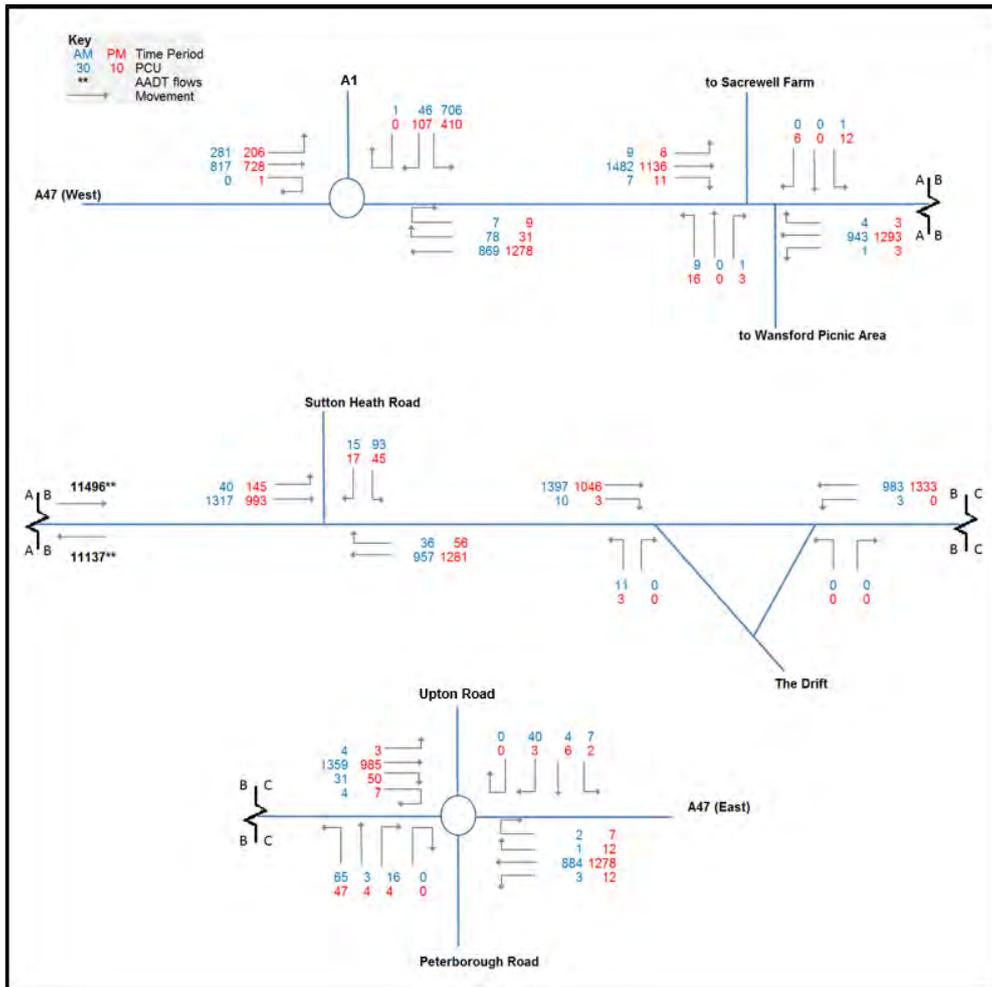
3.3.21 **Figure 3-6** shows the relationship of an average weekday flow to theoretical capacity on the A47 westbound.

Figure 3-6: Relationship of average weekday flow to theoretical capacity on A47 westbound, typical weekday 2015/16



- 3.3.22 Westbound traffic levels are higher in the PM peak where they reach 95% of the road's theoretical capacity on a typical weekday. This is likely to result in lower vehicle speeds given the A47's speed-flow relationship even if the theoretical capacity is not exceeded. The same issues with curvature, junction delay and visibility also apply as with eastbound traffic.
- 3.3.23 Information on the volume of turning movements at the most significant junctions along this section of the A47 were available from the manual junction turning count surveys that were carried out in June 2015 commissioned by AECOM.
- 3.3.24 The turning count figures are shown graphically in Figure 3-7 in passenger car units (PCU's). In addition to the turning count data the AADT data for main line A47 flows has been shown on the diagram. Note that the turning count totals for the AM and PM peaks for significant junctions along the route show slightly more turning movements in the PM peak than the AM peak.

Figure 3-7: Flow Diagram Schematic for Existing Traffic data



3.3.25 The figure shows that with the exception of the A1/A47 Eastern roundabout, the turning flows from side roads are minor when compared to the main line A47 flows. The most significant turning movements are at Sutton Roundabout, at the east end of the scheme, and at the Sutton Heath Road priority junction.

3.4 Collision Data

3.4.1 Records of collisions over the length of the scheme for the 5 year period between October 2011 and September 2016 have been reviewed. The locations and severities of collisions are shown in **Appendix B**.

3.4.2 A total of 41 collisions were recorded in the study area during this period. This included 34 slight, 5 serious and 2 fatal collisions. The 41 collisions resulted in 64 casualties: 51 slight, 10 serious and 3 fatal.

3.4.3 The types of collision reported incidents are split as follows, 19 rear end shunts, 13 junction incidents, 5 overtaking, 3 losses of control and 1 vehicle reversing incident.

3.4.4 For the 5 year period, there was an average of 8.2 collisions per year. This number peaked in 2012 when 13 collisions occurred.

- 3.4.5 Groupings can be seen on the A1 southbound carriageway, at the Wansford roundabout approaches, in front of the service station, at the Sutton Heath Road intersection and The Drift intersection.
- 3.4.6 The HA Area 6 Route Report – Cambridgeshire and Peterborough 2012 highlights the Wansford to Sutton Link as being severely congested.

3.5 Topography, Land Use, Property and Industry

- 3.5.1 Wansford lies immediately southwest of the A1 / A47 Junction where the A1 runs in a north south direction and the A47 runs in a west to east direction. On the east side of the junction, the River Nene meanders close to the southern boundary of the A47 coming within 50 metres of the highway.
- 3.5.2 From its junction with the A1 near Wansford, the A47 road levels fall in an easterly direction by approximately 22 metres over 1100 metres down to a low point 200 metres west of the bridge crossing the disused railway line. At the low point on the A47 the River Nene is closest to the trunk road.
- 3.5.3 From the A1 / A47 junction the ground falls steeply to the south down to the River Nene, a fall of 22 metres over 330 metres. The gradient of the land to the south reduces as the road travels east towards the low point. At the lowest point the road level is approximately 3 metres higher than the area adjacent to the river. To the south of the river the ground is relatively flat across a 300-metre-wide band where numerous ponds are located. The ground then rises gently in a southerly direction.
- 3.5.4 The land north of the A47, between the A1 junction and the low point, falls gradually to the northeast to a watercourse that runs west to east through Sacrewell Farm and Country Centre. North of the watercourse the ground rises gently in a northerly direction.
- 3.5.5 From its low point by the River Nene, the A47 road level rises to the east by 8 metres over 200 metres, crossing over the disused railway line to a “T” junction with Sutton Heath Road that joins the A47 from the north.
- 3.5.6 From Sutton Heath Road, the A47 road levels to the east are relatively flat for 820 metres before falling gently by 3 metres to the Nene Way roundabout, some 360 metres further east.
- 3.5.7 Between Sutton Heath Road and the Nene Way roundabout, The Drift forms a “T” junction with the A47. Along this section of the A47 the ground falls gently north to south.
- 3.5.8 Between Wansford and Sutton the areas of land that are local to the A47 are predominately in agricultural use.
- 3.5.9 The villages local to the route vary in size, with Wansford being the largest. Wansford has a population of approximately 500 with around 250 properties that have a mixture of residential and business use. The village of Sutton has approximately 50 residential properties and one farming business located on the edge of the village. The village of Upton is 1.3 km north of the Nene Way roundabout and has less than 30 residential properties with two farming businesses located on the edge of the village.
- 3.5.10 Sacrewell Farm and Country Centre, a tourist destination that is accessed directly from the A47 is located north of the A47 between the A1 / A47 Junction and Sutton Heath Road. The business is open 364 days of the year and has visitor numbers of approximately 90,000 per annum. Arable farmland surrounds the Country Centre and is accessed using the Country Centre service road.

- 3.5.11 Two residential properties are located north of the A47 close to Sutton Heath Road. The Old Station House is accessed directly from the A47 and Heath House is accessed from Sutton Heath Road.
- 3.5.12 The land north of the A47 between Sutton Heath Road and the Nene Way roundabout is arable with field areas varying between 2ha and 15ha. There is no evidence of access directly from the A47 to these fields. A farm business is located approximately 270 metres north, on the Nene Way.
- 3.5.13 South of the A47 between the A1 / A47 Junction and Sutton Heath Road, the land is dominated by the route of the River Nene. South of the river, grassland runs alongside the southern bank with numerous lakes / ponds and then arable land further south. Between the A47 and the northern river bank the land is of mixed use; arable, grassland, commercial and recreational.
- 3.5.14 The Wansford pumping station is located adjacent to the river Nene to the south of the A47 and is accessed from the A47 via the picnic area. The pumping station pumps raw water from the River Nene to Rutland Water reservoir via a series of pumping stations along the route of the Anglian Water main.
- 3.5.15 A fuel station is located on the southern side of the A47.
- 3.5.16 South of the A47 between Sutton Heath Road and the Nene Way roundabout there are two field plots of approximately 15ha each that are separated by a local road The Drift. There is no evidence of field access provision directly from the A47. One isolated residential property, Deep Springs, lies within this section and this is accessed directly from the A47. South of the two large field plots, the land runs up to the outskirts of the village of Sutton.
- 3.5.17 East of Nene Way, to the south of the A47, the land is agricultural.

3.6 Climate

- 3.6.1 All information was sourced from the Met Office Website.
- 3.6.2 The mean annual temperature over the region varies from around 9.5 °C to just over 10.5 °C. Temperature shows both seasonal and diurnal variations. January and February are the coldest months with mean daily minimum temperatures across the region close to 1 °C. Mean daily maximum temperatures range from just over 6 °C to 8 °C during the winter months and from 20 °C to 23 °C in the summer.
- 3.6.3 Across most of the region there are, on average, about 30 rain days (rainfall greater than 1 mm) in winter (December to February) and less than 25 days in summer (June to August). Much of eastern England receives less than 700 mm per year and includes some of the driest areas in the country.
- 3.6.4 Eastern England is one of the more sheltered parts of the UK. As Atlantic depressions pass by the UK the wind typically starts to blow from the south or south-west, but later comes from the west or north-west as the depression moves away. Directions between south and north-west account for most occasions and the strongest winds nearly always blow from this range of directions. Eastern England has the greatest frequency of tornadoes in the UK.

<http://www.metoffice.gov.uk/climate/uk/regional-climates/ee>

3.7 Drainage and Flooding

- 3.7.1 Information on the existing drainage system has been derived from a combination of:

- The Highways Agency Drainage Data Management System (HADDMS),
 - Highways Asset Data from Integrated Asset Management Information System (IAMIS)
 - Observations from Google Maps images
- 3.7.2 The carriageway is drained through a highway drainage network utilising a variety of drainage systems including:
- Kerb and gully;
 - Central reserve and verge filter drains;
 - Over edge flows into possibly filter drains or ditches running in verges;
 - Kerb drains to pick up runoff from the A1 roundabout (eastern);
 - Kerbs and side entry gullies or 'grips' discharging into ditches within the verges; and
 - Verge and central reserve soakaways.
- 3.7.3 The local highway drainage networks collect the highway runoff and discharge to local outfalls including watercourses and ditches which are likely to convey flows ultimately to the River Nene or one of its tributaries or possibly to soakaways in the ground.
- 3.7.4 The existing drainage system will need to be investigated and verified on site to confirm the condition of the system and outfalls particularly in any areas where the system will remain in use or be adapted for future proposals. Drainage surveys will be carried out in PCF Stage 2.
- 3.7.5 For information on water courses, flood zones/plains, groundwater source protection zones, ponds and aquifers, see Section 4 (Environment including Environmental Status). The scheme corridor is dominated by large agricultural fields. No information is available on field drainage system adjacent to the highway. However, any field drainage systems will be independent of the highway drainage system.
- 3.7.6 HADDMS has a facility to show information on the service, relating to the performance of the asset, and structural condition of the drainage system, relating to the fabric of the asset, including pipework and chambers (but not for water course culverts crossing under the carriageway). Service condition is graded from Grade 1 (Clear) to Grade 5 (Blocked or unsafe condition). Structural condition is graded between Grade 1 (no defects) to Grade 5 (not fit for purpose or unsafe). For the service grading at this section of the A47 (A47/A1 junction to Nene Way Roundabout), the assets have mostly been assigned Grades 3 (Performance slightly reduced) and some have not been graded. For the structural grading, the assets have mostly been assigned Grades 3 (Minor defects) and some have not been graded.
- 3.7.7 With regards to highway flooding, HADDMS has two registers. The first is the Flood Event Register, which is used to record individual flooding events (within 200m of the highway edge). The second is the Flood Hotspots Register, which records the sections of HE networks considered to be at risk of flooding. Each flooding hotspot will usually contain several individual flood events. Three mapping layers are included that show the hot spots colour coded by Overall Status, Verification or Action levels. For each hotspot, a Baseline Risk Level is determined from a combination of the number and severity of flood events (whether river, tidal or surface). The flood hotspots are defined from junction to junction. The HADDMS Flooding Hotspots Register Overall Status is colour coded. The colour codes are 'A Red' (Very high); 'B Orange' (High); 'C Yellow' (Moderate); 'D Green' (Low); 'X Blue' (Risk Addressed); 'Grey' (Not Determined). For this section of the A47 (A47/A1 junction to Nene Way Roundabout), HADDMS does not show any Flood Hotspots.
- 3.7.8 HADDMS does not show any records of spillages in this area.

3.8 Geology

3.8.1 From British Geological Survey (BGS: <http://www.bgs.ac.uk/geoindex/>) records viewed on the Highways England Geotechnical Data Management System (HAGDMS) as well as information provided by the Statement of Intent (SoI), it is noted that the study area is underlain by the following geological sequence. Superficial and Bedrock Geology maps can be found in **Appendix C**.

Artificial Ground

3.8.2 No artificial ground has been recorded on HAGDMS; however, the historic and recent infrastructure development of the site is indicative of the likely presence of made ground beneath the existing carriageway, adjacent roads and disused railway infrastructure.

Superficial Geology

3.8.3 The anticipated Superficial Geology underlying the site is presented in **Appendix C (Figure 1)**

3.8.4 The central and eastern parts of the site are recorded to be predominantly underlain by River Terrace Deposits (clay, silt sand and gravel) of Quaternary age. Alluvium (clay, silt sand and gravel) is observed in concurrence with the presence of two primary watercourses. No Superficial Geology deposits are recorded within the western area of the scheme.

Bedrock Geology

3.8.5 The anticipated Bedrock Geology underlying the site is presented in **Appendix C (Figure 2)** and **Table 3-2**.

Table 3-2: Bedrock Geology

Age	Strata	Rock Type
Jurassic	Upper Lincolnshire Limestone Member	Limestone
Jurassic	Lower Lincolnshire Limestone Member	Limestone
Jurassic	Grantham Formation	Sandstone, siltstone and mudstone
Jurassic	Whitby Mudstone Formation	Mudstone

Historic Ground Investigation Data

3.8.6 Borehole data provided in HAGDMS identified twelve borehole records within 250m of the scheme. These holes have served to confirm the general geological model described in the geological mapping presented above.

3.8.7 A review of the existing HAGDMS reports associated with A47 within the boundaries of the proposed development has been undertaken. Eight relevant reports have been reviewed; however, no ground investigation data was identified within these reports.

Sensitive Geological Sites

- 3.8.8 A review of data available on HAGDMS does not identify any Sites of Special Scientific Interest (SSSI) relating to geologically sensitive sites. Data provided by the Geological Conservation Review (GCR; <http://jncc.defra.gov.uk/page-1>) does not identify any GCR sites within the project area.

GeoSure Datasets

- 3.8.9 GeoSure national datasets provide geological information about potential ground movement or subsidence that can help planning decisions (<http://www.bgs.ac.uk/products/geosure/home.html>). GeoSure deposits are rated from A to E, with A indicating negligible risk, and E indicating deposits with potential for movement have been identified. A basic review of GeoSure data for the site available on HAGDMS has been conducted; a detailed review of the data will be provided in the Preliminary Sources Study Report (PSSR).
- 3.8.10 Alluvium deposits were identified by HAGDMS as having significant potential to be a compressible (Class D), slight potential of running sands (Class C) and shrink-swell hazard (Class B). In proximity to the banks of the River Nene there is also potential for landslide hazard (Class C).
- 3.8.11 River Terrace deposits were identified by HAGDMS as having potential to incorporate collapsible soils (Class B), slight potential of running sands (Class B), slight potential for landslide activity (Class B), and shrinking-swelling (Class B).
- 3.8.12 The Lower Lincolnshire Limestone and Upper Lincolnshire Limestone were identified as having a significant to very significant potential to be soluble (Class C to D).

Hydrogeology

- 3.8.13 Environment Agency (EA) and data available on HAGDMS provides the following information on the hydrogeological regime of the project area.
- 3.8.14 The EA website shows this site is underlain by Secondary A Aquifers for the Alluvium and River Terrace Deposits and Secondary Undifferentiated Aquifers for Head Deposits.
- 3.8.15 The Upper and Lower Lincolnshire Limestone Formations are designated as Principal aquifers with major vulnerability.
- 3.8.16 The Rutland Formation, Grantham Formation and Whitby Mudstone Formation are designated as minor aquifers with intermediate vulnerability.
- 3.8.17 The Upper and Lower Lincolnshire Limestone Formations are designated as Principal aquifers with major vulnerability.
- 3.8.18 The Rutland Formation, Grantham Formation and Whitby Mudstone Formation are designated as minor aquifers with intermediate vulnerability.

Landslide risk

- 3.8.19 Landslide risk data available on HAGDMS identified an area of ground with a significant potential for slope instability approximately 450m east of the current Wansford roundabout. The potential ground instability is associated with the banks of the River Nene and is categorised as a Hazard Class D ("Significant potential for slope instability with relatively small changes in ground conditions") immediately adjacent to the river and as a Hazard Class C ("Possibility of slope instability problems after major changes in ground conditions") to the north of the river. The Hazard Class C area covers a section of the current A47 alignment.

Risk associated with local geological and topographical conditions will be assessed further within the scheme PSSR.

Hydrology

- 3.8.20 Environment Agency (EA) and data available on HAGDMS indicated that River Nene flows to the south of the existing A47 single carriageway. Numerous springs and field drains were recorded to the east, while another primary river confluents with River Nene and was recorded to be culverted beneath the A47 within close proximity to the Sutton Heath road link to the A47.
- 3.8.21 The Environment Agency's [Ref 5] rivers and sea flood map indicates a high flooding risk of the area surrounding the River Nene as well as the second primary river. These areas have been classified under Flood Zone 3 (a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year).

Geomorphological Review

- 3.8.22 Based on available topographic survey information provided by HAGDMS displayed in **Appendix C Figure 3**, the landscape in the area of interest is dominated by water erosion features. The shallow valley cut by the River Nene provides a sharp slope south of the existing A47, and the channel cut by the primary river that passes beneath. As a result, there are two topographic highs north of the River Nene in the west and east of the site, and one in the inside bend to the south of the River Nene. A series of earthworks accommodating the existing A47 carriageway are recorded on HAGDMS; earthworks data is listed in **Table 3-3**.

Table 3-3: A47 Existing Embankments

Earthwork	Type	Length	Max Height	Max Slope	Comment
Eastbound Carriageway					
6_A47_38912	At-Grade	385m	0m	0°	-
6_A47_20922	At-Grade	766m	0m	0°	Cracked pavement 100-600m. Not given feature grade
6_A47_20923	Embankment	189m	4.5m	30°	-
6_A47_28006	At-Grade	57m	1.5m	20°-	-
6_A47_29006	At-Grade	1093m	0m	0°	Badgers 300-550m and 725-850m
Westbound Carriageway					
6_A47_29001	At-Grade	112m	0m	0°	-
6_A47_28004	At-Grade	225m	2.1m	25°	Cracked pavement 0-140m. Not given feature grade
6_A47_28003	At-Grade	253m	0m	0°	-
6_A47_28002	At-Grade	306m	0m	0°	-
6_A47_28001	At-Grade	196m	2.0m	24°	Cracked pavement 135m. Not given feature grade
6_A47_27900	Embankment	197m	4.0m	30°	-
6_A47_27903	At-Grade	571m	0m	0°	-
6_A47_20921	At-Grade	177m	0m	0°	-
6_A47_30403	At-Grade	316m	0m	0°	-

3.9 Unexploded Ordnance

3.9.1 A high level review of the Unexploded bomb (UXB) risk on site was undertaken based on information provided by zetica (zetica: <http://www.zetica.com/>) and the risk was classified as low. Further assessment, including a more detailed review of Unexploded Ordnance (UXO), will be undertaken on this basis during the PSSR.

3.10 Mining Operations (Current and Historical)

3.10.1 Coal Authority data held by HAGDMS indicates there are no coal mining related features, hazards or deposits within or in proximity of the site. Similarly, brine features are not identified in or around the site.

3.10.2 HAGDMS records seven ceased opencast pits in proximity to the A47. Table sand and gravel mineral sites as well as 4 No. ceased opencast limestone mineral sites are recorded within the vicinity of the site. **Table 3-4** provides details of these features.

Table 3-4: A47 Ceased Opencast Pits

Name	Commodity	Geological Unit	X (NGR)	Y (NGR)
Haycock	Sand and Gravel	River Terrace Deposits	508130	299400
Stibbington	Sand and Gravel	River Terrace Deposits	508520	299370
Sutton Pits (North)	Limestone	Upper Lincolnshire Limestone Member	509270	299160
Sutton Pits (South)	Limestone	Upper Lincolnshire Limestone Member	509230	299090
Sutton Gravel Pit	Sand and Gravel	River Terrace Deposits	509990	299250
Wansford Road Station	Limestone	Lower Lincolnshire Limestone Member	509020	299830
Sutton Heath	Limestone	Rutland Formation	509130	299990

3.11 Public Utilities

3.11.1 Utilities records in the area have been requested and, where these have been provided, the information is shown in **Appendix D** and summarised below:

3.11.2 To the east of Wansford, high and low voltage electrical underground cables are evident in the verge of the A1 southbound exit slip road and both verges of A47 in the vicinity of the A1/A47 junction roundabout to the east of the A1.

3.11.3 Between the A1/A47 interchange and Sutton Heath Road, communications underground cables are located in approximately 60% of the existing A47 eastbound verge.

3.11.4 Communication cables are located in the eastbound verge of the access road to the west of the service station and join the A47 eastbound verge. Communication cables in the eastbound verge of the access road feed an electricity sub-station and a Flood Gauging station.

3.11.5 Overhead electricity cables run parallel to the south of the A47 for approximately 60% of the length between the A1/A47 Interchange and Sutton Heath Road.

3.11.6 Water mains are present in the A47 westbound verge between the fuel station and Sutton Heath Road as well as in the eastern verge of Sutton Heath Road. These water mains join in the A47 westbound verge at Sutton Heath Road.

3.11.7 Overhead electricity cables, underground communications and several water mains cross the A47 at various locations between the A1/A47 interchange and Sutton Heath Road.

- 3.11.8 Between Sutton Heath Road and Nene Way, underground communication cables are located predominately in the A47 eastbound verge but also alternate between the A47 eastbound and westbound verges respectively.
- 3.11.9 Low voltage overhead cables run along the eastbound verge from Sutton Heath Road and cross the A47 to a residential property east of Sutton Heath Road. A communication cable also crosses the A47 to the east of the electricity crossing.
- 3.11.10 Water mains cross the A47 at various locations between Sutton Heath Road and Nene Way.
- 3.11.11 High voltage overhead cables are evident in the west verge of Sutton Heath Road which cross over to the south of the A47 and connect to the existing infrastructure.
- 3.11.12 Water mains in the A47 westbound verge travel to the south of the existing A47/Nene Way roundabout and continue into the southern verge of the road connecting the roundabout to Ermine Street. To the west of A47/Nene Way roundabout a water main located in Nene Way to the north of the roundabout connects to the water main in the A47 westbound verge.
- 3.11.13 High Voltage overhead cables pass over the existing A47 just to the east of the existing A47/Nene Way roundabout.
- 3.11.14 Communications cables in Nene Way to the north of Nene Way Roundabout connect to communication cables in the existing A47.

3.12 Technology

- 3.12.1 **Appendix A** which highlights some of the key features of the section of road also shows the technology present in the scheme area.
- 3.12.2 The dumbbell roundabout on the A47 to the east of the A1 is traffic signal controlled and operates only at peak times. This consists of 17 traffic signal heads mounted on 12 traffic signal poles.
- 3.12.3 Three sets of traffic signal loops are located on A47 eastbound and westbound approaches to the dumbbell roundabout to the east of the A1 and have been installed to activate the traffic signals.
- 3.12.4 The traffic signals on the dumbbell A47 roundabout to the east of the A1 are controlled by feeder pillars located in the A47 westbound verge approach to the roundabout.
- 3.12.5 Street lighting is present in the vicinity of the A47 roundabout to the east of the A1. The electrical supply for the street lighting is from a feeder pillar located in the westbound verge of the roundabout. The street lights would appear to be group switch controlled by means of a PECU (photo electric cell unit light censor) mounted on top of a pole located adjacent to the feeder pillar.
- 3.12.6 A Traffic Master Camera is located in the A47 westbound verge approximately 150m east of the A1/A47 Junction's eastern roundabout. Correspondence received from Trafficmaster would appear to indicate that this camera may be redundant.
- 3.12.7 Traffic loops are located in the eastbound and westbound carriageways of the A47 approximately 230m to the west of Sutton Heath Road. The loops are powered by means of a solar panel mounted in the adjacent westbound verge.
- 3.12.8 Street lighting is present in the vicinity of the roundabout at Nene Way.

3.13 Maintenance Access

- 3.13.1 There is no maintenance lay-by or maintenance access track to the Traffic Master Camera to the east of the eastern roundabout of the A47/A1 junction.
- 3.13.2 Dedicated maintenance lay-bys for the recently installed traffic signals have not been provided. Access to the controller can be gained from the cycle paths around the outer diameter of the roundabout but there is no dedicated layby to allow maintenance personnel to park up. Safe access may require lane closures. There is no lay-by in the central island so access to equipment there would require the crossing of live carriageway or lane closures.
- 3.13.3 The tail of the traffic loops to the west of Sutton Heath Road leads to the westbound carriageway verge. There is no dedicated access path. The loops are about 80m east of a public lay-by in the westbound verge and access could be achieved via the narrow verge. About 40m of this is behind a road restraint system.
- 3.13.4 A culvert carries a small watercourse under the A47 just west of Sutton Heath Road. There is no direct maintenance access from the A47. Two other culverts carrying drains pass under the A47 between The Drift and the A47 junction with Nene Way. Again, there is no direct maintenance access from the A47.

4 Environment including Environmental Status Stage 1

4.1 Introduction

4.1.1 The purpose of this chapter is to provide an overview of the existing environment where the proposed scheme will take place. It is based on Chapter 2 of the accompanying Environmental Assessment Report (EAR) for PCF Stage 1 and its associated drawings, and provides a summary of the key environmental receptors. Chapter 2 of the PCF Stage 1 EAR provides details of the methodology used to define the study area and to characterise the environmental baseline and describe its sensitivity to change. The information presented is baseline conditions known at the time during PCF Stage 1. Any subsequent changes will be picked up in PCF Stage 2 Chapter 27 and Chapter 31.

4.2 Air Quality

Introduction

4.2.1 This section provides a summary of the air quality and greenhouse gas baseline within the study area, along with the key constraints which could result from changes in air and greenhouse gases.

Baseline Conditions

4.2.2 No air quality monitoring is undertaken within the study area by Peterborough City Council. There are no declared Air Quality Management Areas (AQMAs) within the study area.

4.2.3 Background air quality concentration data for 2016 from Defra, based on the 2013 background mapping, show that there are no exceedances of the Air Quality Strategy objectives in the study area. Background air quality concentrations at the 1km grid squares in the study area show that:

- The highest concentrations of oxides of nitrogen (NO_x and NO₂) are estimated in the west of the study area (1 km grid square 507500, 299500) and contains the A1/A47 junction; and
- The highest particulate matter (PM₁₀ and PM_{2.5}) concentrations are estimated in the south of the study area (1km grid square 508500, 298500) and contains the A1 close to Stibbington.

Receptors

Human Exposure

4.2.4 An approximate count of human receptors within the study area is shown in **Table 4-1**. These are presented in Figure 2.4.1 of the EAR. The vast majority of these are located in Wansford, Stibbington, Sutton and Ailsworth.

Table 4-1: Approximate Counts of Human Receptors within the Study Area

Receptor Type	Quantity
Residential	1,268
Community	19
Commercial	30
Development (residential dwellings under	9

development)	
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Designated Sites

4.2.5 The designated ecological sites vulnerable to the effects of excess nitrogen deposition are noted in **Table 4-2**.

Table 4-2: Designated Ecological Sites Vulnerable to Nitrogen Deposition

Site	Desig.	Description	DMRB ecosystem type / forest habitat classification(s)
Old Sulehay Forest	SSSI	Ancient woodland on calcareous strata	Deciduous and coniferous
Wansford Pasture	SSSI	Species rich flush and Jurassic limestone grassland	Sub-Atlantic semi-dry calcareous grassland
Sutton Heath and Bog	SSSI	Calcareous grassland of the Jurassic limestone type and neutral grassland of the poor-base marsh type	Sub-Atlantic semi-dry calcareous grassland
			Poor fen

Key Constraints

Temporary (Construction)

4.2.6 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust and exhaust gas pollutants and are therefore potential constraints to the scheme. Risks during construction are primarily from construction dust. This can occur through particles suspended in the air, and through deposition of particles on receptor surfaces. Construction dust can include particles that contribute to ambient PM10 concentrations, and also far coarser particles. There are no limit values for deposition, however dust from wet or dry deposition on receptor surfaces can result in a loss of amenity, and as such is considered a statutory nuisance under the Environmental Protection Act 1990. Construction dust can also affect ecosystems through deposition that acts as a barrier physical to photosynthesising plants, and through the effects of its chemical constituents on sensitive ecological receptors.

4.2.7 Receptor sensitivity is considered medium to the risk of amenity impacts from construction dust. With proper mitigation, the risks of construction dust can be significantly reduced. Receptor sensitivity is considered very high to the risk of emissions of construction vehicle and plant exhaust gas emissions.

Permanent (Local Air Quality)

4.2.8 Permanent risks to local air quality can result from changes in the alignment of road centrelines and road edges to a position closer to sensitive human and ecological receptors, and through changes to traffic, such as volume, composition, speed and flow. Whilst realignment of the road may reduce the distance between pollutant source and receptors, this may be countered by improvements in flow that reduce stationary or low-speed traffic and the amount of time that engines are operating at sub-optimal levels. Changes in composition can affect ambient air quality such as an increase in diesel powered HGV and LGV traffic that could result in an increase to PM and NO2 levels.

- 4.2.9 All receptors within the study area are considered to be exposed to this risk and their sensitivity is considered very high because emissions from road traffic have the potential to cause mortality. Pollutant concentrations will not be impacted in any AQMAs because there are no AQMAs in the study area.

Risk to Ecosystems

- 4.2.10 All ecological receptors within the study area are exposed to the risk of increased concentrations of ambient NO_x and nitrogen deposition of vehicle exhaust gas pollutants and are therefore potential constraints to the scheme.
- 4.2.11 Elevated concentrations of NO_x can have a negative effect on vegetation, including leaf damage and reduced growth. It can make vegetation more susceptible to disease and frost damage. Ecosystems are generally affected by the deposition of nitrogen, affecting the balance of nutrients available. Changes in the levels of nutrient nitrogen can favour those plants that will thrive in a high nutrient environment, and thus out-compete those that favour low nutrient environments. Dust deposition can also act as a physical light barrier and block plant stomata. However, the risk to the health of ecological receptors from temporary construction dust deposition is considered to be low because the impacts are likely to be temporary and transient. Sutton Heath and Bog SSSI is considered to be exposed to these risks and can be considered to have very high sensitivity because of the very limited potential for substitution.

Compliance Risk (EU Directive on Ambient Air Quality 2008/50/EC)

- 4.2.12 The Compliance Risk is the likelihood that the scheme may cause the EU air quality limit values to be exceeded either at the scheme location or at locations on the local Compliance Risk Road Network as affected by the scheme. The latest UK air quality compliance report available described in the EAR states that the Eastern non-agglomeration area in which the scheme is located, did not meet the EU mean annual average limit values for NO₂, but did comply with other thresholds. Accordingly, there is the risk that the compliance risk could increase in the wider Eastern non-agglomeration area assessed by the Government.

4.3 Cultural Heritage

Introduction

- 4.3.1 This section provides a summary of the cultural heritage assets within the study area, and the key constraints on any potential scheme resulting from impacts on such assets are described.

Baseline Conditions

Scheduled Ancient Monuments

- 4.3.2 There are ten Scheduled Ancient Monuments within the 1.5km study area, two of which are within 300m of the centreline of the existing A47; notably Bronze Age crop marks (PE201) which is immediately adjacent to the A47, east of Sutton Heath Road. Details are given in **Table 4-3** below and Figure 2.5.1 of the EAR.

Table 4-3: Scheduled Ancient Monuments within the Study Area

Map Ref.	NHLE No.	UID No.	Description	Area (ha)
1.	1003810 1006835	CB136	16 th -century Wansforth-Bridge	0.312
2.	1006836	CB137	Wansford Roman site	2.213

Map Ref.	NHLE No.	UID No.	Description	Area (ha)
3.	1006796	PE201	Bronze Age cropmarks	4.865
4.	1006880	PE 97	Sutton Heath, Romano-British Site	19.062
5.	1006810	PE220	Shrunken Village at Upton	2.955
6.	1006837	PE138	Roman fort/enclosure at Sutton Cross	2.431
7.	1006863	PE126	Site of Roman Villa at Sibson Hollow	3.633
8.	1006862	PE125	Roman Villa SW of Castor Station	3.551
9.	1006864	PE127	Roman Site in Normangate Field	41.085
10.	1006847	PE159	Moated Site, Castor Manor Farm	2.493

Recorded Archaeological Remains

4.3.3 There are no World Heritage Sites recorded within the study area. There are 206 archaeological records within the study area, including finds of Mesolithic, Neolithic and Bronze Age implements and burials, Roman roads, graves and buildings, Medieval and Post-medieval agricultural features and finds and undated subsurface remains identified by crop marks and geophysical surveys, as well as several modern (20th century) aircraft and buildings.

Unrecorded Archaeological Remains

4.3.4 The known archaeological site record within the study area suggests that there is high potential for further buried archaeological remains to survive.

Listed Buildings

4.3.5 There are 139 Listed Buildings in the study area, primarily located within Wansford, Stibbington, Sutton and Ailsworth. Having regard to the study area and route options, the most significant of these with regard potential impacts are Sacrewell Farmhouse (Grade II), lodge (Grade II), millhouse and stables (Grade II*); the setting of which could be affected by any new motorway off slip. The setting of the Grade II* Bridge over the Nene at Wansford will also require further consideration.

Registered Parks and Gardens and Registered Battlefields

4.3.6 There are no Registered Historic Parks and Gardens or Registered Battlefields within the study area.

Conservation Areas

4.3.7 There are seven Conservation Areas (CAs) located within the study area. These include five CAs which were defined by Peterborough City Council and two by Huntingdon District Council; individual areas of Wansford are designated by each council. Ailsworth CA flanks the south side of the existing A47. Details are given in **Table 4-4**.

Table 4-4: Conservation Areas within 1.5km of the A47

Map No.	Description	Authority	Dist. (m)
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Map No.	Description	Authority	Dist. (m)
226.	Thornhaugh Conservation Area	Peterborough City Council	815
227.	Wansford Conservation Area	Peterborough City Council	300
228.	Wansford Conservation Area	Huntingdon District Council	440
229.	Sutton Conservation Area	Peterborough City Council	330
240.	Stibbington Conservation Area	Huntingdon District Council	635
241.	Ailsworth Conservation Area	Peterborough City Council	6
242.	Castor Conservation Area	Peterborough City Council	450

Historic Landscape Character Areas

4.3.8 The historic character of the area includes Prairie fields (large fields created by combining smaller ones) with relic elements, Pre-18th century irregular enclosures, Post-1950s enclosures; and 20th-century leisure areas, such as parks and wildlife enclosures. Any new dual carriageway road or widening of existing roads will have an impact on this historic character.

Key Constraints

4.3.9 There are ten Scheduled Ancient Monuments within the 1.5km study area (refer to Figure 1.1.2 in PCF Stage 1 EAR), one of which is immediately adjacent to the A47. They are assigned a high sensitivity value as they are nationally designated sites and are protected under the terms of the NPPF. There is the potential for the scheme to have an adverse impact either directly on them or indirectly on their settings.

4.3.10 There are 139 listed buildings within the study area, notably those associated with Sacrewell Farm and Country Centre. Grade I and Grade II* listed buildings are assigned a high value due to their designated status and their national importance. Grade II listed buildings are assigned a medium value due to their designated status and their regional importance. The scheme has the potential to have an adverse impact either directly or indirectly through impact on setting.

4.3.11 There are further 210 archaeological and historical structures recorded in the study area. They vary considerably in size and complexity, from individual finds and aircraft sites to Roman and Medieval settlements. These have been assigned a medium value because together they indicate that the area has been utilised for millennia, and much of the remains are of well-defined extent, date and significance to the local area and region.

4.3.12 There is the potential for encountering unknown features and artefacts during construction, particularly as previous investigations in the area have revealed recorded archaeological sites from the prehistoric to the post-medieval periods. This potential increases with greater land take.

4.4 Landscape and Visual

Introduction

4.4.1 This chapter outlines the various landscape and visual constraints within the study area and identifies their sensitivities to change.

4.4.2 Landscape and visual characterisations are undertaken as separate procedures. Landscape impacts are the changes to the physical landscape which change landscape character, while visual impacts are the modifications to existing views and how the landscape is experienced by people (visual receptors).

Baseline Conditions

Landscape Designations

- 4.4.3 There are no designated landscapes or registered parks or gardens within the study area.

National Character Areas

- 4.4.4 As noted in the EAR, the study area covers two National Character Areas (NCAs). These are NCA 89: Northamptonshire Vales and NCA 92: Rockingham Forest (See Figure 2.6.1 of the PCF Stage 1 EAR).
- 4.4.5 The Northamptonshire Vales NCA consists of a series of low-lying vales and river valleys with occasional steep scarp slopes. Riverside meadows and waterside trees and shrubs are common, along with flooded gravel pits, open areas of winter flooded grassland, and wetland mosaics supporting large numbers of wetland birds and wildfowl.
- 4.4.6 There is a mixed agricultural regime of arable and pasture throughout the area, with arable land tending to be on the broader, flat river terraces and smaller pastures on the slopes of many minor valleys and on more undulating ground. The woodland cover throughout the area is considered low; consisting of spinneys and copses on the ridges and more undulating land and hedgerows and waterside and hedgerow trees.
- 4.4.7 The Rockingham Forest NCA consists of a broad, low, undulating ridge underlain by Jurassic limestone which falls away from a prominent, steep northern scarp overlooking the Welland Valley. The landscape is a patchwork of woodland and large- to medium-sized fields of mixed arable with some pastoral use surrounding small nucleated villages. Fields are commonly bounded by well-managed hedgerows with mature trees or drystone walls and display the rectilinear pattern of the enclosures set within a more sinuous pattern of older enclosures, winding lanes and watercourses.
- 4.4.8 Large areas of woodland remain a significant feature of the rural landscape and, while not forming continuous belts, the blocks of woodland often coalesce visually with hedgerow trees and smaller copses to increase the perception of extensive woodland cover across the landscape.

Local Landscape Character Areas

- 4.4.9 The following local Landscape Character Areas (LCAs) are located within the study area (see Figure 2.6.1 of the PCF Stage 1 EAR):
- Huntingdonshire LCA – Nene Valley: The key characteristics of the LCA include the valley floor of the River Nene, the arable and pastoral land use, the distinctive limestone villages reflecting local geology, the A1 is a predominant feature in the area, the archaeology and the parkland around Elton Hall.
 - Huntingdonshire LCA – Northern Wolds: The key characteristics of the LCA include a strong topography of ridges bisected by pronounced valleys. Valleys are well vegetated and intimate in scale, while ridges feel more open, an historical landscape (containing many medieval features), dispersed pattern of historic villages with little modern development and distinctive square church towers topped with spires form characteristic landmarks.
 - Northamptonshire LCA – Middle Nene Valley: The key characteristics of the LCA include the heavily modified River Nene and its broad floodplain, a Jurassic mudstone valley with limestone and ironstone at higher elevations, a number mineral extraction sites (some of which have been converted into a series of lakes), a number of semi natural grasslands and marshes in wetter environments, arable and pastoral land in areas subject to agricultural improvement and drainage, small woodlands along restored lakes and bordering roads and disused railway lines and numerous historic features including

Bronze Age barrows, limited areas of ridge and furrow and a number of former settlement sites (such as a major Roman town at Chester House Farm and a medieval village at Mallows Cotton).

- Northamptonshire LCA – Rockingham Forest: The key characteristics of the LCA include Harper’s Brook and Willow Brook valleys, heavy intractable soils, large woodlands in upland areas (such as Wakerley, Geddington Chase and Fermyn), Iron Age and Roman period villas (such as the Weldon complex), fragmented calcareous and mesotrophic (neutral) grasslands, historic parks (such as Rockingham, Deene, Drayton and Boughton), pastoral lands with hedgerows and dry stone walls in the valleys and larger arable fields elsewhere, a dispersed pattern of farms beyond settlements, and buildings with a vernacular architecture style constructed from creamy grey Lower Lincolnshire Limestone and often roofed with Collywston Slate.
- Peterborough LCA – Nassaburgh Limestone Plateau: The key characteristics of the LCA include the gently undulating limestone landscape, large blocks of woodland, large arable fields with low hedgerows or dry stone walls, large areas of parkland, largely unspoilt nucleated stone villages comprising vernacular buildings constructed of local stone with local slate roofs, remnant pre-enclosure field systems with ridge and furrow near villages and isolated settlements, remnant unimproved calcareous grassland, limestone heath and fragments of acidic bog and generally a quiet rural ambiance.
- Peterborough LCA – Nene Valley: The key characteristics of the Nene Landscape Character Area include the broad valley of River Nene, the gently meandering River Nene, the pasture and flood meadows along banks of river, the large arable fields further from the river, the villages with distinctive stone buildings and generally sympathetic infill development, the major centre of Roman archaeology in association with the Ermine Street crossing of the River Nene, the areas of former gravel extraction within floodplain and the widespread recreational land uses.

Land cover, pattern and texture

- 4.4.10 This stretch of the A47 is situated west of Peterborough, consists of the broad valley of River Nene, the gently meandering River Nene, and pasture and flood meadows along banks of river. The River Nene and its tributaries cut into the soft loam that blankets the area, creating deeply rolling slopes. The River Nene and its tributaries are lined by riverside meadows and waterside trees and shrubs are common, open areas of winter flooded grassland, and wetland mosaics which support large numbers of wetland birds and wildfowl (**See Photograph 4.1**).
- 4.4.11 Arable farmland is the predominant land cover on the area, divided into relatively small and linear agricultural enclosures interconnected by narrow rural lanes, mature hedgerows (predominantly hawthorn, beech, hazel, and elder species) and ditches throughout the landscape. The fields are interspersed with fragmented patches of woodland and clusters of farms and residential settlement.
- 4.4.12 Small copses are scattered throughout the study area, particularly in the northern extents of the study area where the topography is higher. The southern extents of the study area include scattered woodlands along the banks of the River Nene. The woodlands within the study area are established and mature.
- 4.4.13 The texture of the landscape is defined by the contrast of smooth and uniform texture of arable fields and the coarse and more irregular texture of the deciduous hedges and trees. These textures, as much as the colours in the area, will present some changes following the seasons, which will bring more variety to the landscape (**refer Photograph 4.2**).

Photograph 4.1: View from the PRow near the River Nene – illustrating the prominence of water bodies and associated habitats within the study area



Photograph 4.2: PRow, facing west towards Sacrewell Farm Centre – illustrating the contrasting texture of the smooth agricultural land and the coarse deciduous hedgerows and tree lines.



Scale and appearance

- 4.4.14 As the topography of the land is formed by undulating landforms and low river valleys, there are many points in the area that allow open views of the surroundings, including many views of the current A47 and of the potential options for improvement.
- 4.4.15 Topography rises in a more noticeable way towards the north until it meets the ridge that separates the Nene valley and Welland valley which extends north eastwards which is the main ridge line of the area.

Tranquillity

- 4.4.16 Away from the main roads and larger settlements, the gently undulating and low-rolling topography, uniformly covered with a traditional agricultural pattern, and interspersed with historical landmarks like the spires of the churches; define a place with a great sense of tranquillity that matches the rural lifestyle in the area.
- 4.4.17 The A47 and A1 is the principal source of disturbance within the area, but its effects become less perceptible as the distance from the road increases. Traffic in the rural lanes is generally low, increasing during the hours when people travel to work or commute home to avoid the A1, A47 link, which increases traffic on these secondary roads. Some roads on the south side of the A47, like Elton Road, Yarwell Road and Sutton Heath Road to the north of the A47 present a very high volume of traffic during peak hours, as they offer an alternative route from the congested main road, in great detriment to tranquillity. The tranquillity of the landscape increases as the distance from the busy road network increases.

Cultural

- 4.4.18 The landscape and the associated features present a strong historical character from the agricultural pattern to the vernacular buildings. Two storey cottages made of a mixture of bricks and flint stone, with tiled roofs are typical.
- 4.4.19 Most of the modern houses in the villages of Wansford and Sutton Heath are built in a more contemporary style but keeping the main characteristics of the vernacular typology, with brick stone or whitewashed walls which complement the characteristic historical buildings with tiled roofs.
- 4.4.20 There are numerous Listed Buildings within the area including Church of St. Michael and All Angels (see Photograph 4.3) and the River Nene Bridge (see Figure 2.6.2 of the EAR).
- 4.4.21 There are some utilitarian buildings such as storehouses in the farms or small industrial areas but their presence is not very disruptive in the landscape as they are generally screened by high trees, hedges and other buildings.
- 4.4.22 Remnant buildings, shelters and other World War II infrastructure associated with Stamford Airfield are also present within the surrounding environment.

Photograph 4.3: View taken from Sutton Village – illustrating the Church of St. Michael and All Angels (Grade I Listed Building) which contributes to the historical setting of the study area.



Human Interaction

- 4.4.23 The A47 is the major connecting route for users between Wansford and Sutton. However the A47 also forms a geographical barrier to pedestrians and the other non-motorised users due to heavy traffic flows along it. The rural lanes form key links between the smaller settlements in the area, however these lack footways and the visibility on the lanes is often poor. As a result human interaction with the landscape along the road network within the study area is considered to be limited.
- 4.4.24 There is an extensive network of PRoW (Public Rights of Way) in the area encompassing footpaths, cycle routes and bridle ways within the area that encourage NMU activity (see Photograph 4.4). The PRoWs are generally well signed, although sometimes they cross fields where livestock are kept.
- 4.4.25 The Sacrewell Farm and Country Centre is an additional local community provision, located in the northwest of the study area, which promotes human interaction with the landscape. The facilities offer opportunities for people of all ages to try camping, to navigate wildlife trails, to view historical watermill and listed buildings and to learn about the agricultural practices within the area.

Photograph 4.4: Bridal/PRoW Nene Way, West of Wansford leading to Sutton Village – illustrating the open view along the Bridal/PRoW which allows users to interact with the rural countryside within the area.



Visual Receptors

- 4.4.26 There are a number of residential and commercial premises throughout the study area with a view of the A47. The most notable of which include the residential premises along the A47 between the Sutton Heath Road junction and The Drift junction and along the urban fringes of the various villages within the study area (Sutton, Stibbington, Ailsworth, Upton and Wansford) and the commercial premises at isolated farms (such as Lower Lodge Farm and Manor Farm) and at the Sacrewell Farm and Country Centre. The receptors adjacent the A47 generally experience direct views of the A47, particularly during winter months where screening is less prominent (see Figure 2.6.3 of the PCF Stage 1 EAR).
- 4.4.27 There are extensive public rights of way (PRoWs) within the study area which offer views of the A47. The most notable of which include the footpaths/trails/cycleways located northwest of Ailsworth, southeast of Upton, along the River Nene and around the Sacrewell Farm and Community Centre. The majority of the views of the A47 from PRoWs within the rural landscape are restricted due to the presence of trees and shrub in the lower valley floodplain areas and along the embankments of the A47. The views from PRoWs within the villages are screened by residential properties and established trees which line various routes in the village areas. Visibility of the A47 and the A1 is possible at various high points in Wansford Village. Sutton Village has views of the A47 from various openings within hedgerows. Views of the A47 from PRoWs are likely to be less restricted during winter months when vegetation screening is considerably less (see Figure 2.6.3 of the PCF Stage 1 EAR).

Key Constraints

- 4.4.28 The landscape features within the study area contribute to the distinctive character of the National Character Areas and the local Landscape Character Areas. As a result, the regional and local landscapes are considered to be of moderate sensitivity.
- 4.4.29 The low lying landscape is dominated by the River Nene and contains a patchwork of pasture and arable fields, hedgerows, woodland copses and nucleated villages which contain many historical features and listed buildings. The distinctive land cover, pattern and texture are considered to be of moderate sensitivity.
- 4.4.30 Away from the main roads and larger settlements, the gently undulating topography is only interrupted by hedgerows, woodlands and local roads and lanes. The tranquillity of the local area is considered to be of high sensitivity; and this tranquillity is directly related to the distance from the main road network primarily the A47 and A1.
- 4.4.31 There are a significant number of PRoWs, cycle routes, bridleways and community facilities within the study area which promote human interaction with the landscape. As a result, human interaction provisions within the study area are considered to be of high sensitivity.
- 4.4.32 Given that the majority of views of the A47 from residential dwellings, commercial premises, community facilities and public rights of way within the study area are restricted by vegetation, hedgerows and treelines, the sensitivity of visual receptors is considered to be of low sensitivity.

4.5 Nature Conservation and Biodiversity

Introduction

- 4.5.1 This chapter outlines the various ecological constraints within the study area and identifies their sensitivities to change. It is informed by baseline information gathered through desktop study and fieldwork undertaken in summer 2016.

Baseline Conditions

Designated sites

- 4.5.2 As described in the PCF Stage 1 EAR, online sources identified five statutory designated nature conservation sites within 2km of project extents (extended to 10km for sites designated for bats and birds). The sites are detailed in **Table 4-5** and presented on PCF Stage 1 EAR Figure 2.7.1 with their distance from the existing A47 and the qualifying/notifying features.

Table 4-5: Designated sites

National statutory designated sites	Approx. distance and direction from existing A47	Description
Sutton Heath & Bog Site of Special Scientific Interest (SSSI)	50m North	This area supports grassland communities of two main types, namely calcareous grassland of the Jurassic limestone type and neutral grassland of the base-poor marsh type, both of which are uncommon in Cambridgeshire.
Wansford Pasture SSSI	0.4km West	Supports two main grassland types, notably a species-rich flush and Jurassic limestone grassland. These grassland types are now nationally scarce and are particularly uncommon in Cambridgeshire
Old Sulehay	1.08km South	A large block of semi-natural ancient woodland with

National statutory designated sites	Approx. distance and direction from existing A47	Description
Forest SSSI and Ancient Woodland (AW)	West	several types of coppice including hazel <i>Corylus sp</i> and field maple <i>Acer campestre</i> . This site has been acquired by the Wildlife Trust and is now a nature reserve.
West, Abbot's & Lound Woods SSSI & AW	1.6km North East	This site holds a range of lowland woodland types, many of which are scarce in Britain. These include a stand of plateau alderwood (a type known from no other ancient woodland in Cambridgeshire). Some typical ancient woodland plants are recorded.
Castor Hanglands SSSI, NNR & AW	1.7km North East	This area possesses a range of habitat types from ancient broadleaved woodland to unimproved grassland and scrub. Some of these habitats are scarce in Britain. All are scarce in the East Midlands.

- 4.5.3 Online sources identified eight non-statutory designated nature conservation sites within 2km of the project extents. The sites are detailed in **Table 4-6** below and are shown in Figure 2.7.1 of the PCF Stage 1 EAR.

Table 4-6: Non-statutory Designated Sites

Wildlife site and designation	Approx. distance and direction from A47	Description
Sutton Disused Railway CWS	Runs beneath the A47 carriageway South to North	Supports at least 0.05ha of NVC community CG5 Upright Brome - Chalk False-brome grassland.
A47 / A1 Interchange Road Verges CWS	Immediately North and South	The site qualifies because it has at least 0.05ha of NVC community CG5 Upright Brome - Chalk False-brome grassland and because it supports frequent numbers of at least six strong calcareous grassland indicator species.
River Nene CWS	50m South	This section of the River Nene is not affected by canalisation or poor water quality. The Joint Nature Conservation Committee (JNCC) Invertebrate Site Register (ISR) classifies this section of the River Nene as Grade C. The CWS contains at least three species of pondweed which are regionally and nationally scarce vascular plant species.
Sutton Meadows North CWS	0.1km South	The site qualifies because it supports at least five mature pollard willows in association with other semi-natural habitat.
Stibbington Pits CWS	0.2km South	The site contains a type 10A waterbody with more than 15 submerged, floating and emergent species; because it contains a waterbody with at least 3 species of pondweed; it is a Grade C site in the JNCC Invertebrate Site Register.
Hell Corner and Top Field Spinney CWS	0.6km North	The woods are ancient semi-natural woodlands less than 2ha in size with more than 30 woodland plants, at least 5 are ancient woodland indicator species. At least 500m of mature, wide hedgerow of the required management and species diversity.
Standens Pasture Local	0.6km South West	A remnant of limestone grassland with species-rich springs and flushes. The richest areas for plants are the

Wildlife site and designation	Approx. distance and direction from A47	Description
Wildlife Site (LWS)		flushes dominated by blunt-flowered rush, with other species such as fen bedstraw, large bird's-foot-trefoil and distant sedge. Rarer wetland species can also be found, including large southern marsh-orchids as well as common spotted-orchids.
Sutton Wood Ancient Woodland (AW)	1.3km North	Semi-natural ancient woodland
Yarwell Gravel Pit LWS	1.8km South	A small, well-established gravel pit lake with abundant marginal vegetation and a thriving fish and wildfowl population. This site also provides useful habitat for amphibians and invertebrates, extending the habitat corridor of the River Nene Valley.

Habitats

- 4.5.4 Priority Habitat Inventory Data indicate that seven Biodiversity Action Plan priority habitats are present within 2km; deciduous woodland, lowland fens, coastal and floodplain grazing marsh, lowland calcareous grassland and good quality semi-improved grassland habitats. The habitat types found within the Phase 1 survey area are outlined in **Table 4-7** below and in Figure 2.7.2 of the PCF Stage 1 EAR).

Table 4-7: Habitats

Habitats within Study Area	
Arable	Mixed plantation woodland
Broadleaved plantation woodland	Hedgerows including: 'intact hedge – species rich', 'intact hedge – species poor', 'defunct hedge – species rich', 'defunct hedge – species poor', 'hedge with trees – species rich', 'hedge with trees – species poor'
Semi-improved neutral grassland	Poor semi-improved grassland
Tall ruderal	Improved grassland
Basic flush	Amenity grassland
Running water	Standing water

Protected and Notable Species

- 4.5.5 Following the Phase 1 Habitat Survey and records search the study area has the potential to support to following protected and notable species:
- Amphibians – A Habitat Suitability Index (HSI) assessment identified 11 ponds with the potential to support amphibian communities with emphasis on Great Crested Newts (GCN). The results of eDNA surveys within the eleven ponds indicate the absence of GCN within the study area (See Figure 2.7.4 of the PCF Stage 1 EAR).
 - Bats - Records indicate the presence of seven bat species within a 10km search radius of the A47 site. However, none of which were recorded within the project extents. Site surveys indicate that the trees and buildings in the surrounding area have a low to high bat roost potential and that the habitats within the study area offer foraging and

commuting potential and connectivity with the wider environment (See Figure 2.7.3a of the PCF Stage 1 EAR).

- Birds - Observations during the Phase 1 survey and anecdotal evidence suggest the presence of over-wintering birds; ground nesting birds and protected/notable birds such as red kites, buzzards and barn owls (See Figure 2.7.3a of the PCF Stage 1 EAR).
- Otter – There are 16 records of otter within 2km of the scheme. The River Nene which runs adjacent to the site has a high potential to support otters and is locally known as hosting a stable population, inclusive of potential holt sites as well as foraging and commuting routes (See Figure 2.7.3b of the PCF Stage 1 EAR).
- Water vole – There are nine records of water vole within 2km of the scheme. The River Nene and tributaries are assessed as having areas of suitable habitat for water vole (See Figure 2.7.3b of the PCF Stage 1 EAR).
- Reptiles – Records indicate that two species of reptile (grass snake and common lizard) have been reported within 2km of the scheme. The extended Phase 1 survey identified several areas of suitable habitat for all of the above reptile species including scrub, ruderal habitats and field margins (See Figure 2.7.3b of the PCF Stage 1 EAR).
- Badger - records indicate a stable badger population within the survey area, with 27 records of setts and various sightings scattered throughout the area. Site investigations highlighted the presence of active setts and presence of suitable habitats for the species within the study area (See Figure 2.7.3b of the PCF Stage 1 EAR).
- Fish – Records indicate the presence of European eel, brown trout, and bullhead (See Figure 2.7.3b of the PCF Stage 1 EAR).
- Invertebrates – Records indicate the presence of 112 species of invertebrates. The study area contains suitable habitats for Desmoulins's whorl snail and white-clawed crayfish (See Figure 2.7.3b of the PCF Stage 1 EAR).

Invasive species

4.5.6 No invasive species were identified during the extended Phase 1 habitat survey.

Key Constraints

4.5.7 **Table 4-8** identifies the ecological features within the study area and provides an indication of their value (as explained in detail in the PCF Stage 1 EAR). Key constraints are those of regional, national and international value.

Table 4-8: Ecological Features

Ecological Feature	Resource valuation
Designated Sites	
Barnack Hills & Holes SAC	International
Orton Pit SAC	International
Nene Washes SPA, SAC & Ramsar	International
Sutton Heath & Bog SSSI	National
Wansford Pasture SSSI	National
Old Sulehay Forest SSSI/AW	National
West, Abbot's & Lound Woods SSSI & AW	National
Castor Hanglands SSSI, NNR & AW	National
Ancient Woodland	National
County/Local Wildlife Sites	County
Habitats	

Ecological Feature	Resource valuation
(BAP) Priority habitats	County
Important hedgerows	County
Running water	County
All other habitats	Local
Protected & Notable Species	
Bats	Regional
Breeding bird species	Regional -National
Wintering bird species	Not assigned
Great Crested Newts (GCN)	Local-county
Badger	Local
Brown hare	Local
Otters	County
Water vole	County
Reptiles	Local
Terrestrial invertebrates	Local
Desmoulin's whorl snail	National
White clawed crayfish	Regional-county
Fish (brown trout, European eel)	County / Local
Spined loach	National
Other fish species	Local
Invasive species	Negative

4.6 Materials

4.6.1 Most construction, improvement and maintenance schemes on the road network will require the acquisition and use of primary raw materials and manufactured products, and this scheme will require large quantities of raw materials, the use of which has the potential to cause adverse impacts such as the depletion of natural resources and the generation of waste.

4.6.2 **Table 4-9** identifies the materials use and potential waste that are likely to arise from the scheme.

Table 4-9: Key Constraints Materials and Waste

Project Activity	Material use	Potential waste arisings
Site remediation / preparation / earthworks	Site clearance will involve the removal of street furniture (e.g. street lightening, cabinets, CCTV) and traffic signs as well as any affected boundary walls and fencing. These should be retained wherever possible for reuse after the scheme's completion.	The scheme will involve considerable earthworks with, all excavated earthwork material being re-used on site (where possible) rather than disposed of and importing virgin aggregates. Maximising the reuse of materials won on site for example through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials needing to be imported onto the site and reduce the number of haulage journeys. This practice will have its own cost benefits and will aid in the reduction of airborne pollutants and greenhouse gas emissions from transport. A reduction in waste leaving the site for landfill also has significant cost savings and long

Project Activity	Material use	Potential waste arisings
		term environmental benefits
Demolition	Equipment and machinery will likely be mini-digger, large digger, planer, spreader, jack-hammer, tipper lorries and cranes.	The existing road and roundabouts may be taken up and removed. There may also be properties that may be demolished and removed if they lie beneath the scheme. Vegetation that is removed to allow construction of the earthworks and drainage structures should be chipped on site and used as a mulch to help establish new planting once construction is completed.
Site construction	<p>This scheme will require a large amount of materials in order to construct, most obvious of which is the materials required to construct the new widened carriageways, cycle ways and footpaths.</p> <p>Recycled aggregates can be sourced for road construction to reduce costs and improve sustainability of the scheme. Materials that are required should be sourced from local quarries and suppliers to reduce the length of the haulage route</p> <p>Kerbs and drains will all be precast concrete, with footways being finished with a mix of asphalt surfacing and paving. Tactile paving will be used along the route for pedestrian crossings which will be a mixture of a segregated cycle lane and shared cycleway / footway.</p>	<p>Materials should be ordered as and when required to minimise storage times on site. This will prevent deterioration of materials and reduce wastage</p> <p>Any material excavated and not reused within the scheme boundaries will also likely be removed from site to a materials reclamation site. Any materials not suitable for reuse will likely be disposed of at a landfill site. This may include any excavated material from contaminated land. There is a potential for road planings to contain coal tar which would be classified as hazardous waste and would require disposal at a hazardous landfill site.</p> <p>If waste is disposed of at a landfill site, it would create a large impact, as landfill space within both inert and hazardous landfill sites is a finite resource, (medium sensitivity and major magnitude leading to a large impact). However, if suitable inert material can be reused either on site or from a materials reclamation centre it would reduce the impact</p>
Operational / maintenance	The material resources and waste post construction cannot be estimated at this stage. However assumptions can be made in that any road repairs will require granular sub base, asphalt binder and surface course and will have road planings as waste. There may also be material and waste issues from the upkeep of road furniture and lighting.	

4.6.3 As the design is ongoing, there is insufficient information at present to accurately forecast waste streams that will be produced on the site. Therefore, local landfill capacity as a whole has been reviewed. The Environment Agency (EA) has information on the nearest active landfill sites to the scheme, as summarised in **Table 4-10**.

Table 4-10: Nearest Waste Infrastructure

Name of site	License Number	Distance	Type of site
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Name of site	License Number	Distance	Type of site
Thornhaugh Quarry II, Leicester Road, Peterborough, PE8 6NL	EAEPR\EA/E PR/CB3106S F/V002	1.41km	L05: Inert LF
Thornaugh Landfill Site, Leicester Road, Thornhaugh, Wansford, Cambridgeshire, PE8 6NH	401945	2.29km	WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE
Kings Cliffe Works, Framples Field, Kingscliffe, Peterborough, Cambridgeshire, PE8 6PB	70601	3.98km	A07: Industrial Waste Landfill (Factory curtilage)
East Northants Resource Management Facility, Stamford Road, , Kings Cliffe, Northamptonshire, PE8 6XX	GP3731VL	6.30km	WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE
Bullimores Sand and Gravel Limited, Stamford, Duddington, Northamptonshire, PE9 3QA	210055	8.00km	L05: Inert LF
Grange Top Quarry Landfill, Ketton Works, Ketton, Stamford, Lincolnshire, PE9 3SX	73155	11.16km	WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE
Grange Top Quarry Landfill, Ketton Works, Ketton, Stamford, Lincolnshire, PE9 3SX	71063	11.16km	WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE

4.7 Geology and Soils

Introduction

4.7.1 This section describes the constraints from geology and soils within the study area.

Baseline Conditions

Designated Sites

4.7.2 There are no sites that are designated for their geological or geomorphological importance within the study area and there are no Geological Conservation Review Sites.

Geomorphology

4.7.3 The rocks which characterise this area were deposited during the Jurassic Period between about 195 and 160 million years ago, with later Pleistocene glacial sands and clays laid down on top of the Jurassic bedrock sometime during the last 450,000 years. The underlying rocks have been moulded by rivers and streams to form valleys, with a more pronounced slope profile and undulating landform on the rim of the plateau and ridges. Where water action has been limited, the landscape retains a plateau-like appearance. The pattern of large tracts of

woodland interspersed with farmland that extends across much of the landscape reflects the widespread deposits of glacial till and associated heavy, wet soils. These were less favourable for cultivation and settlements evolved along the valleys where lighter soils are exposed, although there is increasing evidence for prehistoric settlement and land use on the heavier soils.

Bedrock Geology

- 4.7.4 Bedrock deposits underlying the area comprise the Whistby Mudstone Formation, Grantham Formation (sandstone, siltstone and mudstone), Lower Lincolnshire Limestone Formation, Rutland Formation (argillaceous rocks with subordinate sandstone and limestone); Blisworth Clay Formation (mudstone) and Cornbrash Formation (limestone) (see Figure 2.11.1 of the PCF Stage 1 EAR).

Superficial Geology

- 4.7.5 Superficial deposits underlying the area comprise the following:
- Alluvium deposits located along the banks of the River Nene and its tributaries (namely Wittering Brook). The layer extends from the north of the study area to the centre of the study area before forking off into both the south-eastern and south-western extents of the study area;
 - River Terrace deposits located along the borders of alluvium layers. The layer extends from the north of the study area to the centre of the study area before forking off into both the south-eastern and south-western extents of the study area; and
 - Head deposits located in the west (Mill House), south (north of Stibbington) and east (Lower Lodge Farm) of the study area (see Figure 2.11.2 of the PCF Stage 1 EAR).

Soils

- 4.7.6 The European Soil description describes the soils within the study area as a freely draining shallow lime-rich soil over chalk or limestone. This soil has a moderate fertility rating and is typically found in herb-rich downland areas and limestone pastures and pavements in the upland areas; beech hangers and other lime-rich woodlands. The eastern and southern extents of the study area contain freely draining slightly acid but base-rich soil. This soil has a high fertility rating and is typically found in base-rich pastures and deciduous woodlands (see Figure 2.11.3 of the PCF Stage 1 EAR).
- 4.7.7 According to the Cranfield Soil and Agrifood Institute, there are four soilscapes within the study area, soilscape 3 (shallow lime-rich silts over chalk or limestone), soilscape 7 (freely draining slightly acid but base rich soils), soilscape 18 (slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils) and soilscape 20 (loamy and clayey floodplain silts with naturally high groundwater).
- 4.7.8 The Natural England agricultural land classifications indicate that the floodplain areas associated with the River Nene and Wittering Brook (within the southern extents study area) are mostly classified as very good agricultural land (Grade 2) with a few minor areas of poor agricultural land (Grade 4) located immediately adjacent the watercourses. The land located within the northern, eastern and western extents of the study area are generally classified as good-moderate land (Grade 3) for agricultural purposes with minor areas of poor-very poor (Grade 4 and 5) agricultural land located near Thornhaugh and Upton (see Figure 2.11.4 of the PCF Stage 1 EAR).

Mining Resources

- 4.7.9 There are ten historic opencast mining sites located within the study area, including:

- Six limestone quarries – Thornhaugh Quarries (located 0.75km and 1.05km north of Wansford), Sutton Pits (located 410m northwest of Sutton), Wansford Road Station (located 450m north of the A47) and Sutton Heath (located 260m north of the A47); and
- Four sand and gravel pits – Sutton Gravel Pit (located 270m northeast of Sutton, along the A47), Stibbington Gravel Pit (located in South), Stibbington (located 880m of Wansford) and Haycock (located 460m east of Wansford).

4.7.10 The volume of extractable mineral resources within the study area is considered substantial.

Hydrogeology

Aquifers and groundwater vulnerability

4.7.11 There are three groundwater bodies associated with the scheme as follows:

- Welland Limestone Unit A which the EA has classified in 2015 as having an overall quantitative status of poor and overall chemical status of poor;
- Nene Mid Lower Jurassic Unit which the EA has classified in 2015 as having an overall quantitative status of good and overall chemical status of good; and
- Northampton Sands which the EA has classified in 2015 as having an overall quantitative status of good and overall chemical status of good (See Figure 2.9.3 of the PCF Stage 1 EAR).

4.7.12 The BGS indicate the following aquifers underlie the study area:

- Inferior Oolite Group, a highly productive limestone aquifer yielding up to 40 L/s in Lincolnshire, with copious springs at outcrop; brackish at depth where confined;
- Lias Group, an aquifer that has ‘essentially no groundwater’ comprising a largely mudstone sequence with limestone and Marlstone Rock forming local aquifers yielding small supplies; and
- Great Oolite Group, a moderately productive significant limestone aquifer producing large yields.

4.7.13 The superficial deposits form a Secondary A aquifer (permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers) and that the bedrock aquifer form a Principal Aquifer (layers of rock or drift deposits that have high inter-granular and/or fracture permeability which support water supply and/or river base flow on a strategic scale).

4.7.14 The western extents of the study area are in a Major Aquifer High Groundwater Vulnerability Zone with the eastern extents in a Minor Aquifer Intermediate Groundwater Vulnerability Zone (See Figure 2.9.3 of the PCF Stage 1 EAR).

Groundwater Wells

4.7.15 The EA indicate that there is a groundwater source protection zone classified as an ‘Outer zone (Zone 2)’ located in the north of the study area.

4.7.16 According to the EA, there is one groundwater abstraction licence in use 1.22km south of the existing scheme (south of Manor Farm). BGS indicate that there are also 11 groundwater wells within the study area.

Groundwater Dependent Terrestrial Ecosystems

4.7.17 Groundwater dependent terrestrial ecosystems (GWDTE) are wetlands which critically depend on groundwater flows and /or chemistries. The Water Framework Directive (WFD) sets out objectives for the water environment. These include the protection, enhancement and

restoration of surface water, groundwater and water dependent protected areas and prevention of deterioration.

- 4.7.18 As stated within Section 4.5 Nature Conservation and Biodiversity, there are coastal and floodplain grazing marsh, lowland meadows and lowland fens BAP Priority Habitats (England). Although these areas are likely to be dependent on the River Nene, they may also be dependant to an extent on groundwater, for example, bog woodland, mires, swamps, wet grassland.

Contaminated Land

Historical Map Review

- 4.7.19 A review of historical maps indicates that the railway line existed within the study area between 1885 and 1950. The railway line migrates through the eastern extents of the study area in a north to south direction.
- 4.7.20 Potential sources of contamination shown on current OS maps include current and dismantled railways, historic and current landfills, garages, car wash, agriculture and livestock farms and the current roads and associated infrastructure.

Landfill Sites

- 4.7.21 According to the EA, there is an authorised landfill and two historical landfills located within the western extents of the study area, 750m west of Wansford.

Petroleum Sites

- 4.7.22 There is a commercial petroleum site located within the study area, approximately 580m west of the A1/A47 roundabout. There are likely to be petroleum tanks sited on the agricultural properties within the study area; for example, Sacrewell Farm, Lower Lodge Farm, Model Farm and Manor Farm.

Key Constraints

- 4.7.23 The geological and soil features and their sensitivities are summarised below in **Table 4-11**. Those features with a medium or higher sensitivity are considered to be key constraints.

Table 4-11: Key Constraints Geology and Soils

Feature	Sensitivity
Designated sites	Low
Geomorphology	Low
Superficial and Bedrock geology	Low
Soils	Low to medium
Mineral Resources	Low / High
Hydrogeology	High
Contaminated land	Not defined

4.8 Noise and Vibration

Introduction

- 4.8.1 This chapter describes the noise environment, highlights the sensitive receptors and reports any constraints within the study area. It is informed by desk study and preliminary baseline noise measurements undertaken by Amey surveyors in summer 2016.
- 4.8.2 The realignment or improvement of an existing road has the potential to change the existing noise and vibration levels at sensitive receptors and therefore has the potential to cause either beneficial or adverse effects. These potential effects may arise either during construction (which are typically temporary in nature) or during operation (which are typically permanent in nature).

Baseline Conditions

Desk Study

- 4.8.3 As noted in the PCF Stage 1 EAR, traffic volumes have been recorded at two locations relevant to the study area. Count point 81079 records an AADF for 2015 of 23,559 vehicles. Count point 36083 records an AADF for 2015 of 47,438 vehicles. From these figures, it is likely that the A47 is the dominant source of noise in the area.
- 4.8.4 Traffic noise along the A47 between Wansford and Sutton was mapped by Defra and can be viewed on the England Noise Map Viewer website as described in the EAR. The mapped noise levels can be viewed on the England Noise Map Viewer website which also shows that noise levels at the closest sensitive receptors along the A47 between Wansford and Sutton are in the region of 70 to 75 dB LAeq, 16h while at the A1 noise levels at sensitive receptors close to the road are greater than 75 dB LAeq, 16h.
- 4.8.5 Defra identified four Noise Important Areas (NIAs) within the study area due to the high levels of traffic. Noise Important Areas (NIAs) are defined by Defra as areas where the top 1% people affected by noise in England reside. The various NIAs within the study area (ID numbers are 5303, 5304, 5305 and 12125.) are shown on Figure 2.8.1 of the PCF Stage 1 EAR.
- 4.8.6 There are approximately 1268 residential properties, 30 commercial properties and 19 community facilities (the majority of which are located within the villages of Wansford, Thornhaugh, Stibbington, Sutton and Ailsworth) as well as three designated sites (Old Sulehay Farm SSSI, Wansford Pasture SSSI and Sutton Heath and Bog SSSI).

Field Survey

- 4.8.7 During the site visit in June 2016 short term noise measurements were undertaken at sample locations throughout the study area. The survey locations were chosen based on their proximity to sensitive receptors as well as within NIAs. It was observed that predominant noise source within the area is road traffic noise from the A47. Further away from the A47 carriageway, natural sounds become more dominant such as birdsong and the natural wind. Other noise sources within the area include natural sounds such as birdsong and the sound of wind blowing through trees.
- 4.8.8 The results of the noise survey described in the PCF Stage 1 EAR show that noise levels are highest at the monitoring points close to the A1 while noise levels close to the A47 are slightly lower. Within the village of Wansford noise levels decrease with distance away from the A1 and the A47. Similarly, in the village of Thornhaugh noise levels decrease with distance from the A1. Noise levels in the villages of Sutton and Ailsworth are approximately 53 dB LAeq, 15 min and the noise environment is considered tranquil. Noise levels in Upton and Thornhaugh Sutton are even lower (47 and 51 dB LAeq, 15 min respectively).

Key Constraints and Their Sensitivities

- 4.8.9 Sensitive receptors within the study area include all properties in the villages of Wansford, Thornhaugh, Stibbington, Sutton, Upton and Ailsworth and any of the surrounding farms and isolated buildings. This includes residential, community, and commercial properties, which are considered to be of high sensitivity to changes in noise levels.
- 4.8.10 The four Noise Important Areas will require consideration. The presence of NIAs within the study area is a constraint to all dualling options. Even if the dualling has no significant impacts on noise levels, the presence of NIAs means that mitigation must be considered to reduce the noise levels at these areas. However, mitigation will only be included within any scheme design if it provides value for money.
- 4.8.11 Sutton is considered to be the only settlement currently affected by noise from the A47. Any change in the road alignment will change noise levels within settlements and the groups and numbers of residents affected, with properties on the outer edges of the settlements more likely to be affected. Moving the road alignment can have beneficial effects as well as adverse effects with properties currently located close to the existing A47 experiencing a reduction in noise levels if the road were to move further away.

4.9 People and Communities

Introduction

- 4.9.1 The aim of this chapter is to identify the key features and constraints in the study area in relation to people and communities including vehicle travellers, NMUs (pedestrians, equestrians and cyclists) and land use (private property, community land, development land, agricultural land). It is informed by desk study and a site walkover undertaken by Amey surveyors in summer 2016.
- 4.9.2 An Equality Impact Assessment has been undertaken as part of the Highways England PCF PCF Stage 1 process.

Baseline Conditions

Pedestrians, Cyclists, Equestrians and Community Effects

- 4.9.3 At present neither a NMU survey nor Road Safety Audit (RSA) have been completed, these will be conducted at later PCF stages to inform and develop the designs.

Public Rights of Way

- 4.9.4 Public Rights of Way (PRoW) are common within the study area and form a network in the landscape surrounding the existing A47. They are generally well signposted and well-used, with noticeboards observed encouraging their use. Some are permissive, depending on the land owner and most make use of field boundaries with frequent styles and kissing gates. The routes appear to perform an important recreational purpose for residents and provide an alternative to travelling along often busy roads, in close proximity to traffic (see Figure 2.10.1 of the PCF Stage 1 EAR).

Cycle Routes

- 4.9.5 There are no National Cycle Routes within the study area. However, there are local cycle routes within the area (see Figure 2.10.1 of the PCF Stage 1 EAR), that run along:
- Old Leicester Rd;
 - A6118;

- Yarwell Rd / Wansford Rd;
- Thornhaugh 8 / Sutton 5 PRowS;
- Helpston Rd / Peterborough Rd; and
- Sutton 3 PRow.

Equestrians

- 4.9.6 There are four bridleways in the study area. The bridleways are located near the A1 around Sacrewell Farm and east to Sutton Heath Road (runs alongside Thornhaugh 8 PRow), Landley Bush Road and Ailsworth (see Figure 2.10.1 of the PCF Stage 1 EAR).

Footways

- 4.9.7 Footways are almost entirely absent along the A47 (with the exception of a footway along a lay-by). There is very little provision of footways on side roads within the study areas many of which provide access to PRowS and are therefore likely to be used by NMUs. These side roads also carry notable volumes of traffic, making vehicle NMU interactions frequent. Footways within the villages of Wansford, Sutton, Ailsworth and Stibbington are generally narrow, extremely close to traffic and unpleasant to use. Nonetheless, community facilities are concentrated within these residential areas, and given the geographical size of the settlements, footways are likely to be well used as a means of accessing them (see Figure 2.10.1 of the PCF Stage 1 EAR).

Community Facilities and Community Land

- 4.9.8 There are a significant number of community facilities within the study area, including community buildings, places of worship, medical facilities and recreational facilities (see Figure 2.10.1 of the PCF Stage 1 EAR).

Land Use

- 4.9.9 The majority of land within the study area is used for agriculture purposes. There are also a large number of residential properties which include the villages of Wansford and Sutton. Commercial businesses (outside of agriculture) are also common and areas of community land or open space are numerous. Notable additional features include the River Nene and its floodplain which comprises a mosaic of ponds and wildlife habitats and areas of woodland.

Private Property

- 4.9.10 Private properties are concentrated within the villages of Wansford, Sutton, Ailsworth and Stibbington. Although individual properties are also scattered throughout the study area. There are approximately 1268 residential properties within the study area. There are approximately 30 commercial premises within the study area, some of which could also be considered to be community facilities or part of an agricultural unit.

Community Land

- 4.9.11 Areas of community land are common within the study area, including places of worship and associated grounds, schools and playing fields and areas which could be considered to be open space such as allotments or village greens, where exchange land may be required if land is lost.

Development Land

- 4.9.12 A review of current planning applications within the study area was completed. There was an application for the construction of five flats in Wansford; however this was withdrawn by the applicant in July 2016.

- 4.9.13 Also of note is the Homes and Communities Agency proposal for the creation of a village to the east of Sutton Heath Road. This however has yet to be assigned on the local development plan.

Agricultural Land

- 4.9.14 A large portion of the land within the study area can be categorised as open farmland with the primary use of growing crops or other farming practices. This land under the ownership of a number of private individual owners.
- 4.9.15 The Natural England agricultural land classifications indicate that the floodplain areas associated with the River Nene and Wittering Brook (within the southern extents study area) are mostly classified as very good agricultural land (Grade 2) with a few minor areas of poor agricultural land (Grade 4) located immediately adjacent the watercourses. The land located within the northern, eastern and western extents of the study area are generally classified as good-moderate land (Grade 3) for agricultural purposes with minor areas of poor-very poor (Grade 4 and 5) agricultural land located near Thornhaugh and Upton.

Vehicle Travellers

Driver Stress

- 4.9.16 The section of the A47 that is subject to this assessment is the main commuter route between the cities of Peterborough and Leicester as well as serving the western hinterland of Peterborough's suburbs via the A1 and as such it suffers congestion at peak times. The stretch of the A47 between the A47/A1 junction (north of Wansford) and Sutton roundabout is currently a single carriageway. This increases journey times for travellers and is a contributory factor to driver stress. According to the Department for Transport Traffic Count Data, the Annual Average Daily Traffic flow along the A47 (2015) is 23,559 vehicles, 2005 of which are HGV's.
- 4.9.17 Although the single carriageway layout will contribute to levels of traveller stress, especially during peak travel times where traffic may become congested, there are clear views of oncoming traffic along the carriage way, with no sharp corners or blind spots along this section. The speed limit along the carriageway is currently 60mph as a result the level of stress along the carriageway is moderate.
- 4.9.18 Existing traveller care facilities along this section of the A47 are limited to a service station (located approximately 560m east of the A1/A47 junction) and picnic area in Wansford (approximately 350m east of the A47 roundabout).

View from the Road

- 4.9.19 Within the study area, the drivers' views from the A47 are generally obscured by large hedgerows which line both sides of the carriageway, cuttings and structure. As a result the view from the road can be described as a restricted view.
- 4.9.20 Where views are not impeded by the hedgerows, the relatively flat, undulating arable landscape can be viewed from the road.

Key Constraints

- 4.9.21 One of the key constraints within the study area is the movement of NMUs. There are a large number of well-used PRoWs, while side roads and footways within villages provide an important means of access for the local population using community facilities. Therefore, the sensitivity of the local NMU network is considered to be high.

- 4.9.22 In terms of land use, the key constraints within the study area are represented in the need to conserve high quality farmland within the study area. Grade 2 land is considered to be of high sensitivity while areas of Grade 3 land are deemed to be of medium sensitivity.
- 4.9.23 Key areas of community land are those likely to be used by vulnerable groups or frequently by a significant number of people. Such areas of land are common within the study area and are considered to have a high sensitivity. Similarly, where an area of community space is lost, this will represent a notable constraint through the need to provide an area of exchange land; equally advantageous to its users.
- 4.9.24 Also of note, is the potential for any improvement of the A47 within the study area to benefit road users, both in terms of driver stress and views from the road.

4.10 Road Drainage and Water Environment

Introduction

- 4.10.1 The purpose of this section is to describe the road drainage and water environment within the study area, to highlight the sensitive receptors and to identify any constraints associated with the scheme.

Baseline Conditions

Topography

- 4.10.2 The topography of the study area falls in a western direction towards the River Nene and in a southern direction towards the Wittering Brook. Elevations within the study area vary between 10m and 30m above sea level.

Surface Water Features/Abstractions

- 4.10.3 The southern extents of the study area comprise a section of the River Nene which flows in a northern direction through Wansford before passing under the A1 and meandering south and west towards Sutton and Sibson. The River Nene (Islip to Tidal) is a heavily modified watercourse within the Anglian River Basin District. The River Nene currently has good chemical water quality, moderate ecological potential and a moderate overall Water Framework Directive (WFD) status. The catchment areas within the study area are depicted in Figure 2.9.2 of the PCF Stage 1 EAR.
- 4.10.4 The northern extents of the study area comprise the Wittering Brook which flows through the Sutton and Heath Bog Site of Special Scientific Interest (SSSI) and under the A47 before converging with the River Nene. The Wittering Brook is located within the Anglian River Basin District. Wittering Brook currently has good chemical water quality, moderate ecological quality and a moderate overall WFD status. The surface water features within the study area are illustrated in Figure 2.9.1 of the PCF Stage 1 EAR.
- 4.10.5 There are three surface water abstractions located within the study area. The water abstracted is used for general agricultural purposes and industrial/commercial/energy/public services.
- 4.10.6 According to the EA, the entire study area is in a Surface Water Nitrate Vulnerable Zone. The western and south-western extents of the study area are located in a surface water safeguard zone for pesticides.

Aquatic Ecology

- 4.10.7 Aquatic ecology is considered under section 4.5 Nature Conservation and Biodiversity.

Flooding

- 4.10.8 The EA indicates that the land surrounding the River Nene and the Wittering Brook is located within Flood Zone 2 and 3. Flood zone 2 consists of areas which are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year. Flood zone 3 comprises area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year. Figure 2.9.1 of the PCF Stage 1 EAR illustrates the EA flood risk areas within the study area.
- 4.10.9 A review of the EA Surface Water Flood Map indicates that there is widespread surface water flooding along the land surrounding the River Nene and Wittering Brook (and their tributaries). The risk of surface water flooding ranges between high and low. The majority of the land is at medium risk of surface water flooding.
- 4.10.10 HADDMS records indicate that the existing A47 route is largely unaffected by surface water with the exception of the crossing of Wittering Brook which is expected to experience flooding during a 1 in 30 year flood, a 1 in 100 year flood and a 1 in 1000 year flood.
- 4.10.11 HADDMS records also indicate that the A47 route has low to high risk of groundwater flooding.

Groundwater Features/Abstractions

- 4.10.12 The EA indicate the presence of the following groundwater water bodies within the study area (refer Figure 2.9.3 of the PCF Stage 1 EAR):
- The Welland Limestone Unit which has a poor current overall WFD status and an overall objective of good by 2027;
 - The Northampton Sands Unit which has a good current overall WFD status; and
 - The Nene Mid Lower Jurassic Unit which has a good current overall WFD status.
- 4.10.13 A review of the EA Groundwater Vulnerability Map indicates that:
- There is a major aquifer located in the western, north western and north-eastern extents of the study area associated with the Blisworth Limestone, Lower Lincolnshire Limestone and the Upper Lincolnshire Limestone formations. The aquifer experiences high groundwater vulnerability and the soils overlying it are classified as H1 – Soils that readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater.
 - There is a minor aquifer located in the northern eastern and southern extents of the study area within the following geological layers River Terrace Deposits, the Rutland Formation and Whitby Mudstone Formation. The aquifer experiences intermediate groundwater vulnerability and the soils overlying it have an intermediate leaching potential (I1 – Soils which have the potential to transmit a wide range of pollutants).
 - There is a minor aquifer located in the southern extents of the study area between Wansford and Castor and in a narrow band which extends northwards from the A47 towards Sacrewell Lodge Farm within the following geological layers: Alluvium deposits, Whitby Mudstone Formation, Cornbrash Formation, Blisworth Limestone Formation, and Blisworth Clay Formation. The minor aquifer experiences high groundwater vulnerability and the soils overlying it have a high leaching potential (H1 – Soils that readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater).
- 4.10.14 According to the EA, there are no groundwater abstraction licences in operation within the study area. BGS indicate that there are approximately 5 water wells located within the study area.

4.10.15 There is a Groundwater Source Protection Zone, Outer Protection Zone (Zone 2), located approximately 1.4km north of the A47 cutting across the Sutton Heath Road. The northern extents of the study area are also classified by the EA as a Groundwater NVZ area.

Key Constraints

4.10.16 The sensitivity the River Nene and Wittering Brook are considered to be medium given that the water courses currently have moderate WFD statuses and that the surface waters are used for general agricultural and industrial use. The western extents of the River Nene are also located in a surface water safeguard zone.

4.10.17 The various other drainage channels and pond features located within the study area are considered to be of low sensitivity due to their limited size and use.

4.10.18 The sensitivity of flood areas within the study area is considered medium as there are up to 20 residential and industrial/commercial buildings and critical infrastructure within the EA surface water/ river flood extents.

4.10.19 In terms of groundwater, the Northampton Sands Unit and Nene Mid Lower Jurassic Unit are considered to be of high sensitivity as they have good WFD statuses and a small number of groundwater abstractions within the study area. On the other hand, the Welland Limestone Unit is considered to be of low sensitivity given that it has a poor WFD class and that there are only a small number of groundwater abstractions within the study area.

5 Accessibility and Integration

5.1 Existing NMU Provision

- 5.1.1 Public Rights of Way (PRoW) are common within the study area and form a network in the landscape surrounding the existing A47. They are generally well signposted and well-used, with noticeboards observed encouraging their use. Some are permissive, depending on the land owner and most make use of field boundaries with frequent styles and kissing gates. The routes appear to perform an important recreational purpose for residents and provide an alternative to travelling along often busy roads, in close proximity to traffic.

Cycle Routes

- 5.1.2 There is a short length of cycleway provided in the verge on all four quadrants of both Wansford West and East roundabouts. These provide a segregated facility for cyclists to negotiate the junctions without having to enter the circulatory carriageway of the roundabouts. Dropped kerbs on the northern and southern deflection islands facilitate cyclists crossing movements on these arms of the roundabouts, however there are no dropped kerbs at the central islands on the A47 arms of the roundabouts. Beyond this roundabout there is no provision for cyclists along the A47.

Equestrians

- 5.1.3 There are four bridleways in the study area. The bridleways are located near the A1 around Sacrewell Farm and east to Sutton Heath Road.

Footways

- 5.1.4 Footways are almost entirely absent along the A47 (with the exception of a footway along a lay-by). There is very little provision of footways on side roads within the study area many of which provide access to PRoWs and are therefore likely to be used by NMUs. These side roads also carry notable volumes of traffic, making vehicle NMU interactions frequent. Footways within the villages of Wansford, Sutton, Ailsworth and Stibbington are generally narrow, extremely close to traffic and unpleasant to use.

5.2 Existing Access to Transport Systems

Rail Services

- 5.2.1 Rail into East Anglia operates through Cambridge and Ely where it then branches off westwards towards Peterborough, northwards towards Kings Lynn or eastwards towards Norwich, Great Yarmouth and Lowestoft. The services are currently operated by Abellio Greater Anglia, East Midlands and Thameslink Great Northern.
- 5.2.2 There are no direct train services parallel to the A47 between Peterborough and Norwich. Rail journeys between these two locations are made via Ely. Train services between Ely and King's Lynn are run by Abellio Greater Anglia and Thameslink Great Northern.
- 5.2.3 The nearest major long distance rail station is in Peterborough. It has 731 parking spaces with 3 accessible spaces available plus bicycle stands and wheel racks. The station is a major interchange serving both the North-South East Coast Main Line as well as long distance and local East-West services.

Bus Services

- 5.2.4 There are a number of bus services that operate end to end along the corridor. First Group operates the Excel X1 service along the A47/A12 corridor connecting Peterborough, King's Lynn, Norwich, Great Yarmouth and Lowestoft.
- 5.2.5 The journey by bus from Peterborough to Lowestoft can take approximately 4 hours when in comparison to driving the entire route this can take just over 2 hours.
- 5.2.6 A local bus service operated by Centrebus runs between Wansford to Peterborough. The bus stop is located on Old Great North Road. Initial services run from 0712 in the morning then hourly Monday to Friday. On Saturdays services run from 0753 approximately hourly. There are no bus services on Sundays or Bank Holidays. There are no bus stops within the scheme extent.

5.3 Existing Severance

- 5.3.1 Community severance can be defined as the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes in traffic flows. Severance will only be an issue where either vehicle flows are significant enough to significantly impede pedestrian movement or where infrastructure presents a physical barrier to movement.
- 5.3.2 There is currently no provision for cyclists along the scheme route.
- 5.3.3 The River Nene limits communities in the area who want to travel south. The nearest river crossing for people living in the villages of Wansford and Sutton is via the A1 or A6118.

5.4 Integration

Transport Interchange

- 5.4.1 There are no passenger or freight interchanges located in the vicinity of the Wansford to Sutton scheme.

Land Use Policy

- 5.4.2 The majority of land within the scheme is used for agriculture purposes. See Sections 3.5 and 4.9.9 to 4.9.15 for existing land use information within the study area.

6 Maintenance

6.1 Repair Statement

- 6.1.1 This chapter focusses on the existing approach to maintenance of the A47 trunk road and the highways within the scheme study area during PCF Stage 1.
- 6.1.2 Whilst PCF Stage 1 works were progressing the existing highway network along the A47 corridor was maintained on behalf of Highways England as part of the Area 6 Asset Support Contract (ASC) by Amey. During PCF Stage 2 the supplier changed to Kier (April 2017).
- 6.1.3 The highway is maintained in accordance with the requirements of their contract as set out in the Asset Maintenance and Operational Requirements (AMOR) in the Maintenance Requirements Plan. This details Highways England's mandatory requirements for the delivery of routine maintenance and operational services.
- 6.1.4 Side roads connecting with the A1/A47 trunk road are maintained by Peterborough City Council.

6.2 Asset Condition

- 6.2.1 Asset condition has been taken from the latest information using Highways England databases (HAPMS) and information from the Area 6 ASC Contractor.
- 6.2.2 Over the years, the road pavement over the Scheme length has been subject to numerous maintenance interventions to maintain the road in a safe and serviceable condition. The pavements over parts of the scheme length were last resurfaced in 2005.
- 6.2.3 The Asset Manager analysis shows that the pavement is generally in good condition. There are areas of the pavement construction which require resurfacing; these areas correspond to the areas of road covered by the maintenance interventions detailed in section 6.3.3 below.
- 6.2.4 The drainage in the area is subject to ongoing routine maintenance to ensure ditches and over the edge drainage systems remain unblocked by vegetation and debris.
- 6.2.5 Fencing and lighting provisions need to be investigated further in future stages of the current programme.

6.3 Planned Maintenance

- 6.3.1 Maintenance works are carried out by the Area 6 ASC Contractor.
- 6.3.2 Generally, the following routine operations are carried out annually:
- Cut back foliage to maintain visibilities;
 - Cut / spray around fixed furniture;
 - Clear gullies, piped grips, catchpits;
 - Clean signs; and
 - Structural maintenance.
- 6.3.3 The Area 6 ASC Contractor also has the following planned maintenance activities in the area:
- A47 Wansford to Sutton Roundabout pavements re-surfacing works in 2019/20;

- A47 Wansford to Sutton Roundabout local drainage renewal – date to be arranged; and
- A47 Sutton Roundabout to J16 Eastbound – resurfacing works in 2018/19.

6.3.4 The local roads are maintained by Peterborough City Council. There were no major capital works planned for the area around the scheme at the time of writing this report.

6.4 Strategic Diversion Routes

6.4.1 Strategic diversion routes (route 1) for works requiring closures along the A47 trunk road have been provided by Area 6 ASC and are included in **Appendix E**.

6.4.2 Eastbound traffic would join (or continue on) the A1 southbound for 9km until A1(M) Junction 17, where it would join the A1139 eastbound, continuing for a further 12km. Traffic would then take the first exit at Junction 8 (Eye Roundabout) to join the A15 northbound before exiting that route at Junction 20 (Dogsthorpe) after a further 1.5km, where it would re-join the A47. The diversion route is approximately 23km in total, 8km longer than the direct route via the A47. Westbound traffic would follow the same route in reverse.

7 Planning Factors

7.1 Developments

- 7.1.1 There are a number of developments that have been taken into consideration and used in the traffic modelling and included in the uncertainty log for the scheme in the Peterborough area. Further information can be found in the PCF Stages 1 & 2 Traffic Forecasting Reports (document references: PCF Stage 1 A47 IMPS1-AME-WS-ZZ-DO-J0029, PCF Stage 2 A47 IMPS2-AMY-WS-ZZ-DO-J0029).

- 7.1.2 There are potential developments in the area discussed in the Draft Peterborough Local Plan (Section 2.3.9) that may constrain the options if they are committed. These will need to be considered in future PCF stages as the scheme progresses.

8 Other Relevant Factors

Previous relevant studies and reports

8.1.1 There are a number of previous studies and strategy reports which are relevant to the scheme, some of which have been used to inform the national and local policy covered in Chapter 2. They include:

- A47 & A12 Corridor Feasibility Study (2014)
- A47 Alliance Business Case (2014)
- Highways Agency Area 6 Quarterly Safety Report (Q4 2014), Skanska, January 2014
- A47 Dualling: Economic Assessment Methodology
- A47 Strategic Route Gateway to Growth
- East of England Route Strategy Evidence Report (Highways Agency, April 2014)
- East of England Route Strategy Evidence Report Technical Annex (Highways Agency, April 2014)
- Greater Cambridge Greater Peterborough Enterprise Partnership Strategic Economic Plan (July 2014)
- Peterborough City Council, A47 Alliance, A47 Peterborough and Cambridgeshire, Case for Improvement Evidence and Wider Economic Benefits, January 2014.

9 Description of Route Options

9.1 Route Option Development

9.1.1 The feasibility work undertaken in PCF Stage 0 identified that dualling the section of the A47 between Wansford and Sutton represented a feasible potential solution to solve the identified transportation problem.

9.1.2 In seeking to resolve the transport problem two potential options were developed at PCF Stage 0. These were:

- Part Online Part Offline to the North of the existing carriageway plus free flow from A1 southbound (refined Option 2 below); and
- Offline to the North of the existing carriageway plus free flow from A1 southbound (refined Option 5 below).

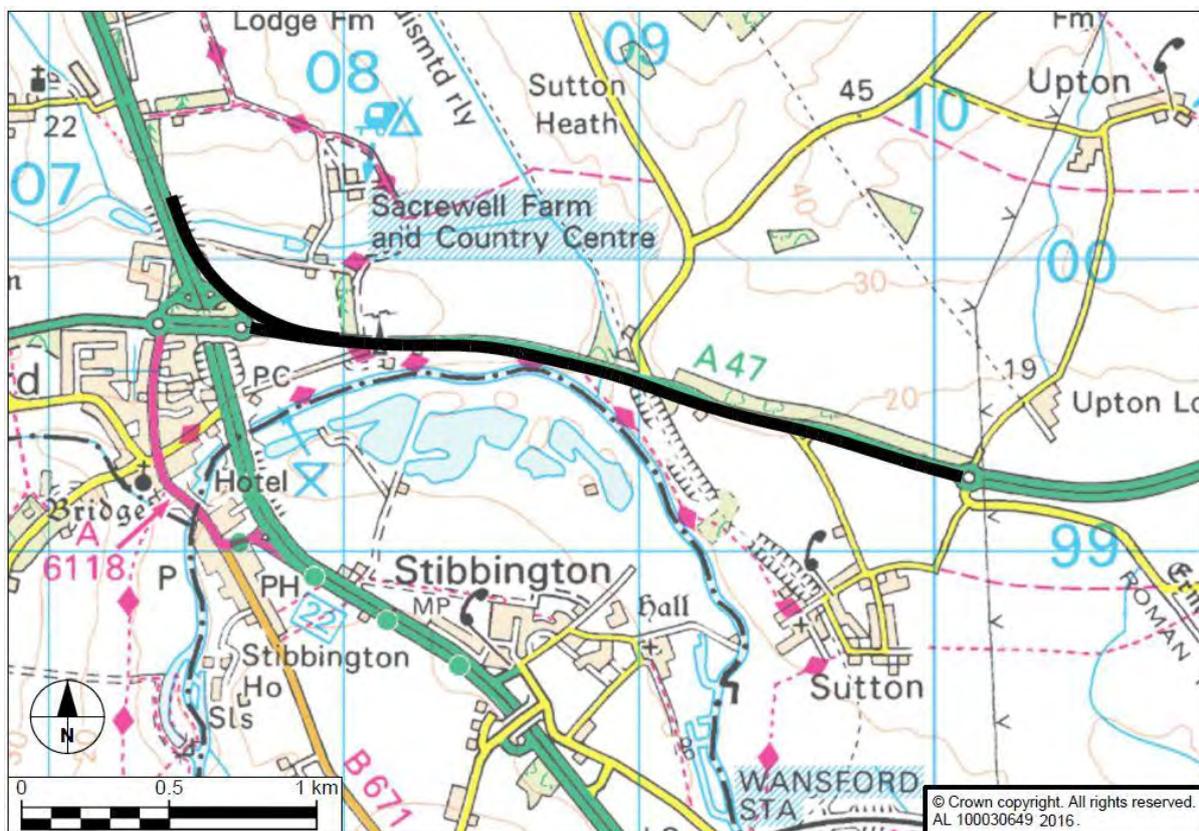
9.1.3 As the scheme moved forward into PCF Stage 1 these two options were refined and further options were developed. An Optioneering workshop took place on 1/02/16 in Amey offices in Birmingham involving technical experts from engineering, traffic and environment. Prior to the workshop a constraints map was created showing key constraints and features in the locality. The constraints Map is shown in **Appendix F**. The team hand drew nine potential routes for the dualling. These line drawings were developed into feasible high level engineering drawings. The route options are described below.

9.1.4 The figures below give an overview of each option. More detailed figures can be found in **Appendix G**.

9.2 Option 1 Online Dualling plus Free flow Slip from A1 Southbound

- 9.2.1 At the western end of the scheme, the southbound slip road from the A1 would be realigned to provide a free flow link between the A1 southbound carriageway and the proposed new eastbound carriageway of the A47. The slip road from the A1 would also have a connection to the existing roundabout to accommodate A47 westbound traffic.
- 9.2.2 The proposed A47 dual carriageway would be 2.5km in length and would be constructed on the line of the existing A47. It would tie in to the existing carriageway at the eastern roundabout at the A1 / A47 interchange and at the Nene Way roundabout at the eastern end of the scheme. To the west of Sutton Heath Road, the route would encroach on the scheduled monument by approximately 3m over a length of 180m.
- 9.2.3 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-1**.

Figure 9-1: Option 1



9.3 Option 2 Part online part offline to the North plus free flow slip road from the A1 Southbound

- 9.3.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.3.2 The proposed A47 dual carriageway would be 2.5km in length and would be constructed on the line of the existing A47 from the western end of the scheme to Sutton Heath Road. It would then go offline to the north of the existing carriageway.
- 9.3.3 The proposed alignment would be online for the first 50% of the route and would encroach on the scheduled monument site by a maximum width of 5m over a length of approximately 100m at the western end of the site. It would cross Sutton Heath Road at grade where it would move offline to the north of the existing A47 for the remaining 50% of the route passing through agricultural land before tying in with the existing at grade roundabout at Nene Way.
- 9.3.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-2**.

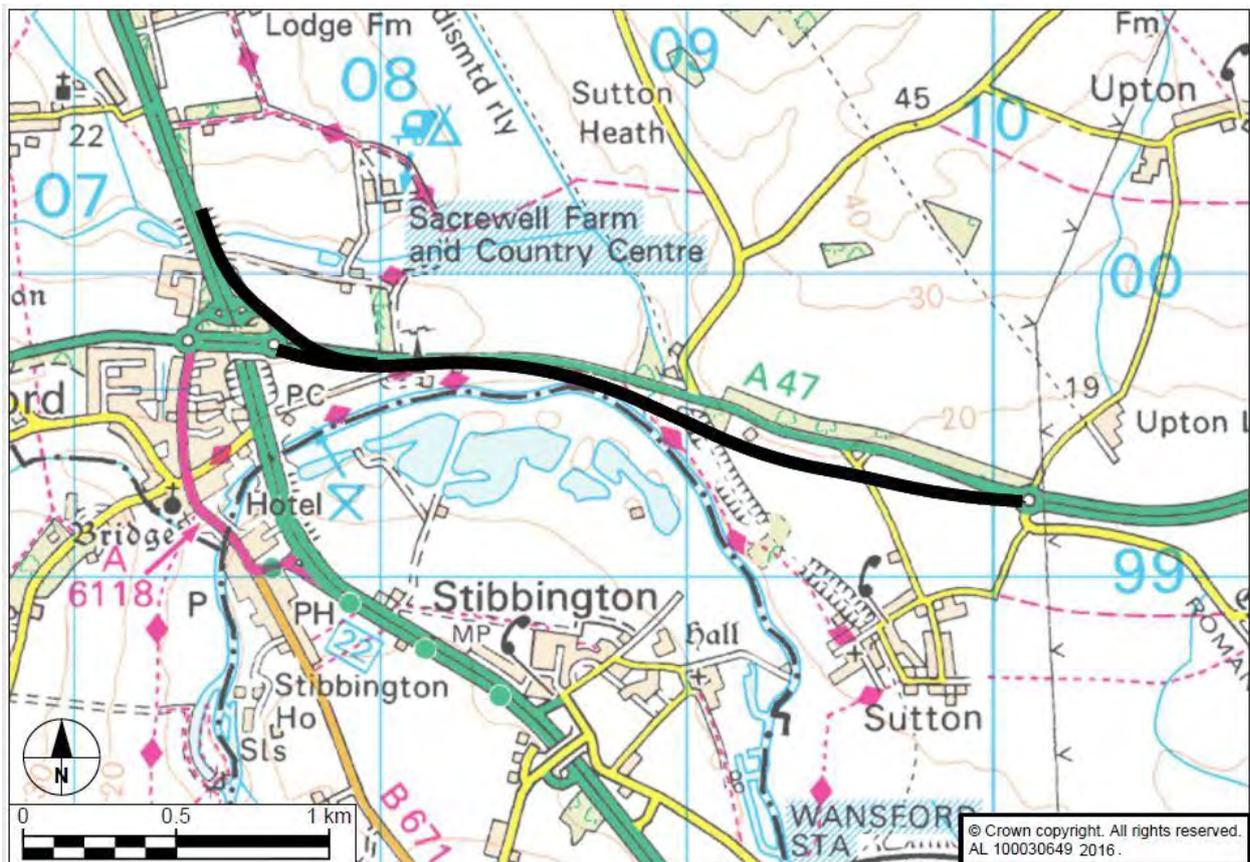
Figure 9-2: Option 2



9.4 Option 3 Offline to the South plus free flow slip road from the A1 Southbound

- 9.4.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.4.2 The proposed A47 dual carriageway would be 2.5km in length and would be constructed offline to the south of the existing carriageway.
- 9.4.3 The proposed alignment from the A1/ A47 junction would be located south of the existing A47 for about 600m before briefly going online at the fuel station prior to reverting to the south of the existing A47 to avoid the scheduled monument travelling through the Sutton Meadows County Wildlife Site (CWS) to the east of Sutton Heath Road. It would then travel at grade 50m south of Sutton Heath Road and south of the property Deep Springs, 200m east of Sutton Heath Road. From here the route would pass through agricultural land, tying in with the existing at grade A47 roundabout at Nene Way.
- 9.4.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-3**.

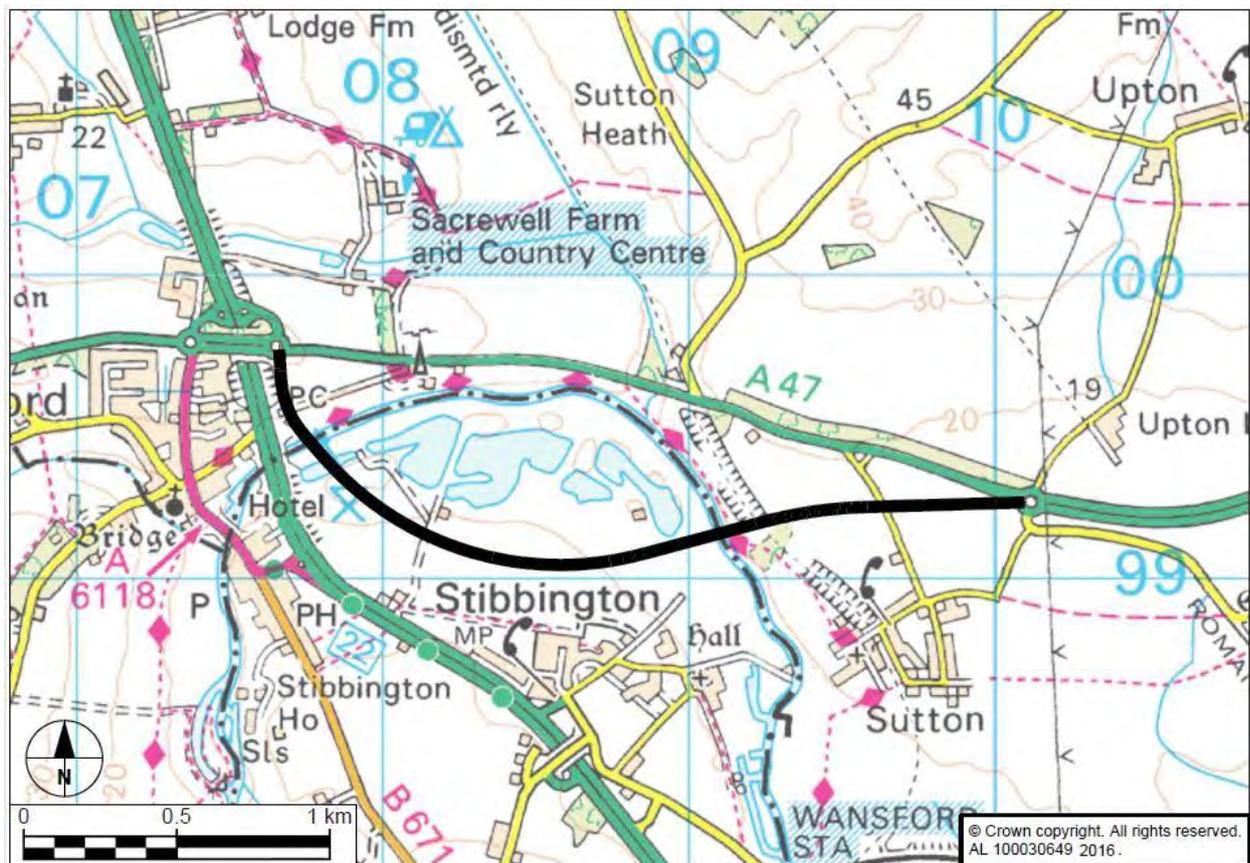
Figure 9-3 Option 3



9.5 Option 4 Offline to the South of the River

- 9.5.1 The proposed A47 dual carriageway would be 2.8 km in length and would be constructed offline to the South of the existing A47.
- 9.5.2 The proposed alignment would connect to the existing A47 roundabout to the west of the scheme by a new southern spur. It would then travel approximately 625m south of the A47, crossing the River Nene and through coastal floodplain grazing grassland. The alignment would then head east towards the existing A47, crossing the River Nene again and through Sutton Meadows CWS. The route would cross the Drift at grade and continue eastwards across agricultural fields to the south of the A47 until it would tie in with the existing at grade A47 roundabout at Nene Way.
- 9.5.3 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-4**.

Figure 9-4: Option 4



9.6 Option 5 Offline to the North plus Free flow slip road from the A1 Southbound

- 9.6.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.6.2 The proposed A47 dual carriageway would be 2.5km in length and would be constructed offline to the north of the existing A47.
- 9.6.3 The proposed alignment of the A47 would pass 40m to the north of the existing fuel station and would run north of the existing A47 predominantly across agricultural land towards Sutton Heath Road. The route would move south at the scheduled monument and the northern boundary of the route would be between 25m and 30m inside the boundary of the scheduled monument over a length of 190m. After passing Sutton Heath Road the route would continue eastwards approximately 40m to the north of the existing A47 and across agricultural fields until it would tie in with the existing at grade A47 roundabout at Nene Way.
- 9.6.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-5**.

Figure 9-5: Option 5



9.7 Option 6 Offline to the North plus Free flow slip road from the A1 Southbound

- 9.7.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.7.2 The proposed A47 dual carriageway would be 2.7km in length and would be constructed offline to the north of the existing A47.
- 9.7.3 The proposed alignment of the A47 would pass to the north of the existing A47 avoiding the scheduled monument. Prior to the at grade crossing of Sutton Heath Road it would go through a Site of Special Scientific Interest (SSSI) for a length of approximately 255m. The northern boundary of the route would be approximately 365m from the northernmost extent of the SSSI and the route's southern boundary would be approximately 225m from the SSSI's southernmost extent. The route would continue eastwards approximately 300m north of the existing A47 before returning south across agricultural fields to tie in with the existing A47 at grade roundabout at Nene Way.
- 9.7.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-6**.

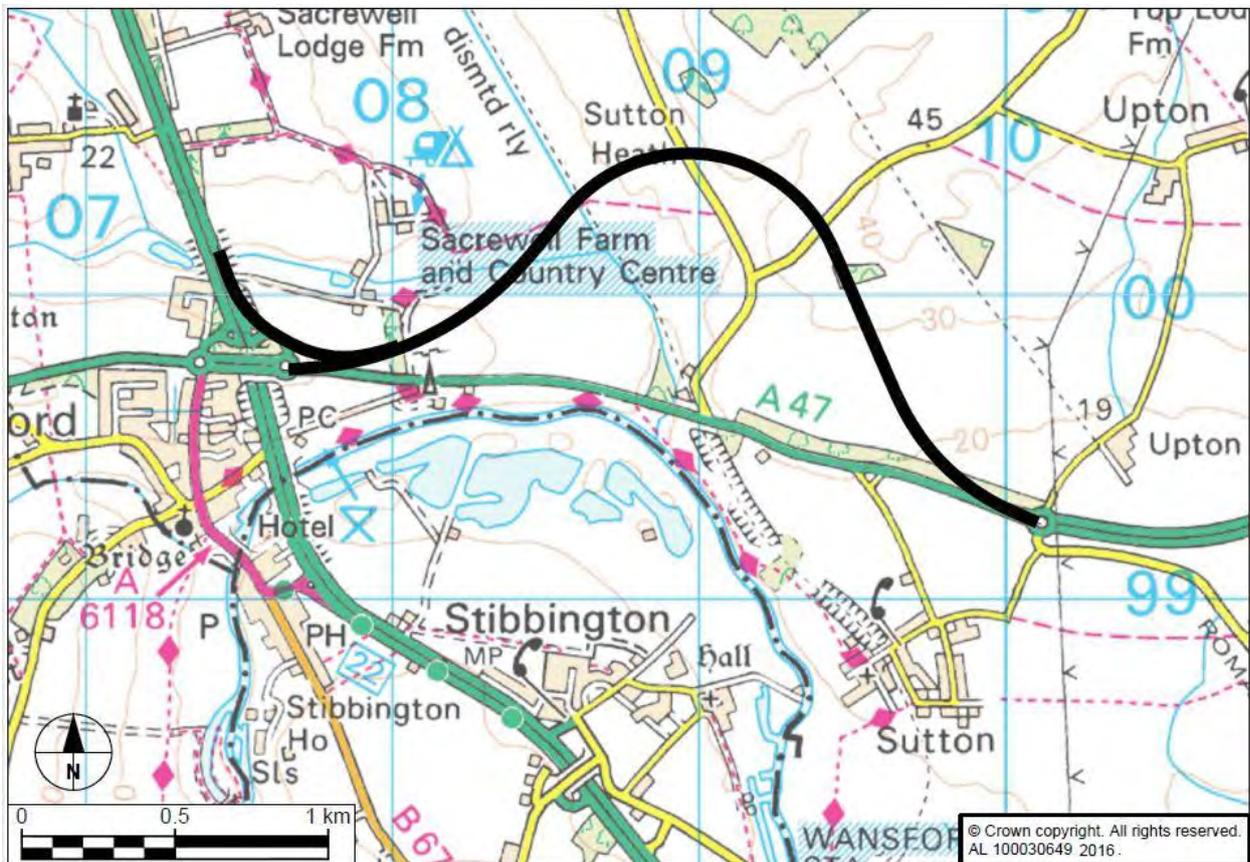
Figure 9-6: Option 6



9.8 Option 7 Offline to the North plus Free flow slip road from the A1 Southbound

- 9.8.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.8.2 The proposed A47 dual carriageway would be 3.3km in length and would be constructed offline to the north of the existing A47.
- 9.8.3 The proposed alignment of the A47 would be north of the scheduled monument through agricultural land and would pass just north of the SSSI on a 2m high embankment and located approximately 850m north of the existing A47. The route would then return south across agricultural fields to tie in with the existing A47 at grade roundabout at Nene Way.
- 9.8.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-7**.

Figure 9-7: Option 7



9.9 Option 8 Part Offline to the North Part Offline to the South plus Free flow slip road from the A1 Southbound

- 9.9.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.9.2 The proposed dual carriageway would be 2.5km in length and would be constructed part offline to the north and part offline to the south of the existing A47.
- 9.9.3 The option would be offline to the north of the fuel station for approximately the first 25% of the route. The route would then cross over the existing carriageway and go offline to the south of the existing A47 through Sutton Meadows CWS to a point approximately 25m from the River Nene. The route would then pass 45m south of the existing A47/Sutton Heath Road junction and south of the property called Deep Springs. It would then cross at grade the side road called The Drift approximately 60m south of the existing A47 and across agricultural land before tying in to the existing A47 at the Nene Way roundabout.
- 9.9.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-8**.

Figure 9-8: Option 8



9.10 Option 9 Part Online Part Offline to the South plus Free flow slip road from the A1 Southbound

- 9.10.1 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 9.10.2 The proposed A47 dual carriageway would be 2.5 km in length and would be constructed online from the western end of the scheme up until Sutton Heath Road then go offline to the south of the existing carriageway before tying in with Nene Way roundabout at the eastern end of the scheme.
- 9.10.3 The proposed alignment would be online for the first 50% of the route then go offline to the south through Sutton Meadows CWS before the junction with Sutton Heath Road. It would cross Sutton Heath Road at grade and continue eastwards just south of the property Deep Springs. It would cross the side road The Drift at grade and continue across agricultural fields south of the A47 until tying in with the existing at grade roundabout at Nene Way.
- 9.10.4 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. The layout is shown in **Figure 9-9**.

Figure 9-9: Option 9



10 Initial Assessment of Options

10.1 Introduction

10.1.1 In order to reduce the number of options to be taken forward to more detailed assessment, initial comparative assessment of the 9 options was undertaken.

10.1.2 Initial assessments were made of the options using:

- EAST (Highways England's Early Assessment of Schemes Toolkit); and
- Highways England KPI Assessment.

10.1.3 These are described briefly in section 10.2 and 10.3 below.

10.2 EAST (Early Assessment Sifting Tool)

10.2.1 EAST is a Department for Transport (DfT) decision support tool that forms the initial part of the DfT's Transport Business Case. It is a high-level assessment of the different options to discard any options that will not meet the transport objectives nor fit with local, regional, national strategies, or would be highly unlikely to pass key viability and acceptability criteria.

10.2.2 The EAST assessment via a RAG (red-amber-green) rates the impact of the scheme against the following headline criteria:

- Strategic Impacts
- Economic Impacts
- Deliverability/ Managerial
- Financial Considerations
- Funding Considerations

10.2.3 Further detail with regard to the EAST assessment methodology undertaken and the results can be found in **Appendix H**.

10.2.4 Looking at the completed EAST, at PCF Stage 1 there is insufficient detail to differentiate fully between the options as the assessment is at a strategic level therefore all options were taken forward for further assessment.

10.3 Highways England KPI Assessment

10.3.1 As presented in Chapter 2, as part of the Highways England Delivery Plan a series of KPI's have been developed to ensure that schemes that Highways England deliver, achieve their strategic outcomes.

10.3.2 Each of the 9 options developed in PCF Stage 1 was measured against these KPIs from 1 to 5 where 1 is poor and 5 is good. The scores have been RAG (red –amber – green) rated and presented in **Table 10-1** below.

Table 10-1: KPI Assessment

Option	Fit with wider transport and government objectives								Average	Rank
	Managing the network safer	Improving user satisfaction	Supporting the Smooth Flow of Traffic	Encouraging Economic Growth	Delivering better environmental outcomes	Helping cyclists, walkers and other vulnerable users	Achieving real efficiency	Keeping the Network in Good Condition		
1	4	3	3	4	3	3	3	4	3.4	4
2	4	4	3	4	4	3	3	4	3.6	2
3	4	3	3	3	3	4	3	4	3.4	4
4	4	2	4	3	1	4	3	4	3.1	9
5	4	4	3	4	3	4	3	4	3.6	2
6	4	2	4	4	1	4	3	4	3.3	8
7	4	2	4	3	3	4	3	4	3.4	4
8	4	4	4	4	3	4	3	4	3.8	1
9	4	3	3	4	3	3	3	4	3.4	4

10.3.3 The KPI assessment showed that Options 4 and 6 scored worse for Delivering Better Environmental Outcomes KPI which focuses on Biodiversity. Option 4 crosses the river in 2 places and Option 6 goes through a SSSI.

10.3.4 At this early stage of the assessment the conservation status of the SSSI was not known. Equally the environmental impacts of the other seven options had not been determined in detail. Given the known environmental sensitivities in the area, Option 6, together with all the other options were taken forward for a more detailed assessment.

10.4 Further Sifting Assessment

10.4.1 Using the desktop information and previous work undertaken on the representative solutions in previous stages, further assessment and appraisal work was undertaken on the 9 options. Initially for each option a qualitative appraisal summary table was completed based on available information. The assessment work was then developed to allow assessment and ranking of the 9 options against the following criteria:

- Environment;
- Transportation;
- Engineering; and
- Economics.

10.4.2 The assessment of each criteria and their results are presented in the following sections.

10.5 Environmental Assessment for Initial Options Review

10.5.1 The Appraisal Summary Table (AST) summarises the results of the economic, environmental, social and public account assessments required as part of the appraisal process. The environmental part of the AST table was completed for each option by assessing the impact on each parameter listed below:

- Noise
- Air Quality
- Greenhouse Gases
- Landscape

- Townscape
 - Heritage of Historic resources
 - Biodiversity
 - Water and Environment
- 10.5.2 Experienced technical environmental specialists carried out the qualitative assessments from the baseline environmental data readily available from the desk studies and previous work undertaken.
- 10.5.3 Based on the known environmental information and constraints from the desk study the likely impact of each option was estimated for each of the topic areas. Each of the environmental topic areas was given an estimated impact based on a 7 point scale as follows:
- Large Adverse -3
 - Moderate adverse (-2)
 - Slightly adverse (-1)
 - Neutral (0)
 - Slightly beneficial (1)
 - Moderate Beneficial (2)
 - Large Beneficial (3)
- 10.5.4 The 8 topic areas and the estimated impacts were compiled for each option and this was used as a basis to determine an environmental ranking of the 9 options. The environmental ranking assessment is shown in **Appendix I**. Scores for each option were ranked from 1 to 9 (no. of options) with 1 being the best performing and 9 the worst from an environmental perspective. Where options were considered to have comparable environmental impacts, they were ranked equal. The rankings have also been RAG (red –amber – green) rated to give an easy visual comparison based on the following banding: ranks 1 to 3 green, 4 to 6 amber and 7 to 9 red. The ranking results are shown in **Table 10-2** below.
- 10.5.5 Please note that the ranking in Table 10-2 is based on an overall assessment of eight environmental topics within the AST whereas the ranking in Table 10-1 for “Delivering Better Environmental Outcomes” is only based on Biodiversity hence the options rank differently. The Environmental Assessment in Table 10-2 is more comprehensive.

Table 10-2: Ranking of Options from Environmental Assessment

Option	Option Rank	Comment
1	2	Online option. Impact on Heritage of Historic Resources is considered to be large adverse as the route encroaches on scheduled monument. Impacts on Landscape and Biodiversity are slight adverse.
2	3	Option part online, part offline to the north. Impact on Heritage of Historic Resources is considered to be large adverse as the route goes through the scheduled monument. Impacts on Landscape and Biodiversity and Noise are slight adverse.
3	3	Option offline to the south. Impact on Biodiversity is large adverse as route goes through Sutton Meadows County Wildlife site. Impact on Heritage of Historic Resources, Landscape and Water Environment is slight adverse.
4	9	Option offline to the south of the river. Option crosses the river in 2 places and goes through flood plain hence impact on Landscape and Biodiversity is large adverse. Impact on Heritage of Historic Resources and Landscape are slight adverse as the option is closer to a couple of Grade II listed buildings. Impact on noise is slight adverse.
5	3	Option is predominantly offline to the north. Impact on Heritage of Historic Resources is considered to be large adverse as the route encroaches on the scheduled monument. Impacts on Air Quality, Noise and Biodiversity are slight adverse.
6	3	Impact on biodiversity is large adverse and on Landscape is moderate adverse. Impact on Heritage of Historic Resources and Water Environment is slight adverse. Impact on Noise is slight beneficial as the option moves away from the NIA at Sutton Heath Road.
7	1	Option is offline to the north. Environmentally this option scores best as it avoids SSSI and the scheduled monument. Impact on Landscape is moderate adverse, impact on biodiversity is slight adverse. Air quality and Noise impacts are slight beneficial as the route moves away from the SSSI and the NIA at Sutton Heath Road.
8	3	Option is part online to the north, part offline to the south. The impact on biodiversity is large adverse as it goes through Sutton Meadows County Wildlife site and is closer to the river. The impact on Landscape, Water and Environment and Heritage of Historic Resources is slight adverse.
9	3	Option is part online part offline to the south. The impact on Heritage and Historic Resource is large adverse as the online part encroaches on the scheduled monument. The impact on Biodiversity is moderate adverse. Impact on Water Environment and Landscape is slight adverse. The impact on noise is slight beneficial as it moves away from the NIA at Sutton Heath Road.

10.6 Transportation Assessment for Initial Options Review

10.6.1 The 9 options all provide a dual carriageway replacing the length of single carriageway between Wansford and Sutton. From a transportation perspective, all routes will perform in a similar way, the only real differentiating factor in terms of preliminary initial transport assessment was based on proposed route length.

10.6.2 The length of the route was used to assess the journey times – the longer the route the longer the journey times. The shortest route ranked the best and the longest route ranked the worst. Where the length of the route was very similar they were ranked equal. The rankings have also been RAG (red –amber – green) rated to give an easy visual comparison based on the following banding: ranks 1 to 3 green, 4 to 6 amber and 7 to 9 red. The rankings are summarised in **Table 10-2** below:

Table 10-2: Ranking of Options from Transportation Assessment

Option	Length of Option (km)	Option Rank	Comment
1	2.5	1	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option very similar in length to options 2,3,5,8 and 9
2	2.5	1	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option very similar in length to options 1,3,5,8 and 9
3	2.5	1	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option very similar in length to options 1,2,5,8 and 9
4	2.8	8	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. This option is the second longest route.
5	2.5	1	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option very similar in length to options 1,2,3,8 and 9
6	2.7	7	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option is the third longest route.
7	3.3	9	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option is the longest route.
8	2.5	1	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option very similar in length to options 1,2,3,5 and 9.
9	2.5	1	Ranking based on option length. Shorter routes will offer quicker journey times and are ranked higher. Option very similar in length to options 1,2,3,5 and 8.

10.7 Engineering Assessment for Initial Options Review

10.7.1 An Engineering assessment was undertaken of the 9 route options. Each of the options was assessed and ranked comparatively based on the following seven criteria:

10.7.2 The following criteria were assessed:

- Buildability
- Landtake
- General Alignment
- Accommodation Works
- Geotechnical
- Structures
- Impact on Stats

Buildability

- 10.7.3 The buildability of each option was reviewed based on a qualitative assessment of the likely ease of construction. This predominantly assessed the level of offline and online construction which would be required assuming that online construction is more difficult disruptive and requires more complex phasing and traffic management arrangements than building offline. This assessment was then used to rank the 9 options 1 to 9. The least challenging from a buildability being ranked highest through to the most challenging being ranked lowest.

Landtake

- 10.7.4 The landtake requirement of each of the route options was determined from the engineering layouts. The options were then ranked from 1 to 9 according to the area of land take required by the option. The route option with the smallest area of land take being given the highest ranking through to the route with the largest area of land take being given the lowest ranking.

General Alignment

- 10.7.5 The alignment of each route option was assessed based on its horizontal geometry, taking account of the bendiness of the alignment (the change of bearing along the whole route expressed as degrees of angle per kilometre) and what proportion of the alignment used radii less than the Desirable Minimum for the Design Speed. A route with fewer degrees of bendiness and a smaller proportion of length at less than Desirable Minimum was given a better ranking. Other layout factors, such as cross section, verge width and frequency of junctions were assumed to be the same for each route and therefore were neutral in terms of assessment. Options were ranked 1 to 9 with the route with comparably the best alignment being ranked number one.

Accommodation Works

- 10.7.6 The potential for accommodation works required for each route option was reviewed and assessed. Options were ranked 1 to 9 with the routes estimated to require comparably less accommodation works being ranked highest through to the route options estimated to require more accommodation works being ranked lower. Accommodation works would include the provision of new accesses to properties, adjacent land and fields. It would also include the provision for the loss of facilities associated with the proposed options. At this stage, it was assessed that the accommodation works for every option was very similar so there was very little difference in the ranking of the options.

Geotechnical

- 10.7.7 The geotechnical complexity of each route option was reviewed based on the available desk top information. Each route option was assessed with regard to geotechnical complexity. The assessment was then used to rank the 9 options 1 to 9. Those with more complexity with regard to geotechnical scheme input ranked lowest through to the options with less complexity and higher scores being ranked higher. The Geotechnical Classification as defined by DMRB HD22/08 is considered to be Category 2 for the proposed route options. Further analysis of the classification will take place in the formulation of the scheme PSSR.

Structures

- 10.7.8 The structural impact of each route option was reviewed based on the number, size and complexity of potential structures (bridges and culverts) required for the option. This assessment was then used to rank the 9 options 1 to 9. Those offering comparably more complexity with regard to structural input ranked lowest through to the options with less complexity being ranked higher.

Impact on Statutory Undertakers

10.7.9 The potential amount of works required to divert or protect statutory undertakers' plant in order to accommodate each route option was reviewed and assessed. These assessments were then used to rank the 9 options 1 to 9. Those options estimated to require comparably less statutory undertakers' works being ranked highest through to the route options estimated to require more statutory undertakers' works being ranked lower.

Overall Engineering Assessment Ranking

10.7.10 The rankings for the seven individual engineering criteria were assessed and shown in **Appendix I**. The individual ranks were combined to give an overall initial engineering assessment ranking. Summary of the overall ranking for each of the 9 options together with comments is shown in **Table 10-3**.

10.7.11 The scores for each option were ranked from 1 to 9 (no. of options) with 1 being the best performing and 9 the worst from an engineering perspective. The rankings have also been RAG (red –amber – green) rated to give an easy visual comparison based on the following banding: ranks 1 to 3 green, 4 to 6 amber and 7 to 9 red.

Table 10-3: Ranking of Options from Engineering Assessment

Option	Option Rank	Comment
1	8	Option is online so would be more disruptive requiring extensive and prolonged traffic management and traffic diversions during construction. The construction works in close proximity to the existing A47 will result in a high level of statutory undertakers diversions. Land take area is expected to be less than off line options. Rated as moderate beneficial for geotechnical impacts. Geohazards present but considered to be of lower impact potential than other options.
2	4	50% of the length of this option would be online so will be disruptive in terms of traffic management and traffic diversions during construction. Landtake area is expected to be less than offline options. Rated as neutral for geotechnical impacts due to presence of potentially unstable slopes and lack of geotechnical data.
3	2	Option is offline to the south so easier for construction and traffic management. The route is closer to the River Nene than the existing A47 and moves away from the area designated as a scheduled monument. Landtake is expected to be more than online or part online options. Rated as slight beneficial for geotechnical impacts.
4	9	Option is offline to the south of the existing A47. It crosses the navigable River Nene in two places and would have to be constructed through the flood plain. The construction and future maintenance of two substantial structures over the river and flood management measures are significant disadvantages of this option hence ranks worst. Rated as large adverse for geotechnical impacts due to presence of weak, collapsible strata and high risk of river flooding.
5	6	Option is offline to the north so would be less intrusive during construction. It infringes on scheduled monument and requires a larger area of land take compared to other options. Rated as neutral for geotechnical impacts due to presence

Option	Option Rank	Comment
		of potentially unstable slopes and lack of geotechnical data.
6	1	Option is offline to the north so least intrusive during construction and requires the least amount of land take. It has the least impact on statutory undertakers equipment similar to Option 7. Rated as slight adverse for geotechnical impacts due to presence of potentially unstable slopes and significant lack of geotechnical data.
7	2	Option is offline so less disruptive to road users during construction and the route has the least impact on statutory undertakers equipment. Land take is expected to be more than online options. Rated as moderate adverse for geotechnical impacts due to presence of weak, collapsible strata.
8	5	Option is part offline but the new route crosses the existing A47 carriageway so the construction period will be disruptive in terms of traffic management and traffic diversions. The option requires a larger area of land take when compared to online and part online part offline options. The route is closer to the River Nene than the existing A47 and avoids the area designated as a scheduled monument. Rated as moderate beneficial for geotechnical impacts. Geohazards present but considered to be of lower impact potential than other options
9	7	Option is part online and part offline to the south. Construction of the online section will be disruptive requiring extensive and prolonged traffic management and traffic diversions. Significant diversions of statutory undertakers equipment would be required. Rated as moderate beneficial for geotechnical impacts. Geohazards present but considered to be of lower impact potential than other options.

10.8 Comparative Economic Assessment for Initial Options Review

- 10.8.1 The cost and economic benefit provided by a highway scheme are important assessment criteria, however at the initial assessment stage information on the estimated costs and potential benefit to cost ratio for each option were not available. Benefits and order of magnitude estimates have previously been estimated for a typical widening solution for the Wansford to Sutton dualling scheme and these were used as a starting point for a comparative assessment.
- 10.8.2 Benefit Cost Ratio (BCR) information for each option did not exist for the options at the time of optioneering. Therefore, an exercise was undertaken to estimate the benefits and cost of each of the proposed 9 options based on the previous PCF Stage 0 cost estimate and benefits.
- 10.8.3 A rough order of cost estimate of the likely scheme cost of each of the options was estimated based on the typical solution estimate from previous stages with an adjustment made to account for the split of the option length online to offline. Offline construction was estimated to be cheaper by about 20% than online construction.
- 10.8.4 Scheme benefits from the typical solution analysed at PCF Stage 0 were used as a base and a comparative pro-rata based on option length applied to give an estimate of benefits for each option.

- 10.8.5 The benefits and the estimated costs were used for each option to give a numerical figure representing an indicative BCR for comparative assessment.
- 10.8.6 The indicative BCRs were used to rank the 9 options. The higher the figure the higher the scheme ranked in terms of the economic assessment.
- 10.8.7 The economic assessment ranking of the route options is presented in **Table 10-4** below along with the indicative BCR for comparative purposes and high level comment.

Table 10-4: Summary of Economic Ranking

Option	Indicative BCR	Option Rank	Comment
1	1.42	7	Online option ranked low due to the increased cost of construction and traffic management. The journey time benefits are expected to be lower due to construction delays.
2	1.49	5	Option is 50% online and 50% offline so costs and journey time benefits are expected to be better than Option 1.
3	1.55	3	Option is mostly offline so expected to be cheaper due to decreased traffic management costs. It is also one of the shorter routes in length so would give improved journey time benefits.
4	0.8	9	Option is offline to the south of the river and ranked worst as it would have higher construction costs due to the option crossing the river in 2 places and being built on flood plain. It is also a longer route hence would give reduced journey time benefits. It also does not have the freeflow slip road from the A1 southbound so the benefits are reduced significantly.
5	1.56	2	This option is ranked second best as it is mostly offline so construction costs are likely to be cheaper. It is also one of the shorter routes in length so gives improved journey time benefits.
6	1.45	6	Option is offline so construction costs are likely to be cheaper but is a slightly longer route so expected to provide less benefits due to increased journey time.
7	0.95	8	Option is offline however this route is longest of the offline solutions and is on a 2m high embankment so has the highest likely construction costs. The longer route would give reduced journey time benefits and ranks poorly.
8	1.59	1	This option is ranked best as it is mostly offline so construction costs are likely to be cheaper. It is also one of the shorter routes in length so gives improved journey time benefits.
9	1.53	4	Option is online for about 25% of the route and offline for the remaining part so construction costs and journey time benefits are expected to be better than Options 1 and 2.

11 Options Ranking, Sifting and Review

11.1 Options Review Meeting

11.1.1 The initial options assessment undertaken as described in section 10 was reviewed at an Options Review Meeting (ORM) which took place on 16th June 2016. The options, the assessment of the options and the rankings were presented to senior representatives from Highways England, Amey and AECOM.

11.1.2 The EAST assessment and the Highways England KPI assessments didn't show discernible differences between the developed options so the assessment was not utilised at the ORM.

11.1.3 A review of the options development assessment process described in sections 10.4 to 10.8 was undertaken. The assessment methodology was discussed and agreed as being appropriate.

11.1.4 The assessment rankings described in section 10.4 onwards were combined to give overall rankings for each of the developed options and are shown in **Table 11-1** below. The table has been Red – Amber – Green rated with the top performing options 1-3 green, 4-6 amber, 7-9 red.

Table 11-1: Overall Ranking from Initial Assessments

Option	Option Rank				Overall Rank
	Environment Assessment	Engineering Assessment	Traffic Assessment	Economic Assessment	
Option 1	2	8	1	7	7
Option 2	3	4	1	5	4
Option 3	3	2	1	3	1
Option 4	9	9	8	9	9
Option 5	3	6	1	2	3
Option 6	3	1	7	6	6
Option 7	1	2	9	8	8
Option 8	3	5	1	1	2

Option 9	3	7	1	4	5
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11.1.5 The overall rankings included in **Table 11-1** above were presented and reviewed at the ORM alongside the assessments described in sections 11.1.4 to determine which of the developed options represented the most appropriate options to take forward for further more detailed assessment. The results from the review and the rationale behind the review decisions are described in the following section.

11.2 Initial Options Review Conclusions and Recommendations

11.2.1 The overall rankings from Table 11-1 have been presented below in **Table 11-2** with the conclusions of the options review meeting and whether the option is to be taken forward for further assessment.

Table 11-2: Initial Options Review Conclusions and Recommendations

Option	Overall Rank from Initial Assessment	Option to be taken forward for Further Assessment	Overview of Key Reasons
Option 1	7	Yes	Option is online so the construction costs are higher, however it has the least impact on Designated sites. Although it ranked 7, once the remaining options were grouped together (see Table 11-3 below) it ranked 3rd so was taken forward
Option 2	4	No	Option was considered too similar to Option 5 within the tolerance of design evolution so was not taken forward
Option 3	1	No	Option ranks 1 st and ranks well on all 4 assessments however it was considered similar to Option 8 which ranked 2 nd . Option 3 was closer to the fuel station compared to Option 8 so Option 3 was not taken forward
Option 4	9	No	Option scores poorly on all 4 assessments and is 0.3 km longer so was not taken forward.
Option 5	3	No	Option was considered similar to Option 2 within the tolerance of design evolution. It was agreed the option should move slightly further north (see 11.2.7 below) and called Option 10 and taken forward.
Option 6	6	No	Option ranks 6 th . It is a longer route giving reduced journey time benefits. It was agreed at ORM that the option should not be taken forward – see 11.2.3 below.
Option 7	8	No	Although from an environment perspective the option ranks well as it is away from designated sites it takes the local residents through a much longer route. It also scores poorly on transport

Option	Overall Rank from Initial Assessment	Option to be taken forward for Further Assessment	Overview of Key Reasons
			and economic assessment so was not taken forward.
Option 8	2	Yes	Option ranks second and was selected for further assessment as it is slightly further away from the Fuel station compared to Option 3
Option 9	5	No	Option was considered too similar to Options 3 and 8 within the tolerance of design evolution so was not taken forward.

11.2.2 Options 4 and 7 ranked worst so were not taken forward for further assessment.

11.2.3 A discussion took place at the ORM about the impact of Option 6 going through the SSSI and it was felt that Natural England may not be supportive of the route going through the middle of the SSSI. The option also ranked 6th – it's a longer route with reduced journey time benefits so it was agreed that the option would not be taken forward for further assessment.

11.2.4 The remaining options were grouped together and shown in **Table 11-3** below:

Table 11-3 Option Grouping

Options Grouped together	Original Ranking	Revised Grouped Ranking	Option selected for further assessment
Options 3 and 8 and 9	Ranked 1, 2 and 5	1st	8
Options 2 and 5	Ranked 4 and 3	2nd	Revised Option 5
Option 1	Ranked 7	3rd	Yes

11.2.5 Options 3, 8 and 9 can be grouped together within the tolerance of design evolution as they are all offline to the south at the eastern end with minor variances at the western end. Option 3 gave the highest ranking followed by Option 8. As Option 3 is closer to the Fuel Station and Option 8 moves away from the fuel station, Option 8 was selected for further assessment.

11.2.6 Option 1 was selected for further assessment as it had the least impact on designated sites and with the grouping of options shown in Table 11-3 ranked 3rd.

11.2.7 Option 2 and 5 were considered to be similar within the tolerance of design evolution. Option 5 impacted on the southern end of the scheduled monument. At that same point the proposed route also partially utilised the existing A47 carriageway so a suggestion was made at the ORM to modify Option 5 so it moves slightly further north to avoid using the existing carriageway and to re-name this Option 10. It was acknowledged that Option 10 impacted more on the scheduled monument however at that time the significance of the scheduled monument was not understood fully and Option 10 was selected for further assessment. It was acknowledged that consultation with Historic England would be required and surveys within the scheduled monument would need to be carried out early in PCF Stage 2. Further assessment on impact of going through a scheduled monument was done in PCF Stage 2 (please refer to Chapter 27 – Preferred Route Decision). The description for Option 10 is given below and is shown in **Figure 11-1**.

Option 10 Offline to the North plus Free flow slip road from the A1 Southbound

- 11.2.8 At the western end the southbound slip road from the A1 would be as described in 9.2.1.
- 11.2.9 The proposed dual carriageway would be 2.5km in length and would be constructed offline to the north of the existing A47.
- 11.2.10 The proposed alignment of the A47 would pass 46m to the north of the existing fuel station and runs across agricultural land towards Sutton Heath Road. The proposed route would go through the scheduled monument and the northern boundary of the route would be up to 50m inside the boundary of the scheduled monument over a distance of 200m and would just cross the southern tip of the SSSI. After passing Sutton Heath Road the route would continue at grade 60m to the north of the existing A47 and across agricultural fields until tying in with the existing at grade A47 roundabout at Nene Way.
- 11.2.11 Appropriate provision would be made to ensure connectivity to side roads, properties, fields and farms. An overview of the layout is shown in **Figure 11-1**. More detailed layout can be seen in **Appendix J**.

Figure 11-1: Option 10 Offline to the North



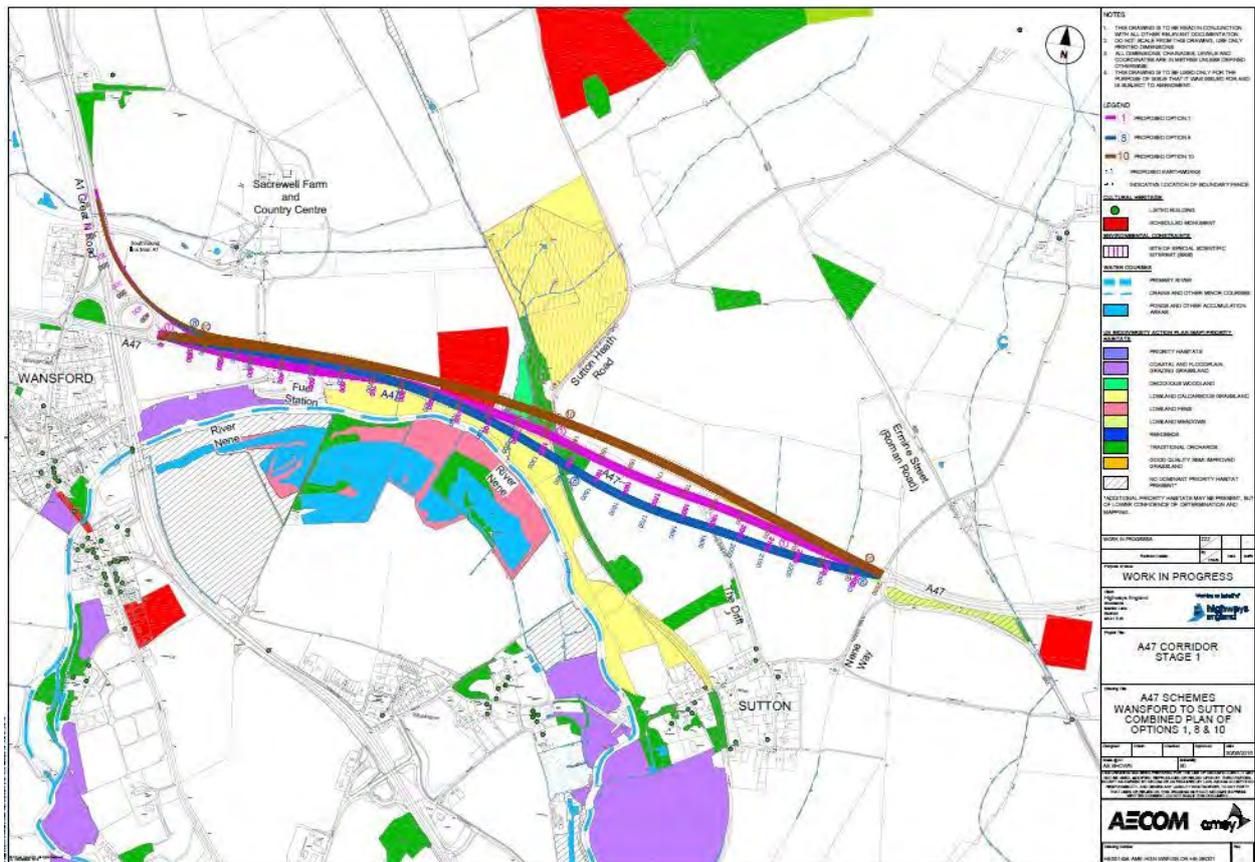
11.3 Options Selected for Further Assessment

11.3.1 The three options selected for further assessment are:

- Option 1 – Online dualling plus Free flow slip road from A1 southbound
- Option 8 – Part offline to the north, part offline to the south plus Free flow slip road from A1 southbound; and
- Option 10 – Offline to the north plus Free flow slip road from A1 southbound

11.3.2 The 3 selected options are shown in **Figure 11-2** below.

Figure 11-2: Options selected for Further Assessment



Further Sub Options

11.3.3 Two sub options were introduced for Option 1 in order to test the operational performance on both the western and eastern end of the scheme. These were for comparative purposes only and could apply to any of the 3 options:

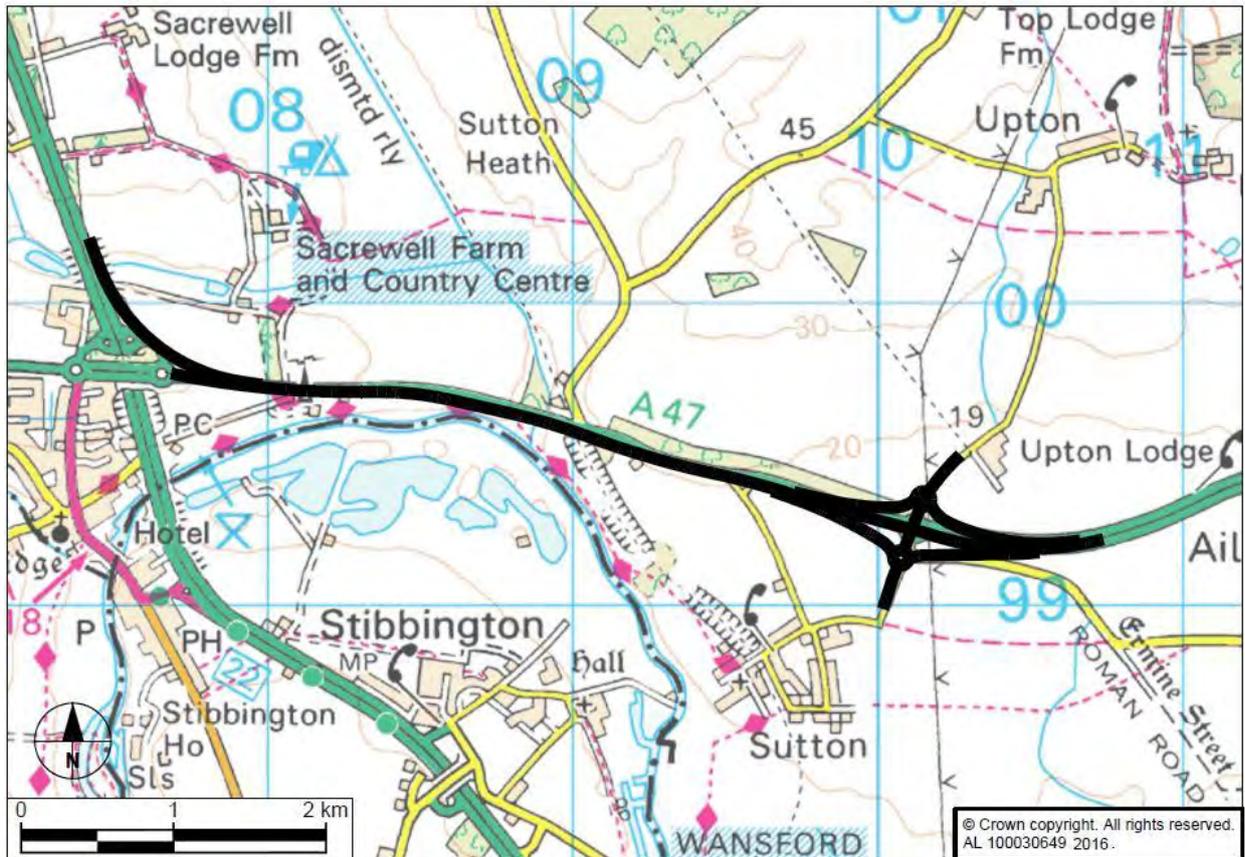
- Option 1A – As Option 1 but having grade separation at Nene Way roundabout
- Option 1B – As Option 1 but without a free flow slip road from the A1 southbound.

11.3.4 The options are described below and are analysed in Sections 12 (Traffic Analysis), Section 17.5 (Relative Cost Estimates) and Section 18 (Economic Modelling) only.

Option 1a – Online Dualling with Grade Separation at Nene Way roundabout

11.3.5 The proposed A47 dual carriageway would be similar to Option 1 except at the eastern end of the scheme. The connection to the existing A47 at the eastern end of the scheme would be achieved by the provision of a grade separated dumbbell interchange with four slip roads connecting to the A47. An overview of the layout is shown in **Figure 11-3**. More detailed layout can be seen in **Appendix J**.

Figure 11-3: Option 1A Online Dualling with Grade Separation at Nene Way roundabout



Option 1B – Online Dualling without free flow slip road from A1 south

11.3.6 The proposed new A47 dual carriageway is similar to Option 1 but lacks the free flow slip road from the A1 southbound. An overview of the layout is shown in **Figure 11-4**. More detailed layout can be seen in **Appendix J**.

Figure 11-4: Online Dualling without free flow slip road from A1 south



12 Traffic Analysis of Sifted Options PCF Stage 1

12.1 Introduction

12.1.1 The PCF Stage 1 traffic analysis was conducted using the Peterborough Transport Model (PTM). This model was developed by Atkins on behalf of Peterborough City Council (PCC) in 2006. The PTM is a combination of a spreadsheet based Trip Generation, Trip Distribution and Modal Choice model and a SATURN highway model, calibrated to a 2006 base year.

12.1.2 The SATURN highway model is a macroscopic traffic model that primarily predicts traffic assignment (i.e. route choice) within the modelled area. This is appropriate for the scheme as the improvements to the A47 may attract traffic from nearby routes. The SATURN model is good for predicting the level of traffic re-routing.

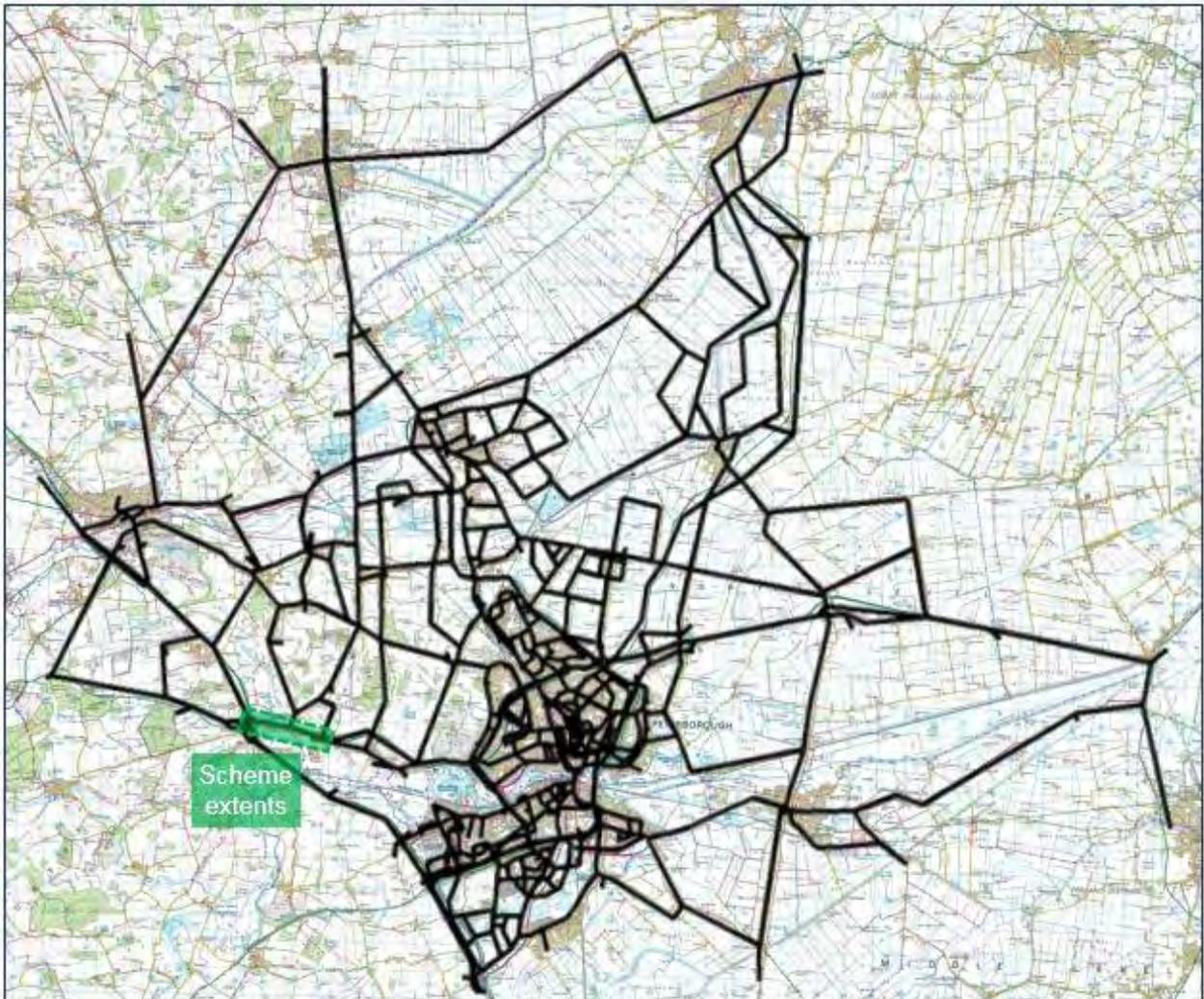
12.1.3 The SATURN model does not provide a detailed representation of every junction along the A47 between Wansford and Sutton and does not model the movement of individual vehicles, nor does it model every hour within the day. However, it does model the busiest junctions and the most important hours of the day, and therefore was appropriate for the PCF Stage 1 assessment of the scheme.

12.2 Modelling Approach

Traffic Network

12.2.1 The SATURN highway model covers the whole of the PCC area and extends to the north along the A15 corridor to Market Deeping and Spalding, to the east along the A47 and A605 corridors to Guyhirn, and to the south along the A15 corridor to Yaxley. The western boundary is formed by the A1 trunk road, from Junction 16 of the A1(M) at Norman Cross to the A1/A606 junction at Stamford. The model also extends further west to the A47/A43 junction at Duddington. Therefore, the PTM contains the A47 route between Wansford and Sutton, and the most likely alternative routes that traffic may take. The extents of the PTM are shown in **Figure 12-1**.

Figure 12-1: Extents of the Peterborough Transport Model



12.2.2 A model constructed of data older than 6 years is no longer fully compliant with the requirements of WebTAG; Highways England Transport Planning Group (formerly TAME) permitted a relaxation of this requirement to 10 years for this scheme (as documented in the ASR Document reference A47 IMPS1-AME-WS-ZZ-DO-J-0013) in order to prevent the need for an extensive remodelling and revalidation exercise which would be disproportionate for a PCF Stage 1 assessment.

12.2.3 For PCF Stage 2 it is likely that the updated PTM SATURN model, currently being developed by PCC will be completed. When combined with origin-destination data from the updated East of England Regional Model (EERM) this would provide an improved model for the more detailed PCF Stage 2 assessment.

12.2.4 Minor changes were performed to reflect changes to the road network not envisaged in the PTM base year, generating a reference case model for use in the assessment:

- The eastern roundabout at Wansford was reconstructed and signalised between January and March 2015 to ease congestion and mitigate against traffic stacking along the A1 exit slip road and back on to the mainline.
- The constructed design of the A1/B1081 Carpenter's Lodge junction in Stamford (completed in 2009) differed from the modelled representation.

Do Something Traffic Network

- 12.2.5 Do-Something models were developed to test the scheme designs described in Chapter 11.3: Options 1, 8 and 10 as shown in Figure 11-2, Option 1A shown in Figure 11-3 and Option 1B shown in Figure 11-4. Options 1A and 1B were introduced to test the operational performance of the scheme and are only discussed in this Chapter, Chapter 17.5 (Relative Cost Estimates) and Chapter 18 (Economic Assessment) as stated in paragraph 11.3.4.
- 12.2.6 Options 1, 8 and 10 differ only in their alignment between Wansford and Sutton. SATURN does not model these alignment characteristics in detail, instead describing them as point-to-point links with speed-flow relationships. As the standard of the road would be the same in Options 1, 8 and 10, their speed-flow relationships would be identical and therefore the links would not differ in their traffic behaviour. SATURN would therefore not resolve differences between these three options and it was appropriate to model them using a single option model. Therefore, three option models were constructed:
- One model representing Options 1, 8 and 10;
 - One model representing Option 1A; and
 - One model representing Option 1B.

Traffic Data

- 12.2.7 The SATURN origin-destination matrices were developed using 1991, 2003 and 2006 Roadside Interview (RSI) surveys, 2003 manual classified turning count surveys conducted during the 2003 RSI and 2001 Office of Population and Census Surveys data. Matrix estimation (using SATURN ME2) was used to complete the origin-destination matrices and ensure the best possible fit with observed traffic count data. This produced the resulting AM, PM and Interpeak matrices.
- 12.2.8 In addition to the traffic data used to develop the PTM, Highways England procured a series of MCCs for use in Stage 0 of the A47/A12 corridor RIS schemes. Five of these were for junctions within the Wansford to Sutton scheme extents, the locations of which are shown in **Figure 12-2** and listed in **Table 12-1**. Each of the MCCs was conducted on Thursday 25th June 2015. CCTV cameras were installed to view turning counts which were reported at 15 minute intervals over a 12-hour period between 07:00 and 19:00. Seven vehicle classes were counted: car, LGV, OGV1, OGV2, PSV, motorcycle and pedal cycle.

Figure 12-2: Wansford to Sutton scheme MCCs

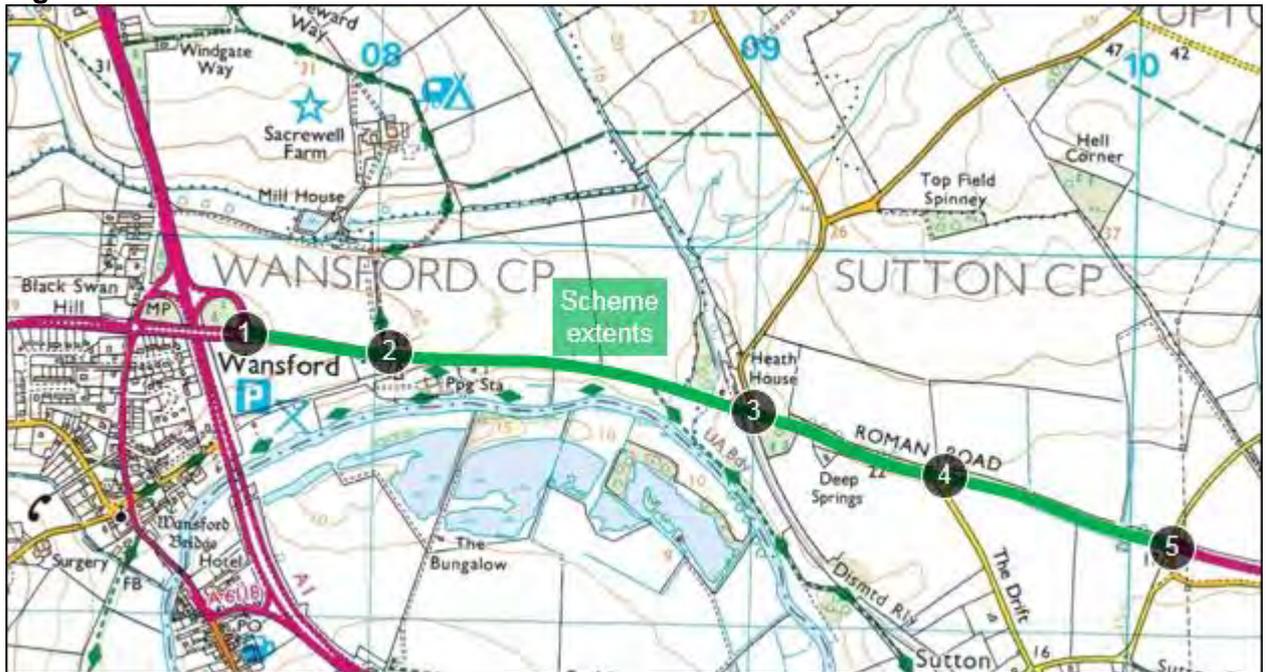


Table 12-1: Wansford to Sutton scheme MCCs

MCC	Junction Name	Junction Arms
1	Wansford East Roundabout	A47 and A1 southbound sliproads
2	Sacrewell Farm	A47, Sacrewell Farm Park access and picnic area
3	Sutton Heath Road	A47 and Sutton Heath Road
4	The Drift	A47 and The Drift
5	Sutton Roundabout	A47, Old Peterborough Road and access to Upton village

Time Periods

12.2.9 The traffic modelling used all three of the hours that are included in the PTM SATURN model namely:

- AM Peak (0800-0900);
- Inter Peak (1400-1500); and
- PM Peak (1700-1800).

12.3 Model Validation

Link validation against traffic counts

12.3.1 The model was previously fully validated to a 2006 base year. An additional validation test was performed to determine if the model was still broadly reflective of existing traffic conditions. For this purpose, the flows observed in the MCCs were compared to the link counts in existing 2006 base model and 2016 forecast models. The validation test was carried out to the standards described in WebTAG Unit M3.1 "Highways Assignment Modelling". The validation results are shown in **Tables 12-2 and 12-3**.

Table 12-2: Link flow validation against PTM base model

Time Period	Link	Traffic flow		Difference		WebTAG validation		GEH standard	
		Count	Model	Absolute	Percent	Target	Met?	Target	Met?
AM	A47 Eastbound	1,358	1,397	39	2.9	15%	YES	1.1	YES
	A47 Westbound	691	1,049	358	51.8	100vph	NO	12.1	NO
	A1139 Eastbound	2,661	2,504	-157	5.9	15%	YES	3.1	YES
	A1139 Westbound	2,310	2,419	109	4.7	15%	YES	2.2	YES
	A15 Northbound	1,053	741	-312	29.6	15%	NO	10.4	NO
	A15 Southbound	329	558	229	69.6	100vph	NO	10.9	NO
IP	A47 Eastbound	576	707	131	22.7	100vph	NO	5.2	NO
	A47 Westbound	617	701	84	13.6	100vph	YES	3.3	YES
	A1139 Eastbound	1,463	1,414	-49	3.3	15%	YES	1.3	YES
	A1139 Westbound	1,407	1,414	7	0.50	15%	YES	0.2	YES
	A15 Northbound	474	375	-99	20.9	100vph	YES	4.8	YES
	A15 Southbound	573	447	-126	22.0	100vph	NO	5.6	NO
PM	A47 Eastbound	728	779	51	7.0	15%	YES	1.9	YES
	A47 Westbound	1,204	1,161	-43	3.6	15%	YES	1.3	YES
	A1139 Eastbound	2,134	2,089	-45	2.1	15%	YES	1.0	YES
	A1139 Westbound	2,407	2,479	72	3.0	15%	YES	1.5	YES
	A15 Northbound	588	642	54	9.2	100vph	YES	2.2	YES
	A15 Southbound	1,025	775	-250	24.4	15%	NO	8.3	NO
Success against WebTAG criteria						12 of 18		12 of 18	
% success against WebTAG criteria						66.7%		66.7%	

12.3.3 Four of the six A47 data values met the WebTAG requirements. The interpeak eastbound flow only slightly exceeded the WebTAG requirements, with a GEH value of 5.2 (5.0 is the threshold) and a difference of 131 (100 is the threshold). The AM peak westbound flow was substantially higher than the survey value, with a GEH value of 12.1, however this was in the opposite direction to the one which suffered significant AM congestion.

12.3.4 All six of the A1139 data values and two of the six A15 values met the WebTAG criteria. Overall 66.7% of the 18 values achieved the WebTAG standards. To be WebTAG compliant, 85% of values should meet the WebTAG standard.

Table 12-3: Link flow validation against PTM 2016 forecast model

Time Period	Link	Traffic flow		Difference		WebTAG validation		GEH standard	
		Count	Model	Absolute	Percent	Target	Met?	Target	Met?
AM	A47 Eastbound	1,691	1,548	-143	-8.5%	15%	YES	3.6	YES
	A47 Westbound	959	835	-124	12.9%	15%	YES	4.1	YES
	A605 Eastbound	669	512	-157	-23.5%	100 vph	NO	6.5	NO
	A605 Westbound	166	116	-50	-30.1%	100 vph	YES	4.2	YES
	A1139 Eastbound	1,206	2,066	860	71.3%	15%	NO	21.3	NO
	A1139 Westbound	2,941	3,355	414	14.1%	400 vph	NO	7.4	NO
	A15 Northbound	533	507	-26	-4.9%	100 vph	YES	1.1	YES
	A15 Southbound	849	1010	161	19.0%	15%	NO	5.3	NO
IP	A47 Eastbound	757	1,037	280	37.0%	15%	NO	9.3	NO
	A47 Westbound	960	943	-17	-1.8%	15%	YES	0.6	YES
	A605 Eastbound	198	119	-79	-39.9%	100 vph	YES	6.3	NO
	A605 Westbound	205	147	-58	-28.3%	100 vph	YES	4.4	YES
	A1139 Eastbound	991	1,651	660	66.6%	15%	NO	18.2	NO
	A1139 Westbound	2,138	2,495	357	16.7%	15%	NO	7.4	NO
	A15 Northbound	444	500	56	12.6%	100 vph	YES	2.6	YES
	A15 Southbound	457	372	-85	-18.6%	100 vph	YES	4.2	YES
PM	A47 Eastbound	994	1088	94	9.5%	15%	YES	2.9	YES
	A47 Westbound	1,317	1,379	62	4.7%	15%	YES	1.7	YES
	A605 Eastbound	199	123	-76	-38.2%	100 vph	YES	6.0	NO
	A605 Westbound	736	546	-190	-25.8%	15%	NO	7.5	NO
	A1139 Eastbound	1,347	1,397	50	3.7%	15%	YES	1.3	YES
	A1139 Westbound	2,753	3,560	807	29.3%	400 vph	NO	14.4	NO
	A15 Northbound	994	444	-550	-55.3%	15%	NO	20.5	NO
	A15 Southbound	579	580	1	0.2%	100 vph	NO	0.0	YES
Success against WebTAG criteria						13 of 24		12 of 24	
% success against WebTAG criteria						54.2%		50.0%	

12.3.5 Five of the six 2016 forecast A47 data values met the WebTAG criteria. The A15 results performed substantially better than in the base year with four out of the six values meeting the criteria. Four of the six flow values and two of the six GEH values met the WebTAG criteria on the A605 and only one of the A1139 flow values achieved the WebTAG GEH and flow criteria.

12.3.6 Overall, 54.2% of the 24 values achieved the WebTAG traffic flow standards against the 2016 forecast years and 50.0% of the GEH values achieved the WebTAG standards.

12.3.7 Although these results strictly represented a failure against the WebTAG criteria there was, with a few exceptions, broad agreement between the observed and modelled flows. Therefore, the level of validation was sufficient for the traffic flow element of a PCF Stage 1 assessment. Note, however, that this does affect the level of assurance around the modelling and appraisal and should be borne in mind when assessing the final modelling results.

Analysis of rerouting behaviour

12.3.8 The PTM base model was used to predict the level of traffic re-routing in each of the option scenarios. Re-routing occurred due to journey time improvements along the A47 following dualling, increased AM peak period trips from the A1 southbound due to the free-flow lane, and the re-routing of Sutton Heath Road traffic due to the modelled closure of its priority junction with the A47.

12.3.9 Using the SATURN Select Link Analysis (SLA) module, the origins and destinations of traffic using the A47 through the scheme extents in the base model were investigated in the base year (2006). A summary of these origin-destination results is shown in **Table 12-4**.

Table 12-4: The origins/destinations of traffic on the A47 between Wansford and Sutton

Origin/Destination	A47 Eastbound			A47 Westbound		
	AM	IP	PM	AM	IP	PM
West End	From	From	From	To	To	To
A1(North)	16%	16%	14%	6%	17%	13%
Stamford via the A1	26%	22%	21%	12%	24%	29%
Wittering via the A1	-	-	-	7%	9%	8%
A47 Wansford/Wittering area	26%	11%	15%	6%	9%	5%
A47(West)	29%	33%	23%	35%	38%	42%
Oundle Road via the A1	-	1%	14%	21%	1%	1%
Fletton Parkway via the A1	-	1%	2%	3%	-	-
A605(West) via the A1	-	4%	3%	3%	1%	1%
A1(South)	3%	12%	8%	7%	1%	1%
Origin/Destination	AM	IP	PM	AM	IP	PM
East End	To	To	To	From	From	From
Sutton Heath Road and the villages in the Barnack and West Deeping Areas	5%	19%	34%	3%	6%	6%
Nene Way Roundabout (North arm)	-	-	-	34%	-	-
Jn 15 Bretton Parkway	2%	3%	1%	1%	4%	3%
Jn 15 Nene Parkway	13%	17%	7%	10%	18%	26%
Jn 15 Thorpe Wood & Thorpe Road	22%	3%	4%	4%	7%	11%
A47 Soke Parkway and locations within Peterborough	36%	42%	45%	31%	44%	43%
A47 Soke Parkway towards Guyhirn and A47(East)	21%	15%	9%	17%	21%	11%

12.3.10 The dualling of the A47 between Wansford and Sutton in the Option 1 model (representative of Options 8 and 10 also) attracted additional traffic to use this route as it became more attractive compared to the A1139 Fletton Parkway to the south and the local route between Stamford and the A47 via Barnack and Marholm villages, both of which generally experienced traffic reductions in the option models.

- In the AM peak, around 550 vehicles per hour eastbound and 250 vehicles per hour westbound re-route to the A47. Approximately 50% of this traffic comes from trips between Stamford and Peterborough that previously used Stamford Road (parallel to the A47 and north of the A47). Approximately 10% comes from trips via the A1139, Fletton Parkway, and the remainder comes from other local roads. The overall level of re-routing is around 50% higher in 2036 than 2026.
- In the interpeak and PM peak, the level of rerouting is smaller with traffic volume decreases on the Stamford-Road route between Stamford and Peterborough and the A1139 being less pronounced. During these time periods the, the major driver of routing change is the closure of the Sutton Heath Road junction on the A47.

12.3.11 A significant impact on rerouting is the proposed closure of the priority junction between the A47 and Sutton Heath Road:

- In the AM peak, an increased flow of traffic uses the new link road between Sutton Heath Road and the south arm of Nene Way Roundabout, drawing traffic away from the neighbouring Upton village road. In the Option models traffic increases by more than 500 vehicles per hour;
- In the interpeak and PM peak periods traffic that would previously have used Sutton Heath Road to travel to Stamford and the villages north of the A47 instead, in the option models, divides between the new link road via the south arm of Nene Way Roundabout and the Upton village road, significantly increasing the volume on the latter.
- Another effect of the removal of the Sutton Heath Road priority junction is the preference for traffic to route north bound using the A1260, Nene Parkway, and the A47 as far as Nene Way Roundabout to reach Sutton Heath Road, rather than travelling northbound along the A1 and eastbound along the A47. Up to 200 vehicles per hour are rerouted away from the A1 northbound carriageway due to this effect.

12.3.12 It is important to note that the precise choice of local road used by traffic to and from Sutton Heath Road was significantly influenced by the sensitivity of the PTM SATURN model in this area. Therefore, the additional traffic predicted on very minor local roads is unlikely to be realistic and that traffic is more likely to remain on the re-aligned Sutton Heath Road. However, the predicted re-routing via the A1, A1139, Fletton Parkway, and A1260, Nene Parkway, is likely to be realistic.

12.4 Forecasting Methodology

Forecast Approach

12.4.1 The PTM model included forecast traffic for 2016, 2021 and 2026.

12.4.2 Forecasts for local car traffic were developed using individual growth factors for each PCC ward based upon committed developments, local car ownership rates and background growth predicted by the Trip End Model Presentation Program (TEMPro). Forecasts for car traffic between two external zones, and for all OGV traffic, were taken from the DfT National Road Traffic Forecasts (NRTF).

12.4.3 New traffic forecasting was carried out to extend the final modelled year of the PTM from 2026 to 2036. This used a combination of TEMPro and NRTF data and continued the approach that was used within the development of the PTM. This new growth year represents 15 years after scheme opening and was sufficient for a PCF Stage 1 level of assessment.

12.4.4 To predict car traffic growth between the final PTM growth year of 2026 and the future year of 2036, growth estimates from the National Trip End Model (NTEM) as presented in TEMPro version 7.0 were used. Forecasts for goods vehicles and passenger service vehicles were obtained from the National Transport Model (NTM) as output in the National Road Traffic Forecasts. The NTM/NRTF growth factors are also used for all trips that have both origin and

destination outside of Peterborough. This forecasting method continues the approach used in the development of the original PTM.

12.4.5 The options have been tested at 2021, 2026 and 2036 future traffic levels. The year 2021 is the planned scheme opening year, 2026 is the latest future year included in the PTM SATURN model, and 2036 extends the PTM SATURN model to represent traffic patterns 15 years after opening.

Variable Demand

12.4.6 The Peterborough Transportation Model does not include variable demand modelling. The model is generally large enough to contain any traffic re-routing that may arise from the options that are being tested.

12.5 Modelling Outputs

Journey Time Improvements

12.5.1 Journey times for vehicles using the A1 and A47 are shown in **Table 12-5**, using the routes shown in **Figure 12-3**.

Figure 12-3: Routes used in journey time analysis

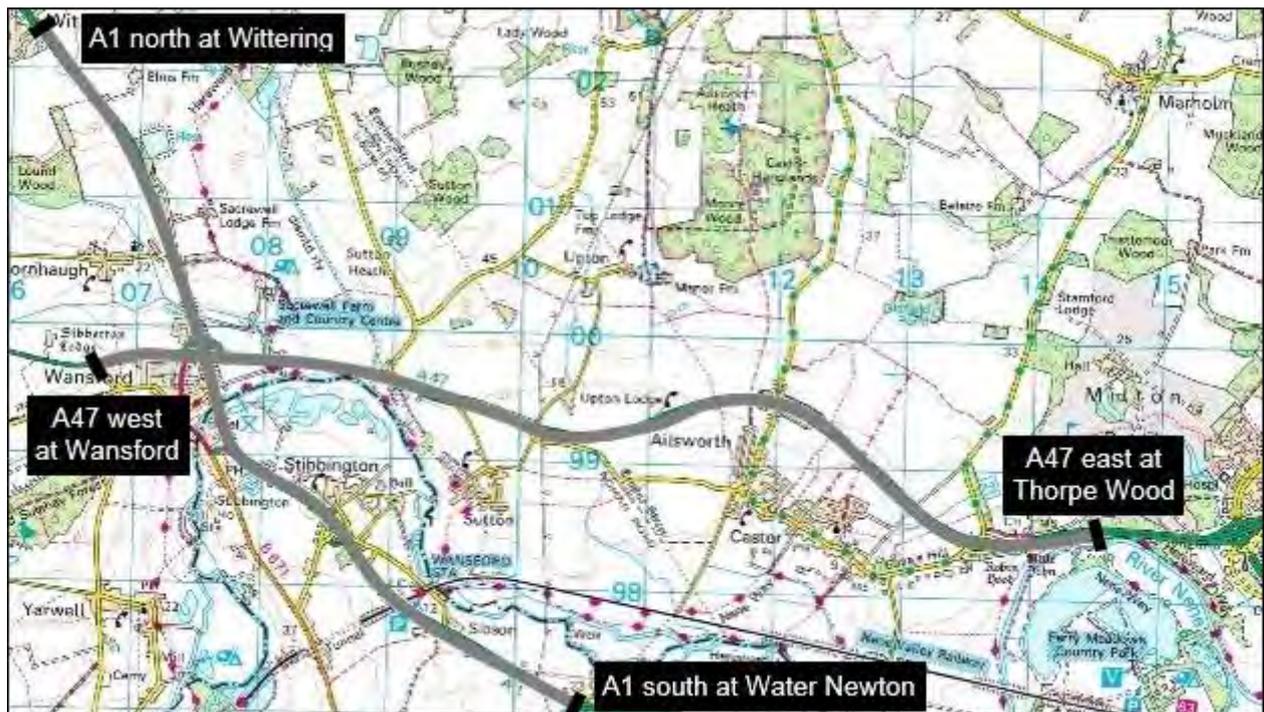


Table 12-5: Journey times for vehicles using A1 and A47

AM Peak Hour	2021 journey times				2036 journey times			
	Do-Min	Opt 1,8,10	Opt 1A	Opt 1B	Do-Min	Opt 1,8,10	Opt 1A	Opt 1B
A1 north to A47 east	584	429	421	541	711	460	449	609
A1 south to A47 east	1200	490	480	1145	1410	532	579	1386
A47 west to A47 east	1066	358	348	1010	1269	398	445	1245
A47 east to A1 north	505	427	415	605	523	435	423	706
A47 east to A1 south	596	493	482	689	641	531	520	812
A47 east to A47 west	416	338	326	517	428	340	328	613

- 12.5.2 The dualling of the A47 between Wansford and Sutton in the Option 1 model (also representative of Options 8 and 10) produced improvements in journey times due to a higher speed limit, improved overtaking opportunities, and the removal of delays caused by vehicles that would previously have turned into the side roads. There were significant AM peak period journey time improvements due to the free-flow lane from the southbound A1.
- 12.5.3 With Option 1A the grade separated junction at Sutton Roundabout brings journey time improvements as mainline traffic no longer slows down to negotiate the roundabout and no longer stops to give way to opposing traffic. This grade separated option also improves journey times for side road traffic attempting to enter the A47.
- 12.5.4 Option 1B offers fewer journey time benefits due to the lack of improvements at Wansford junction. This limits additional utilisation of the A47.
- 12.5.5 The 2036 results showed that during the AM peak hour Options 1,8 & 10 reduced the journey time from the A1(N) to the A47(E) by over 4 minutes. For the A1(S) to the A1(E) and from the A47 west of Wansford to the A47(E) the improvement was over 14 minutes. From the A47(E) to the A47 west of Wansford the improvement was approximately 1.5 minutes.
- 12.5.6 During the PM peak hour Options 1,8 & 10 reduced the journey time from the A1(N) to the A47(E) by just under 3 minutes. For the A1(S) to the A1(E) and from the A47 west of Wansford to the A47(E) the improvement was just over 2.5. From the A47(E) to the A47 west of Wansford the improvement was just over 0.5 minute.
- 12.5.7 During the Interpeak hour Options 1,8 & 10 reduced the journey time from the A1(N) to the A47(E) by just over one minute. For the A1(S) to the A1(E) and from the A47 west of Wansford to the A47(E) the improvement was approximately one minute. From the A47(E) to the A47 west of Wansford the improvement was just over 0.5 minute.

12.6 Conclusions

- 12.6.1 The results of the SATURN modelling showed that the scheme options 1,8,10 and 1A resulted in a significant amount of AM peak period re-routing with traffic between Stamford and Peterborough switching from the local Stamford road to the A1 and A47. During both the AM and PM peak periods there was a small amount of re-routing from the A1139, Fletton Parkway, to the A47 for traffic travelling between Peterborough and the A1. The SATURN modelling showed additional re-routing as a result of the closure of the Sutton Heath Road priority junction with the A47. This resulted in some re-routing away from the A1139/A1/A47 route and onto the A1139/A1260 (Nene Parkway)/A47 route. The model also showed re-routing from Sutton Heath Road to other local roads, but this is likely to be due to limitations in the accuracy of the modelling of these minor roads within the PTM SATURN model.

- 12.6.2 The SATURN modelling results showed that Options 1,8 & 10 and 1A resulted in substantial journey time savings eastbound along the A47, particularly during the AM peak period. This was largely a result of the free-flow lane from the southbound A1 along with the resulting reduction in congestion at Wansford Roundabout. The journey time improvements were up to 14 minutes in the AM peak, 3 minutes in the PM peak and one minute during the inter peak.
- 12.6.3 The journey time results also showed that in Option 1 and 1A, the level of delay in the AM and PM peak periods, compared to those in the interpeak, was considerably less in the Do-Something options than in the Do-Minimum. This suggested there was less underlying delay and more journey time reliability throughout the day for these design options.
- 12.6.4 Option 1B, which lacked the free flow lane from the southbound A1, performed much worse than the other options and failed to deliver significant journey time benefits or journey time reliability improvement.

13 Engineering Overview of Sifted Options (PCF Stage 1)

13.1 Introduction

13.1.1 The following sections describe the engineering features assessment and key comparison between the 3 options which are to be taken forward to non-statutory public consultation.

13.1.2 The layouts for the 3 options, (Options 1,8 and 10) have been developed from the layouts used at the time of the sifting exercise to show an indicative side road and junction layout. This indicative side road and junction layout has been included to allow Highways England Commercial team to price the options. The Option layouts for options 1, 8 and 10 with indicative junction and side road layouts are included in **Appendix K**.

13.2 Highways Alignment

General

13.2.1 The proposed carriageways would both be 7.3m wide with a provision of 1m hard strips on both sides of the carriageways. The central reserve would be a minimum of 2.5m however it is likely it would be wider at locations to accommodate forward visibility at bends. The verge width would be a minimum of 2.5m but designed to accommodate forward visibility, traffic signs, vehicle restraints system and other network infrastructure.

13.2.2 At this stage the vertical alignment has not been fully developed in detail, the road would be designed where practical to follow the existing ground to minimise the earthworks.

13.2.3 The national speed limit would apply on the proposed dual carriageway throughout its length. Any major junctions would be lit and laybys would be provided on both carriageways at appropriate locations.

13.2.4 Current standards do not include direct access from properties and gaps in the central reserve on dual carriageways due to safety reasons.

13.2.5 Options 8 and 10 which are mostly offline would allow the existing single carriageway A47 to remain and operate as a local access road potentially with improved non-motorised user facilities. Where required, local access roads may need to be diverted or include mitigation measures to provide access to properties and adjacent fields.

Option 1

13.2.6 The online improvement proposal would be to upgrade the existing single carriageway A47 to a two-lane dual carriageway by primarily online widening, with discrete offline sections to avoid or minimise the impact on a number of constraints. Where required, local access roads may need to be diverted or include mitigation measures to provide access to properties and adjacent fields.

13.2.7 The alignment of this online improvement proposal would follow closely the existing A47 both horizontally and vertically. As already noted in section 3.2, the existing road alignment is made up of large radius horizontal curves with limited lengths of straight carriageway between them. The vertical alignment is undulating with some fairly low radius but short in length vertical crest curves. These crest curve radii are less than the Desirable Minimum for the design speed of this road. Generally, the longitudinal gradients are shallower than 3% but there would be an instantaneous maximum of nearly 5% just to the west of the crossing of the disused railway and Sutton Heath Road.

13.2.8 The proposed free flow slip from the southbound A1 would be on a 590m radius left hand horizontal curve combined with a vertical crest curve radius equal to the Desirable Minimum for the design speed.

Option 8

13.2.9 The proposed new dual carriageway would be constructed part offline to the north and part offline to the south of the existing A47. The option would be a short distance offline to the north for approximately the first 25% of the route, crossing over the existing carriageway and then running 50m or so offline to the south.

13.2.10 The proposed route is offline therefore it is not so constrained by the existing A47 alignment as Option 1, although because the route crosses the existing A47, levels would have to be designed such that a through route could be maintained during construction. To move the alignment away from and then across the existing A47 would require horizontal radii smaller than the existing alignment but they would always be in excess of the Desirable Minimum for the design speed.

13.2.11 The vertical alignment could be much improved compared to the existing but the proposal would have a vertical crest curve radius that is smaller than the Desirable Minimum for the design speed. Generally, the longitudinal gradients would be 2% or shallower but there would be an instantaneous maximum of nearly 3½% just to the west of the crossing of the disused railway and Sutton Heath Road.

13.2.12 The proposed free flow slip from the southbound A1 would be on a 510m radius left hand horizontal curve combined with vertical crest curve radius greater than the Desirable Minimum for the design speed.

Option 10

13.2.13 The proposed new dual carriageway would be constructed offline around 20m to 30m to the north of the existing A47.

13.2.14 The proposed route would be offline and because the route would not cross the existing A47 it would therefore not be so constrained by the existing A47 alignment as either Option 1 or Option 8. Horizontal radii in excess of the Desirable Minimum for the design speed could be used throughout.

13.2.15 The vertical alignment could be much improved compared to the existing and the proposal would have vertical crest curve radii greater the Desirable Minimum for the design speed. Generally, the longitudinal gradients would be 2% or shallower but there would be an instantaneous maximum of 3% 600m to the west of Sutton Heath Road.

13.2.16 The proposed free flow slip from the southbound A1 would be on a 482m radius left hand horizontal curve combined with vertical crest curve radius greater than the Desirable Minimum for the design speed.

Junctions Strategy

13.2.17 As noted above in 13.1.2 an indicative side road and junction layout was developed for each option. This indicative side road and junction layout has been included at this stage to allow Highways England Commercial team to price the options more fully. Junction strategy and side road strategy will be fully considered and developed in PCF Stage 3 so the layouts should be treated as indicative only.

13.2.18 The proposed A47 dual carriageway would tie in to the existing A47 carriageway at the western end of the scheme via the existing eastern dumbbell roundabout of the A1 / A47 interchange.

- 13.2.19 A new proposed connecting road to the south would be added to this roundabout to access the Picnic area / Truck stop and Sacrewell Farm and Country Centre.
- 13.2.20 A proposed A1 southbound exit slip road from the A1 would provide a free flow link between the A1 southbound carriageway and the proposed new A47 eastbound carriageway.
- 13.2.21 The proposed A1 southbound exit slip road from the A1 would also provide a connection to the existing eastern roundabout of the A1/A47 interchange and would facilitate A1 southbound traffic wishing to access the A47 westbound carriageway.
- 13.2.22 Traffic travelling in either direction of the A47 would be able to gain access to the A1 southbound carriageway via the eastern dumbbell roundabout of the A1/A47 interchange, as is currently the case. Traffic travelling on the A1 northbound carriageway and wishing to access the A47 would do so via the western dumbbell roundabout of the A1 / A47 interchange which would be unaffected by the scheme.
- 13.2.23 The proposed A47 connection at the eastern end of the scheme would be via an at grade roundabout situated on the A47 at Nene Way. The roundabout would provide access to Upton to the north and Sutton to the south of the A47.
- 13.2.24 The way in which the local highway network is amended to accommodate the route options and the junctions above is described in section 13.5.

13.3 Departures from Standard

- 13.3.1 At this stage, no Departure from Standards have been submitted to Highways England Safety, Engineering and Standards (SES) (formerly PTS) for approval. Early engagement with SES will take place in later PCF Stages as the design develops to gain expert opinion and advice on how to address and progress these in regard to each specific option.

Option 1

- 13.3.2 In the highway alignment work undertaken, three Departure from Standards were identified. These were the result of the combination of vertical alignment geometry and the available stopping sight distance (SSD) associated with the Option 1 proposal.
- 13.3.3 The on-line option, in general, follows the vertical alignment of the existing A47 which is below standard in parts. At two locations on the eastbound carriageway and one location on the westbound carriageway the combination of relaxations in crest curves, sag curves and SSD would result in Departures from Standards. The three locations are as follows:
- Eastbound – The section of carriageway from 700m west of Sutton Heath Road to a point 580m west of Sutton Heath Road;
 - Eastbound – The 1,050m section of carriageway from 500m west of Sutton Heath Road to a point 550m east of Sutton Heath Road;
 - Westbound – The 1,050m section of carriageway from 550m west of Sutton Heath Road to a point 500m east of Sutton Heath Road.

Option 8

- 13.3.4 In the highway alignment work undertaken, two Departure from Standards were identified. These were the result of the combination of vertical alignment geometry and the available SSD associated with the Option 8 proposal.
- 13.3.5 At one location on the eastbound carriageway and one location on the westbound carriageway the combination of relaxations in crest curves and SSD results in the Departures from Standards. The two locations are as follows:

- Eastbound – The section of carriageway from 100m west of Sutton Heath Road to a point 250m east of Sutton Heath Road;
- Westbound – The section of carriageway from 50m west of The Drift to a point 310m west of The Drift.

Option 10

13.3.6 In the highway alignment work undertaken, one Departure from Standards was identified, this was the result of the combination of vertical alignment geometry and the available SSD on the approach to a junction associated with the Option 10 proposal.

13.3.7 The Departure from Standard occurred as a result of a relaxation in SSD on the eastbound carriageway on the approach to the A1 to A47 slip road merge; no relaxations are permitted on the approach to junctions.

13.4 NMU Provision

13.4.1 At PCF Stage 1 neither an NMU survey nor a Road Safety Audit (RSA) were completed. These will be conducted in later PCF stages to inform and develop the designs.

General

13.4.2 There are no National Cycle Routes in the area, however there are a large number of cyclists who wish to have a safe cycling route from Wansford to Peterborough. Initial talks have taken place with PCC, Sustrans and Peterborough Cycle West Project team to understand their requirements. Collaboration will continue as the scheme progresses in later PCF stages to see how their needs can be accommodated.

13.4.3 In all cases the design of provision for NMUs would take due regard of the Disabilities Discrimination Act and national guidance on the provision of facilities to allow inclusive access for all those with a disability.

13.4.4 NMU access to and from Sacrewell Farm and Country Centre would be provided via the proposed bridge connecting the picnic area with Sacrewell Farm.

Option 1

13.4.5 Option 1 is an online option that would incorporate the existing single carriageway of the A47 within the footprint of the new two-lane dual carriageway. To provide a safe through route for non-motorised users (NMUs) from Wansford to Sutton a completely new facility for the use of pedestrians, cyclists and other NMUs would have to be included in the scheme design.

13.4.6 The shared NMU facility would likely be located on the south side of the new A47 with compliant NMU crossing layouts also provided at any new junctions to gain access to the north side of the A47.

Option 8

13.4.7 The proposed new dual carriageway would be constructed part offline to the north and part offline to the south of the existing A47. To provide a safe through route for non-motorised users (NMUs) from Wansford to Sutton a facility for the use of pedestrians, cyclists and other NMUs would have to be included in the scheme design.

13.4.8 The shared NMU facility would likely be located on the north side of the new A47 with compliant NMU crossing layouts also provided at any new junctions to gain access to the south side of the A47.

13.4.9 Significant lengths of the existing single carriageway would not be incorporated in the new dual carriageway so these sections could be utilised for the NMU facility.

Option 10

13.4.10 The proposed new dual carriageway would be constructed offline to the north of the existing A47 except for the tie-in to the existing carriageway at the west and east ends of the scheme. To provide a safe through route for non-motorised users (NMUs) from Wansford to Sutton a facility for the use of pedestrians, cyclists and other NMUs would have to be included in the scheme design.

13.4.11 The shared NMU facility would be located on the south side of the new A47 with compliant NMU crossing layouts also provided at any new junctions to gain access to the north side of the A47.

13.4.12 The existing single carriageway sections not incorporated within the new dual carriageway would be utilised for the NMU facility.

13.5 Side Roads, Access and Accommodation Works

General

13.5.1 The full extent of accommodation works, side roads and access can only be determined after detailed consultation with land owners and occupiers as to how the surrounding land and properties are accessed and used. High level assumptions have been made for each of the three options. The section starts with statements that are common to all options followed by each option where they are different.

13.5.2 The southbound free-flow slip road between the A1 southbound carriageway and the new A47 eastbound carriageway alignment would be located on the northeast side of the existing A1 / A47 junction within the existing agricultural landscape.

13.5.3 Access to Sacrewell Farm and Country Centre, north of the A47 and interests to the south, including Wansford Picnic Area, would be reconfigured with a connecting bridge over the A47. Access to the A47 eastbound and westbound would be via a modified eastern roundabout. The fuel station would be retained with a modified access / egress layout. The land affected is predominately of agricultural use. However, the area of land immediately to the south of the A47 and west of the Truck stop / Picnic Area access that contains the filter tanks is likely to be affected by the proposals.

13.5.4 The existing Sutton Heath Road / Langley Bush Road junction would be reconfigured with an additional link road that would connect to the road known as The Drift, via a proposed new bridge structure over the new A47 alignment. The Drift, severed by the proposed alignment and Sutton Heath Road would not have direct access to the proposed alignment. These roads would access the proposed A47 alignment via the Nene Way roundabout. A section of the existing A47 between Sutton Heath Road and The Drift would be retained to provide local access.

13.5.5 Ermine Street would be realigned to connect with Nene Way at a proposed new junction. These roads would connect to the A47 via the Nene Way roundabout. The connection of the road from Upton to the Nene Way roundabout would be retained with a revised alignment.

Option 1

13.5.6 As this option would be online along its entire length, the existing A47 single carriageway would be incorporated within the construction of the proposed dual carriageway. Existing accesses would be affected; however, direct access onto the proposed new carriageway is not proposed so alternative access via new side road or service road links would be required.

- 13.5.7 The access to the Old Station House would be affected by the proposed alignment but the property would not be directly affected. A new access would have to be provided to the property from Sutton Heath Road.
- 13.5.8 The Drift and Sutton Heath Road would be stopped up and would not have direct access to the new alignment. These roads would connect with the new A47 alignment at the Nene Way roundabout. Access to the new A47 alignment for the property known as Deep Springs would be provided via the proposed new link road.

Option 8

- 13.5.9 The proposed option would be mostly offline except where it crosses the existing A47 to run to the south. Much of the existing A47 carriageway could be retained to maintain local access to adjacent fields and properties, particularly to the north. Access to the fuel station to the south would be via a portion of the remaining A47 carriageway connected by a proposed new link to the eastern roundabout of the A1/A47 junction. Where the proposed new carriageway is to the south of the existing A47, access into land between the proposed highway and the River Nene would require links bridging across the new carriageway.
- 13.5.10 The Old Station House would not be directly affected by the new route and access to the property would be from the section of the existing A47.
- 13.5.11 Deep Springs would be accessed from the unaffected section of the existing A47 single carriageway.

Option 10

- 13.5.12 This option would be off-line option to the north of the existing A47 therefore much of the existing A47 carriageway could be retained to maintain local access to adjacent fields and properties, particularly to the south between the proposed highway and the River Nene. Accesses to the north would require links bridging across the new carriageway.
- 13.5.13 Throughout its length, this option affects land north of the existing A47 alignment. The free-flow slip road affects land northeast of the existing A1 / A47 junction. A short section of the existing A47, between the Sutton Heath Road and The Drift, will be retained to provide access.
- 13.5.14 The Old Station House would be directly on the line of the new A47 and would have to be demolished if Option 10 was selected as the preferred route.
- 13.5.15 Deep Springs would not be directly affected by the route of the A47 and access to the property would be from the unaffected section of the existing A47 single carriageway.

13.6 Drainage and Flooding

General

- 13.6.1 The section starts with statements that are common to all options followed by each option where they are different.
- 13.6.2 For information on water courses, flood zones/plains, groundwater source protection zones, ponds and aquifers, see Section 4 (Environment including Environmental Status) and Section 16 (Environmental Assessment). Both temporary and permanent works have to ensure that the aquifer and extraction licenses (if any) are unaffected by the works and the EA's consent sought. The provision of treatment facilities in the form of oil interceptors and/or storage ponds etc. would reduce the potential for contamination.

- 13.6.3 HADDMS also indicates the presence of a number of soakaways along the A47 corridor. These may be affected by any improvement works and may have to be relocated.
- 13.6.4 Depending on the suitability of the ground conditions, infiltration may be used as a form disposal of flows from the storage structures.
- 13.6.5 The carriageway subsurface would also be drained. In the case of a carriageway on embankment, the proposed carriageway sub surface would be drained via a system of fin or narrow filter drains, on the lower side of super elevated carriageways, or on both sides for cambered carriageways. In turn, these would discharge into the nearest piped network. In the case of a proposed carriageway in cutting, the subsurface as well as the sloped cutting would be drained via a system of filter drains placed in the verge. Depending on the topography of the surrounding land, filter drains may also be required to collect flows at the top of cuttings.
- 13.6.6 The desk top searches did not indicate the presence of outfalls for the existing drainage system. These outfalls should be located during future site visits and investigations.
- 13.6.7 Drainage proposals are likely to include positive drainage in the form of carrier drains, filter drains, gullies, combined kerb drains (roundabouts), channels etc. These would convey rainwater falling on the carriageways to the nearest existing or proposed outfalls.
- 13.6.8 Where the proposed carriageway is in greenfield areas (i.e. the new A1 southbound Link to the A47) it may be a requirement for the catchment discharge to be limited to 'Greenfield' run off. This in turn is likely to require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.
- 13.6.9 The proposed dualling whether online or offline would be likely to involve the severing of any existing field drainage. These systems will have to be reconstructed with the agreement of field owners/occupiers. In any case, any substantial areas of field sloping towards the proposed carriageway will have to be drained by a system of ditches or filter drains in the vicinity of the new highway boundary.

Option 1

- 13.6.10 Any proposals for on line widening of the A47 may encroach on the River Nene flood zones. This would require the consent of the EA, whether for temporary or permanent works.
- 13.6.11 Any proposals for online widening of the A47 in this area would require the extension/protection of the culverts as well as constructing a new box culvert approximately 400m west of the Nene Way Roundabout to maintain field drainage to the south of the A47. There would also be a requirement for a new box culvert below the proposed A1 southbound Link to the A47 eastbound as it crosses one of the water courses.
- 13.6.12 The online widening of the existing carriageway would necessitate the abandonment of some of the existing drainage and replacement with new drainage features for that section of carriageway as well as affected side roads. There would also be an increase in the contributing area. Storage would be provided to limit proposed flows to no more than existing peak flows.

Option 8

- 13.6.13 Proposals for this option may encroach on the River Nene flood zones. This would require the consent of the EA, whether for temporary or permanent works.
- 13.6.14 Any proposals of new offline carriageway in this area would require the extension/protection of the existing culverts or the construction of new culverts over water courses being crossed.

There would also be a requirement for a new box culvert below the proposed A1 southbound link to the A47 eastbound as it crosses one of the water courses.

13.6.15 Both temporary and permanent works would have to ensure that the aquifer and extraction licenses (if any) are unaffected by the works and the EA's consent is sought. However; the risk of contamination of ground water via the infiltration of road run off is deemed as negligible. This is because over edge road run off would be conveyed to the outfalls via ditches and or filter drains to the outfalls. Very little flow would infiltrate into the ground, unless infiltration techniques are specifically used for disposal of road run off. Furthermore, the provision of treatment facilities in the form of oil interceptors and/or storage ponds etc. would further reduce the potential for contamination.

13.6.16 Sections of online widening (at tie ins and where the option crosses over the existing carriageway from north to south) would necessitate the abandonment of some of the existing drainage and replacement with new drainage features for that section of carriageway as well as affected side roads. There would be an increase in the contributing area. Storage would be provided to limit proposed flows to no more than existing peak flows.

13.6.17 For the offline sections of carriageway, it may be a requirement for each catchment discharge to be limited to 'Greenfield' run off. This in turn would likely require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.

Option 10

13.6.18 Any proposals of new offline carriageway in this area would require the extension/protection of the existing culverts or the construction of new culverts over water courses being crossed. There would also be a requirement for a new box culvert below the proposed A1 southbound link to the A47 eastbound as it crosses one of the water courses.

13.6.19 For the offline carriageway, it may be a requirement for each catchment discharge to be limited to 'Greenfield' run off. This in turn is likely to require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.

13.7 Geotechnical Considerations

13.7.1 The primary geological risk anticipated at this stage is a lack of ground investigation information within the study area. While the basic geological make up beneath the site is understood there is no detailed information available that could be used to assess the potential impact of geological features in any significant detail.

13.7.2 A broad level assessment of the currently available information has identified the following potential geological risks that would require further assessment:

- The available geological mapping indicates that the underlying superficial geology will be variable in nature. Settlements beneath earthworks and structures will need to be assessed to avoid unacceptable levels of differential settlement. Scheme specific ground investigations will be required to fully inform this assessment. Delineating the extents of the alluvial materials known to exist will be particularly important. Settlement beneath new road created for Options 8 and 10 will need to be identified.
- Risk of differential settlement at the interface between existing and proposed infrastructure, including embankments and structures. A better understanding of the proposals and the ground conditions will be required before this impact can be fully assessed. This risk is of more significance for Option 1 where expansion of the existing infrastructure is considered.

- The scheme extents are in an area at risk of flooding and therefore raised earthworks may be required as part of the works. The construction of embankments will increase the load being carried by the underlying soils thus leading to increased levels of settlement. Further ground investigation information will be required to fully assess the anticipated settlements.
- The existing lack of site investigation information means that all three proposed options are exposed to similar anticipated engineering risk.

13.7.3 A geotechnical risk register was developed for the scheme and was presented within the Scheme Statement of Intent (Road Investment Strategy, East Area 6, Geotechnical Statement of Intent, A47 Wansford to Sutton Document reference A47IMPS1-AME-WS-ZZ-DO-J0034 Wansford SOI Issue dated August 2016. HAGDMS Ref: 29187).

Mining

13.7.4 The historic Sutton Gravel Pit adjacent to the southern boundary of the existing A47 highway at the eastern end of the site. Work on Options 1 and 8 are likely to have a high chance of coming in to contact with this feature (which from available information appears to now be a pond). If either of these options are to be progressed with interaction with this obstacle the pond will require draining, soft material to be excavated and the cavity to be backfilled with engineered fill.

13.7.5 Historic and future mining activities across the rest of the site pose minimal engineering concerns for the project.

13.8 Structures – High Level Structures Strategy

13.8.1 The proposed structures are very similar for the three options with some variations in the locations. **Table 13-1** below shows the structures for each option and their approximate proposed locations.

Table 13-1: Structures for Option 1, 8 and 10

S.No	Structure	Chainage (m)		
		Option 1	Option 8	Option 10
1	Culvert near A1 slip road	Approx 50	Approx 50	Approx 50
2	Single Carriageway Overbridge	Approx 265	Approx 290	Approx 290
3	Culvert	Approx 1175	Approx 1195	Approx 1140
4	Wansford Sluice	Approx 1225	-	-
5	Railway Under Bridge	Approx 1400	Approx 1400	Approx 1350
6	Single Carriageway Overbridge	Approx 1825	Approx 1880	Approx 1800
7	Culvert	Approx 2110	Approx 1210	Approx 1225
8	Culvert	Approx 2350	Approx 2360	Approx 2110
9	Culvert	-	-	Approx 2375

Culvert near A1 slip road

- 13.8.2 The proposed culvert would be located below the southbound exit slip road connecting the A1 to the A47 eastbound. There is an existing culvert below the A1 at same location; the new culvert would be connected to the existing culvert to enable the free flow of the watercourse. The proposed culvert is likely to be a reinforced concrete box culvert and would be slightly skewed to match the alignment of the existing culvert and the watercourse. The culvert would be constructed by either precast or in situ solutions. The length, width and depth of the culvert will need to be determined based on site investigations.

Single Carriageway Over Bridge

- 13.8.3 The proposed single carriageway over bridge would enable ease of access to Sacrewell Farm north of the A47 and the Truck stop / Picnic Area to the south of the A47. The bridge would be slightly skewed with a length of approximately 25m and the width of the bridge would be approximately 11m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

Culverts

- 13.8.4 The proposed culverts would likely be reinforced concrete box culverts would be moderately skewed and approximately 30m long constructed by either precast or in situ solutions. The width and depth of the culverts would be determined based on site investigations.

Wansford Sluice

- 13.8.5 The Wansford Sluice is a 1.8m wide brick culvert with small brick headwall/wingwalls at both ends. The structure is located to the west of Wansford Railway bridge, the southern end of the structure is hidden by a thick hedge. Based on the existing conditions the sluice would either be widened or a new reinforced concrete culvert would be constructed and connected to the existing sluice. This only affects Option 1.

Railway Underbridge

- 13.8.6 Wansford Railway Bridge was constructed in the 19th century. The structure is a single span underbridge and carries the A47 single carriageway and two verges over a disused railway line, formerly the Stamford and Wansford Railway. Due to the age of the bridge it is proposed that the existing structure would not be used to carry the dual carriageway. Instead a new dual carriageway underbridge would be constructed to carry the A47 across the disused railway line.

Single Carriageway Over Bridge

- 13.8.7 The proposed single carriageway over bridge would enable ease of access to either side of the A47 connecting The Drift and Sutton Heath Road. The bridge would be slightly skewed with an approximate length of 25m and the width of the bridge will be approximately 11m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

13.9 Public Utilities

General

- 13.9.1 C2 and C3 enquiries were submitted and obtained for the scheme area. These were reported in Statutory Undertakers Report for PCF Stage 1 (ref A47IMPS1-AME-WS-ZZ-DO-J-0037)

Wansford Statutory Undertakers Report). Further statutory undertakers' requests will be made in future stages to check for detailed positions of utilities and to provide cost certainty. Proposed changes to accommodate the options will need to be considered during the construction stages. General descriptions of each option are described below.

- 13.9.2 For all options, extensive diversions would be required in the vicinity of Nene Way, including diversions to communications and water utilities. High Voltage (HV) overhead cables (400kv) are present in this location and the impact of their height above ground level should be considered prior to any future A47 improvement. National Grid has confirmed that diversions of these overhead cables are unlikely to be required provided a minimum clearance distance of 8.1m between the road level and the catenary of the overhead line is maintained.

Option 1

- 13.9.3 Online improvement of the A47 in the vicinity of A1/A47 junction would require rationalisation of the existing utilities and require diversions of existing electrical statutory undertaker's equipment to facilitate any revised road layouts.
- 13.9.4 The area between A1/A47 junction improvement along this section would require significant statutory undertaker's diversions for BT, Interoute, Vodafone, Western Power and Anglian Water utilities that currently run parallel with the A47. Other existing statutory undertaker's equipment currently crossing the line of an online improvement, including Electricity and Water, may need to be diverted or locally lowered so that the utilities are protected from possible damage caused by future construction traffic.

Option 8

- 13.9.5 Offline improvements to the north of the existing A47 in the vicinity of A1/A47 junction would require rationalisation of the existing utilities and require minor diversions of existing electrical statutory undertaker's equipment to facilitate any revised road layouts.
- 13.9.6 Offline improvement of the A47 to the north of the existing alignment between the A1/A47 junction and Sutton Heath Road would have slightly less of an impact on existing statutory undertaker's equipment in this area than the on-line option, although it would still have a significant impact on BT, Vodafone, Western Power and Anglian Water. There would also be an impact on existing equipment currently crossing the line of a future improvement. This would include Electricity and Water utilities that may need to be diverted or locally lowered so that the utilities are protected from possible damage caused by future construction traffic. There may be a need to locally divert existing Communications and BT utilities, currently running parallel with the existing A47 if the provision of a new layby is required.
- 13.9.7 Offline improvement of the A47 to south of the A47 between Sutton Heath Road and Nene Way would require significant statutory undertaker's diversionary work. Some duct crossings and protection works to existing Anglian Water mains may be required where these utilities cross a future A47 improvement.

Option 10

- 13.9.8 Offline improvement of the A47 to the north of the existing alignment between the A1/A47 junction and Sutton Heath Road would have slightly less of an impact on existing statutory undertaker's equipment in this area than the on-line option, although it would still have a significant impact on BT, Vodafone, Western Power and Anglian Water. There would also be an impact on existing equipment currently crossing the line of a future improvement. This would include Electricity and Water utilities that may need to be diverted or locally lowered so that the utilities are protected from possible damage caused by future construction traffic. There may be a need to locally divert existing Communications and BT utilities, currently running parallel with the existing A47 if the provision of a new layby is required.

- 13.9.9 Offline improvement of the A47 to the north of the A47 between Sutton Heath Road and Nene Way would require significant statutory undertaker's diversionary work. Some duct crossings and protection works to existing Anglian Water mains may be required where these utilities cross a future A47 improvement.

13.10 Topography, Land Use, Property and Industry

General

- 13.10.1 Due to the gently rolling topography of the land either side of the A47 between Wansford and Sutton any A47 improvements online or offline to the north would not be unduly influenced as to their location. Offline to the south would be influenced by the proximity of the river Nene running close to the existing carriageway.

Option 1

- 13.10.2 The online dualling of the A47 would affect land either side of the existing A47 trunk road. The free-flow slip road from the A1 southbound would affect land northeast of the existing A1 / A47 junction. The land affected is predominately of agricultural use.
- 13.10.3 The new alignment of the A47 between the A1 / A47 junction and Sutton Heath Road would follow the existing A47 and the widened carriageway would generally be on low embankment or in shallow cutting, with the exception of the localised valley to the west of the disused railway line, where a higher embankment would be needed. The land affected along this section is agricultural.
- 13.10.4 The access to the Old Station House would be affected by the proposed alignment but the property would not be directly affected.
- 13.10.5 The access to the property Deep Springs would be affected by the proposed alignment but the property would not be directly affected.
- 13.10.6 The proposed alignment of the A47 from Sutton Heath Road to the Nene Way roundabout would generally follow the existing single carriageway. The widened carriageway would require the acquisition of agricultural land.

Option 8

- 13.10.7 This option affects land north of the existing A47 alignment for the initial 850 metres and south of the existing A47 alignment thereafter, up to the Nene Way roundabout. The free-flow slip road affects land northeast of the existing A1 / A47 junction. Sections of the existing A47, between the Sutton Heath Road area and Nene Way roundabout, would be retained as a local link road. The land affected is predominately of agricultural use.
- 13.10.8 The Old Station House would not be directly affected by the new route and access to the property would be from the section of the existing A47.
- 13.10.9 The new alignment of the A47 between Sutton Heath Road and Nene Way roundabout would be to the south of the existing road and the property Deep Springs. The land required to accommodate the new A47 would be agricultural.

Option 10

- 13.10.10 Throughout its length, this option affects land north of the existing A47. The free-flow slip road from the A1 southbound affects land northeast of the existing A1 / A47 junction. A short section of the existing A47 between the Sutton Heath Road and The Drift, would be retained to provide access. The land affected is predominately of agricultural use.

- 13.10.11 The route option would need to acquire land from the Sacrewell Farm estate and would also pass through the area of the scheduled monument.
- 13.10.12 The Old Station House would be directly on the line of the proposed new A47 and would have to be demolished if Option 10 was selected as the preferred route.
- 13.10.13 The proposed A47 alignment of the A47 between the Sutton Heath Road and the Nene Way roundabout would be to the north of the existing road. The land required to accommodate the proposed A47 is agricultural.
- 13.10.14 Deep Springs would not be directly affected by the route of the A47 and access to the property would be from the unaffected section of the existing A47 single carriageway.

13.11 Buildability

Option 1

- 13.11.1 This Option would have the most impact regarding Buildability of the scheme and would cause significant disruption to the public for reasons included in the information given below:
- 13.11.2 Permanent traffic management measures would be required throughout the length of the scheme to keep traffic segregated from the construction works. Traffic management would also be required on the A1 southbound carriageway to facilitate the connection of the free flow link from the A1 to the A47. The traffic management is generally likely to take the form of single carriageway running of the existing A47 with narrow lanes and is likely to cause disruption to the public during the period that the traffic management is in place.
- 13.11.3 The tie-ins at either end of the A47 where the improvement connects into the existing A47 carriageway would possibly be constructed either under temporary traffic signals or by temporary diversion works. The construction of the tie-ins would cause some disruption to the travelling public.
- 13.11.4 Existing utilities run along the existing A47 corridor throughout the length of the route and as such major diversionary works will be required. There are various crossings of the site by electricity cables and water which would be buried where they intersect the route. 400kV power lines supported on pylons cross the route at Nene Way. During PCF Stage 3-preliminary design process, consideration is to be taken as to the minimum clearance requirements to these overhead electricity cables and they would need to be clearly identified during construction.
- 13.11.5 The combination of the provision of permanent traffic management and the requirement to facilitate statutory undertakers' diversionary works would inevitably result in a reduced working space in which to carry out the improvement works when compared to an offline option.
- 13.11.6 The construction of an embankment up to 5m high to carry the widened A47 carriageway would be required west of Sutton Heath Road, where there is a watercourse in a localised valley between the area of the scheduled monument and the disused railway line. The embankment would be difficult to build adjacent to the existing A47 without the construction of a temporary road diversion running parallel to the A47. This would be further complicated, as the temporary diversion would need to cross the existing disused railway cutting.
- 13.11.7 Existing watercourses cross the site at several locations. Consideration would be given to methods of maintaining the flow of water of these watercourses while construction of culverts to accommodate them is carried out.
- 13.11.8 Direct access to land severed by the construction works would need to be maintained throughout the construction period.

13.11.9 Three bridges would be constructed on the line of the route. An underbridge at Sutton Heath Road crossing the disused railway line could be constructed in two halves to mitigate the requirement of a full closure of the A47. The remaining two bridges, one at Sacrewell Farm and another at The Drift would be constructed over the A47 and would require the closure of the live A47 carriageway for a period of time to allow the bridge decks to be installed. This work would be carried out at off-peak times and require the closure of the A47 and the installation of long diversion routes likely to cause major inconvenience to the public.

Option 8

13.11.10 This Option would have a moderate effect regarding Buildability and would also cause some disruption to the public for reasons included in the information given below:

13.11.11 This option can be constructed predominantly offline. This means that a large proportion of the works can be carried out within moderate traffic management measures required at the tie-ins at either end of the scheme where the new alignment connects to the existing A47 and A1 carriageways and at the point where the alignment crosses the existing A47 when moving from north to south. At these locations, more extensive traffic management arrangements would be required.

13.11.12 The tie-ins at either end of the A47 where the improvement connects into the existing A47 carriageway would possibly be constructed either under temporary traffic signals or by temporary diversion works. The construction of the tie-ins may cause some disruption to the travelling public.

13.11.13 Existing utilities run along the existing A47 corridor throughout the length of the route and as such do not generally intersect the site. The exception to this is where the route crosses the existing A47 to the west of Sutton Heath Road where diversions for water and communications crossings are required. High voltage overhead electrical cables that are currently located south of the existing A47 to the west of Sutton Heath Road would be diverted prior to construction. There are various crossings of the site by electricity cables and water which would be buried where they intersect the route. 400kV power lines supported by pylons cross the route at Nene Way. During the design process consideration is to be taken as to the minimum clearance requirements to these overhead electricity cables and they would need to be clearly identified during construction.

13.11.14 To the west of Sutton Heath Road, the alignment moves south of the existing A47 to within 30m of the River Nene. The routes proximity to the river at this point may require the installation of an earthwork special treatment area to mitigate the possible presence of poor ground conditions.

13.11.15 Existing watercourses cross the site at a number of locations. Consideration would be given to methods of maintaining the flow of water of these watercourses while construction of culverts to accommodate them is carried out.

13.11.16 Direct access to land severed by the construction works would need to be maintained throughout the construction period.

13.11.17 Three bridges would be constructed on the line of the route. A bridge over the new alignment at Sacrewell Farm may need to be constructed having first installed a temporary diversion around the structure to allow room for construction. The remaining two bridges, an underbridge crossing a disused railway to the south of Sutton Heath and an over bridge where the route crosses The Drift can be constructed completely offline without any significant construction ramifications.

Option 10

13.11.18 This Option would least effect of any option regarding Buildability and would also cause minimal disruption to the public for reasons included in the information given below:

- 13.11.19 This option can be constructed almost totally offline. This means that for the majority of the time the works can be carried out with traffic management required at the tie-ins at either end of the scheme where the new alignment connects to the existing A47 and A1.
- 13.11.20 Existing utilities run along the existing A47 corridor throughout the length of the route and as such are not generally contained within the site. The exception to this would be the two extremities of the site where the route connects to the existing infrastructure and at Sutton Heath Road where electricity water and communications equipment would be treated. There are various crossings of the site by electricity and water utilities which would be buried where they intersect the route. 400kV power lines supported on pylons cross the route at Nene Way. During the design process consideration is to be taken as to the minimum clearance requirements to these overhead electricity cables and they would need to be clearly identified during construction.
- 13.11.21 The tie-ins at either end of the A47 where the improvement connects into the existing A47 carriageway would possibly be constructed either under temporary traffic signals or by temporary diversion works. The construction of the tie-ins may cause some disruption to the travelling public.
- 13.11.22 Existing watercourses cross the site at a number of locations. Consideration would be given to methods of maintaining the flow of water of these watercourses while construction of culverts to accommodate them is carried out.
- 13.11.23 Direct access to land severed by the construction works would need to be maintained throughout the construction period.
- 13.11.24 Three bridges would be constructed on the line of the route. A bridge over the new alignment at Sacrewell Farm, a bridge crossing the disused railway west of Sutton Heath Road and a bridge over The Drift. All three bridges can be constructed completely offline without any significant construction ramifications.

13.12 Effective Construction Management – Construction (Design and Management) Regulations 2015

- 13.12.1 The Construction (Design and Management Regulations) 2015 requires the client to formally appoint a Principal Designer (where it is reasonably foreseeable that more than one contractor will be working on a project at any one time) who essentially have responsibility to plan, manage and monitor the pre-construction phase and co-ordinate matters relating to health and safety during the pre-construction phase.
- 13.12.2 AECOM were appointed as Principal Designer (PD) on the A47 Programme during PCF Stage 1.
- 13.12.3 During PCF Stage 1, Amey undertook the following tasks as part of its duties under the CDM regulations:
- CDM audit; and
 - Design review PCF Stage 1.
- 13.12.4 The outcomes of the audit were issued to the Project and Programme Director, with corrective measures being actioned by the appropriate Design Discipline Lead.
- 13.12.5 The design reviews were conducted by the PD with the appropriate Design Discipline Lead and Amey Project Manager. As a result of the design reviews the project team undertook to amend the design to incorporate the recommended actions.

14 Operational, Technology and Maintenance Assessment of Sifted Options

14.1 Operational Assessment

- 14.1.1 The Wansford to Sutton link is part of the A47 route which forms a major east-west route through East Anglia, connecting key population areas such as Peterborough, Kings Lynn, Norwich and Great Yarmouth. The corridor intersects with key strategic routes including the A1, A10 and A11. These strategic roads provide links to other urban centres including Cambridge, Ely and London.
- 14.1.2 The road currently operates as a single carriageway link with local roads linking in along the route.
- 14.1.3 All Options for the proposed dualling scheme would operate as a dual 2 lane all-purpose highway.
- 14.1.4 For all options the southbound slip road from the A1 southbound at the western end of the scheme would be realigned to provide a free flow link between the A1 southbound carriageway and the proposed new eastbound carriageway of the A47. The proposed slip road from the A1 would also have a connection to the existing roundabout to accommodate westbound traffic.
- 14.1.5 The side road strategy was developed for pricing purposes and is not developed fully at PCF Stage 1 but once dualled there would be a reduced number of junctions onto and off the section of road. Due to the operating regime of modern dual carriageway standard there would be no direct right turn off or on to the dual carriage way.

14.2 Technology Assessment

- 14.2.1 As detailed in section 3.11 there is limited technology in the section of the A47 Wansford to Sutton.
- 14.2.2 The technology equipment where affected will be replaced as required and as appropriate in PCF Stage 3 – preliminary design.
- 14.2.3 The isolated road traffic loops on the approach to the A1/A47 roundabout eastbound and westbound will be re sited as necessary in the new arrangements.
- 14.2.4 There is road lighting local to the A1/A47 roundabout and the Nene Way roundabout. There is no lighting on the single carriageway section between Wansford and Sutton. It is likely that the new scheme will follow a similar lighting strategy, however street lighting provision along the scheme will be reviewed in PCF Stage 2 and appropriate street lighting will be provided as required.

14.3 Maintenance Assessment

- 14.3.1 Maintenance considerations will be developed further as the scheme progresses through to the next stage. It is expected that PCC would adopt and maintain the de-trunked sections of the A47 and side roads. Dialogue with PCC will take place in PCF Stage 3.
- 14.3.2 A Maintenance Repair Strategy Statement (MRSS) was produced in PCF Stage 2 document reference number A47IMPS2-AMY-WS-ZZ-DO-J-0030 which gives further information.

15 Safety Assessment of Sifted Options

15.1 Introduction

- 15.1.1 This section discusses the consideration of safety in the design considerations and how these align with the Highway's England RIS and Delivery Plan.

15.2 Summary of Safety Assessment

Highways England Delivery Plan 2015-2020: A safe and serviceable network

- 15.2.1 The Highways England Delivery Plan 2015-2020 sets out the following safety measures that will result in noticeable improvements for customers and will contribute significantly to achieving the 40% reduction in KSIs. The Delivery Plan has received a number of updates since publication which is discussed further in Chapter 32. A commentary is provided below about how the options identified align with these measures.

Upgrades to junctions and removing some of the worst bottlenecks

- 15.2.2 All the options identified seek to upgrade the A47 from single carriageway to dual carriageway over the length of the scheme. This will remove the current bottleneck caused by the section of single carriageway between the A47 Wansford to Sutton which is already operating over capacity. The free flow slip road from the A1 south is expected to reduce the congestion on the approach to the roundabout at the A1/A47 junction.
- 15.2.3 At this current stage, a junction strategy has not been produced but will be addressed in future stages once further data has been collected and processed to provide a substantial assessment and strategy.

Developing higher standard A roads, to be known as 'Expressways'

- 15.2.4 The RIS sets out its vision of the network toward 2040. The A47 Wansford to Sutton Scheme is identified in the "current, planned and potential Expressways" category.
- 15.2.5 When the Expressway network is expanded to include the A47 Wansford to Sutton scheme the key relevant criteria to these schemes is "Junctions which are largely or entirely grade separated, so traffic on the main road can pass over or under roundabouts without stopping." The Nene Way roundabout could be updated for grade separation. This will be considered and if appropriate will be developed in later PCF Stages. The route options do not currently preclude a change to Expressway standard.

Upgrading central barriers

- 15.2.6 The existing highway layout does not include a central reserve barrier as the section of the road within the scheme is single carriageway. All of the proposed options are dual carriageway and would incorporate appropriate central reserve barrier. There would be no direct right turn off or on to the dual carriageway.

Providing safer verges with improved run off protection

- 15.2.7 Providing safer verges with improved run off protection is a detailed consideration which will be looked into during preliminary design in PCF Stage 3.

Improved road signing and markings

- 15.2.8 All of the options identified offer the opportunity to undertake a detailed review of the existing road signings and markings, and upgrade and replace these as necessary.

Upgrading lay-bys

- 15.2.9 There is currently 1 existing layby between the A47 Wansford to Sutton section which does not comply with current standards. This layby will be upgraded to comply with current standards. The number of laybys required will be reviewed at a later PCF stage.

Developing and deploying technology to prevent, detect and monitor incidents.

- 15.2.10 The current scheme scope does not necessitate the introduction of technology to prevent, detect and monitor incidents.

Using designated safety funding to deliver targeted safety improvements.

- 15.2.11 Opportunities for use of designated safety funding to deliver targeted safety improvements will be explored in the following stages.

16 Environmental Assessment of Sifted Options PCF Stage 1

16.1 Introduction

16.1.1 Chapter 11 describes the options sifting process and identified that Options 1, 8 and 10 will be taken forward for further assessment. The following sections provide an initial environmental review of these three options in relation to each of the environmental topics described in Chapter 4.

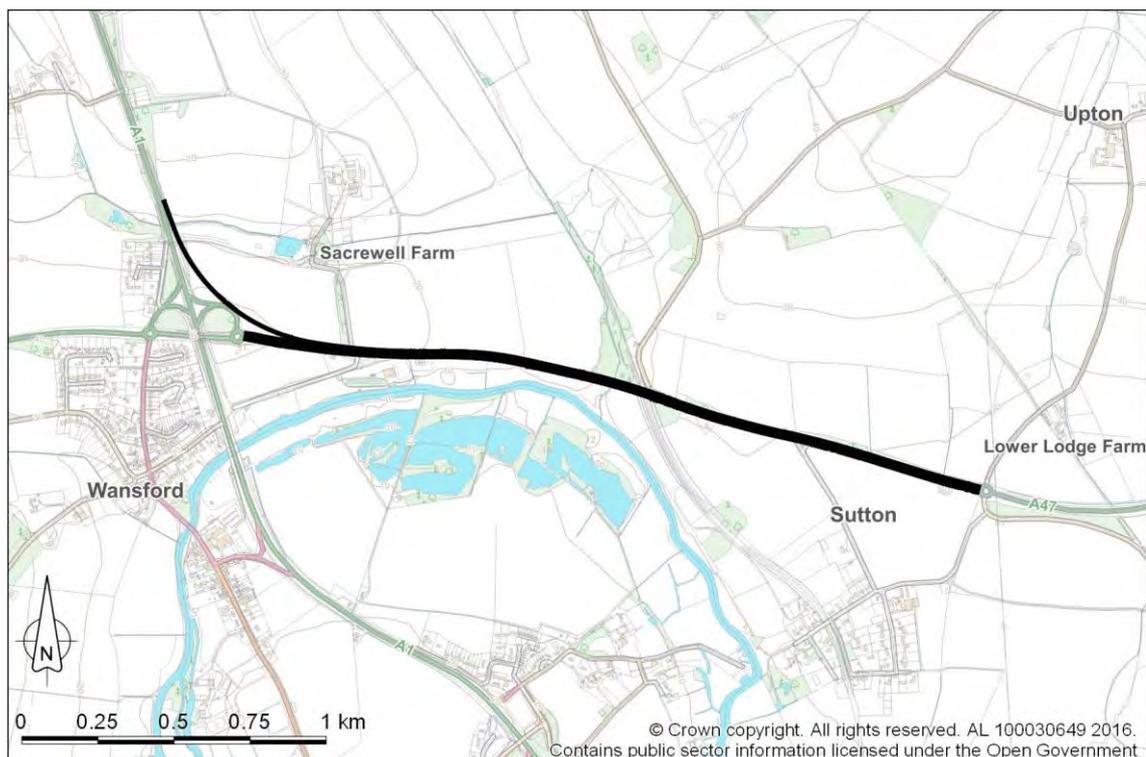
16.1.2 At this stage, much of the assessment that has been carried out is qualitative in nature which is appropriate to this stage of scheme development.

16.2 Option 1

16.2.1 Option 1 Online Dualling plus Free flow Slip from A1 Southbound.

16.2.2 Option 1 is shown in **Figure 16-1**

Figure 16-1: Option 1



Air Quality

16.2.3 The A1 off-slip would shift the road alignment closer to a number of residents located near Thackers Close and Old North Road. However, Option 1 is not expected to result in any adverse impacts on these residents, as they are situated in close proximity to the A1 which is and will remain the primary source of air pollutants.

16.2.4 Given that the distance between the road and the residential/ community/ commercial receptors or ecological receptors (such as Sutton Heath and Bog SSSI) located in the study area will remain unchanged, it is considered that Option 1 will have no operational impacts on

the various receptors. The dualling of the A47 is expected to improve traffic flow and reduce low speed traffic and congestion and subsequently it may reduce greenhouse gas emissions and improve the local air quality. Therefore, unless significant changes in traffic occur on the main roads no significant effects at these receptors would be anticipated.

- 16.2.5 There are no Air Quality Management Areas (AQMA) recorded within the study area. Option 1 is not expected to adversely impact on any AQMA nor result in the exceedance of air quality objectives.
- 16.2.6 However, it is possible that the construction works associated with Option 1 and the subsequent dust emissions could impact people and property, human health and ecological receptors as a result of dust inhalation and dust soiling.
- 16.2.7 Provided appropriate mitigation measures are implemented, the impacts on air quality resulting from Option 1 are considered to be **neutral**.

Mitigation

- 16.2.8 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.
- 16.2.9 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Cultural Heritage

- 16.2.10 There are 5 Scheduled Monuments within 1km of this option. Although it is an online option, Option 1 has the potential, during construction, to infringe and impact the National Monument (Bronze Age Crop marks (NHLE No. 1006796)) during the construction phase.
- 16.2.11 There are 139 Listed Buildings within the study area. The proposed offline section of option 1 (A1 off-slip) has the potential to impact the setting of a Grade II* Listed Building (Sacrewell Millhouse and Stables (NHLE No. 1127493)) and two Grade II Listed Buildings (Sacrewell Farmhouse (NHLE No. 1266496) and Sacrewell Lodge (NHLE No. 1331233)).
- 16.2.12 There are a further 206 archaeological sites recorded within the study area. The number of known archaeological sites recorded within the study area suggests that there is a high potential for further unrecorded subsurface archaeological remains to survive within the footprint of the scheme. Although the earthworks associated with Option 1 will be minimal relative to other options due to its online nature, the scheme still has the potential to impact unknown archaeological sites as there are nine recorded archaeological sites located along the existing A47 route.
- 16.2.13 Within the study area, there are seven Conservation Areas. Option 1 will not impact any of the conservation areas.
- 16.2.14 At this stage, impacts on cultural heritage from Option 1 are considered to be **large adverse** due to the potential impact on the national monument.

Mitigation

- 16.2.15 It is recommended that a detailed assessment be undertaken in line with DMRB to assess in detail the potential effects. This assessment should include a programme of archaeological

evaluation works to be developed as part of the ongoing assessment. This should be undertaken in consultation with the archaeological advisor for Peterborough /Huntingdon District Council and, if appropriate, Historic England. Further archaeological evaluation may be required as a result of these surveys.

- 16.2.16 Any disturbance of a scheduled monument would require scheduled monument consent (SMC) from the Secretary of State or Heritage England and, if issued, a detailed investigation and recording would need to be undertaken.
- 16.2.17 Should archaeological finds be encountered, they would necessitate investigation and recording, potentially requiring considerable time and expertise. As such, advance archaeological investigation, such as geophysical survey and trial trenching, should be proposed to prevent delays during the construction phase.
- 16.2.18 Consultation with the archaeological advisor for Peterborough/Huntingdon District Council will be undertaken in regards to possible control measures to mitigate potential impacts on the listed buildings within the study area.

Landscape and Visual

- 16.2.19 There are a number of designated landscape features (two national character areas, six local landscape character areas, seven conservation areas and 139 listed buildings) within the study area. The A1 off-slip has the potential to impact the setting of a Grade II* Listed Building (Sacrewell Millhouse and Stables (NHLE No. 1127493)) and two Grade II Listed Buildings (Sacrewell Farmhouse (NHLE No. 1266496) and Sacrewell Lodge (NHLE No. 1331233)). However, given that the off-slip is already in the vicinity of a significant junction and hence a recognisable feature in the local landscape, it is considered unlikely that the off-slip would have a significant effect on the landscape.
- 16.2.20 Given that the remainder of the Option 1 route alignment is primarily online it is considered that there would be minimal impact on those hedgerows and treelines which are considered significant landscape features,
- 16.2.21 Visual receptors located along the A47, Sutton Heath Road, The Drift and Sacrewell Farm Country Centre are not likely to experience adverse impacts from Option 1 as it is online.
- 16.2.22 At this stage impacts on landscape and visual receptors from Option 1 are considered to be minor adverse due to the impact of the slip road and loss of existing roadside vegetation. With sensitive design and mitigation planting to restore field boundaries and screen visual receptors this impact will be reduced to **neutral** over time.

Mitigation

- 16.2.23 Mitigation should seek to integrate the scheme and associated structures into the landscape as far as possible. Potential mitigation could consist of screen planting or reinstatement of hedgerows and woodland to limit views of this from the wider area and to integrate structures (bridges, embankments, cuttings) into the landscape. It is likely that over time the establishment of planting applied as mitigation would decrease the level of effect from some but not all receptors.

Nature Conservation and Biodiversity

- 16.2.24 There are three national statutory designated sites (including Sutton Heath and Bog SSSI, Wansford Pasture SSSI and Old Sulehay Forest SSSI) and eight non-statutory designated sites within the study area. The dualling of the A47 may have minor impacts on the hydrological setting and/or the air quality (dust deposition and nitrogen deposition) which could subsequently impact on the flora and fauna associated with Sutton Heath and Bog SSSI. The construction and operation of Option 1 could also result in the disruption/loss of

habitats and species associated with Sutton Meadows North (CWS), Sutton Disused Railway line and A47/A1 Interchange Road Verges CWS.

16.2.25 The proposed scheme would also result in the loss of woodland areas designated by the Forestry Commission National Forest Inventory and in the loss of a number of small areas of priority habitats including wood pasture and parkland and lowland calcareous grassland.

16.2.26 The direct loss and severance of habitat has the potential to adversely affect various species including bats, badger, reptile, water vole, birds, aquatic and terrestrial invertebrates, and botanical species.

16.2.27 Indirect impacts of noise, watercourse pollution / sediment dust, lighting, increased human disturbance, potential for invasive non-native species from works at various locations and operational traffic also have potential to adversely affect various species. Some of the resulting effects may be temporary or permanent, and of varying magnitude, which may in turn be significant or not significant.

16.2.28 At this stage, impacts on nature conservation and biodiversity from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.29 Options to avoid/reduce/mitigate/compensate for any potential adverse effects on designated sites, and protected/notable habitats and species should be undertaken as the scheme evolves. Standard HE mitigation measures are also to be considered which include for example; legislative compliance; no-net loss in biodiversity in regards to habitats and species; pollution prevention control measures; standard control measures to control dust from construction activities; preconstruction surveys; Ecological Construction Environmental Management Plan (EcoCEMP); and production of a Handover Environmental Management Plan (HEMP).

16.2.30 Additional mitigation measures to also consider during the scheme design, construction and operation, include:

- Retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and HE BAPs;
- Off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary);
- Biodiversity no net loss assessment;
- Enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design; Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and
- On-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.

16.2.31 Specifically, in order to conserve the habitats associated with the SSSI, it will be important to ensure no hydrological effect occurs on the local watercourse at Sutton Heath which flows from the site. To protect the CWS, the works areas shall be kept to the minimum required, vegetation clearance will be minimised where possible and the site compound will be sited away from notable/protected habitats.

16.2.32 It is anticipated that the impacts on the CWS will require the establishment of compensatory habitat elsewhere and where possible replacement planting within road land take. Net-gains in biodiversity could potentially be achieved, which would meet objectives in the Highways England Biodiversity Plan ahead of the 2040 target.

16.2.33 Further baseline surveys are required at Stage 2 to inform fully mitigation proposals. Consultation will also be required with ecological stakeholders on the mitigation proposed.

Noise and Vibration

16.2.34 The proposed alignment of Option 1 is primarily online with the exception of the A1 off-slip. The off-slip would shift the road alignment closer to a number of residents located near Thackers Close and Old North Road. However, Option 1 is not expected to result in any adverse impacts on these residents, as they are situated in close proximity to the A1, the primary noise source in the area.

16.2.35 Given that the distance between the residential/ community/ commercial receptors or ecological receptors (such as Sutton Heath and Bog SSSI) located in the study area and the online section of the A47 will remain unchanged, it is considered that Option 1 will have no operational impacts on the various receptors. The dualling of the A47 is expected to improve traffic flow and reduce low speed traffic and congestion and subsequently it may reduce noise and vibration levels.

16.2.36 Option 1 will not move the existing A47 alignment closer to any of the sensitive receptors located either in the villages of Wansford, Stibbington and Sutton or along the existing A47; therefore, noise levels are not anticipated to change significantly.

16.2.37 There are four Noise Important Areas (NIAs) within the study area designated due to their high levels of traffic noise (ID no. 5303, 5304, 5305 and 12125). NIA ID no. 5304 is located adjacent to the online road alignment of Option 1 at Sutton Heath Road. Without mitigation, the increase in traffic speed will have negative effect on this NIA. Option 1 would result in temporary noise impacts on the NIA during the construction works.

16.2.38 No details of the construction work required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.

16.2.39 At this stage, impacts on noise and vibration from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.40 Mitigation measures that could be considered to reduce the impact of traffic noise on local receptors, if required, include:

- Maximising the distance between new/realigned sections of road and nearby receptors;
- Minimising changes in traffic on existing roads due to the scheme;
- Earth bunds/noise barriers to screen nearby receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of new/realigned sections of road into the surrounding area. This can also provide visual mitigation;
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
- Noise insulation of individual properties to protect the internal noise environment.

16.2.41 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

Road Drainage and Water Environment

- 16.2.42 Option 1 is primarily online with the exception of the A1-A47 off slip thus is considered that the option will have a minimal impact on the road drainage and water environment.
- 16.2.43 The A1 off-slip and the dualling of the A47 are likely to require the widening of the existing culverts located to the west of Sacrewell Farm and to the west of Sutton Heath Road. The construction works associated with the culverting of the drainage channels have the potential to result in adverse impacts on the surface water quality and flow and surface water abstractions as a result of accidental spillage/pollution events. The extension of the culverts may also result in operational impacts on the flow and the biological potential of surface water features.
- 16.2.44 The widening of the existing culverts may also require the alteration of flood defences of streams which are located in planning flood zones (Flood Zones 2 & 3). As a result, it is considered that the construction works could lead to subsequent increases in flood risks during the construction phase. The extension of the culverts may also increase flood risk during the operational phase.
- 16.2.45 Option 1 has the potential to adversely impact the groundwater features within the study area (including the Northampton Sands Unit and the Nene Mid Lower Jurassic Unit) during the construction and operational phases as a result of accidental spillages/pollution events.
- 16.2.46 At this stage, impacts on road drainage and the water environment from Option 1 are considered to be **minor adverse or neutral**.

Mitigation

- 16.2.47 The scheme would require a HAWRAT assessment to quantitatively assess potential impacts to the water environment from the junction. A HAWRAT assessment would indicate if spillage containment is required to satisfy the spillage risk assessment and whether attenuation of pollution is required for routine runoff.
- 16.2.48 Mitigation requirements would be those needed to reduce impacts (identified in DMRB HD45/09 assessments) to an acceptable level and may require attenuation measures to be included within the drainage design which may require additional land take. Mitigation requirements would need to take into account sustainable drainage principles and the advice of the EA and Internal drainage Board (IDB).
- 16.2.49 A Flood Risk Assessment should be undertaken in PCF Stage 2 with particular attention to be given to the capacity of the culvert designs. Consultation with the Lead Local Flood Authority or Internal Drainage Board/ Local Authority may also be required.
- 16.2.50 The procedures for managing the water resources implications during scheme construction would be defined in the CEMP, and would therefore comply with current planning policies / regulations for the protection of water resources. This document would be compiled, reviewed and revised when the project progresses to the construction stage.

People and Communities

- 16.2.51 The proposed A1 off-slip will impact the NMU track which stretches between the A1 and Sacrewell Farm and Country Centre which culminates at the A1 embankment. There are no pedestrian crossing facilities for NMUs directly connecting Wansford and Sacrewell Farm. The online dualling of the existing carriageway will also impact NMUs' access between the footways at the Sacrewell Farm and Country Centre and the footway and picnic area located south of the A47 along the River Nene. It is considered that Option 1 would impact on the pleasantness of pedestrians' views along the NMU tracks and PRoWs within the western extents of the study area.

- 16.2.52 The online dualling of the carriageway could result in local severance restricting access to facilities on the south side of the A47 (such as the petrol station and community facilities (the lorry park / picnic area).
- 16.2.53 The online widening, at operation, will improve traffic flow and reduce congestion which would bring about subsequent beneficial effects on vehicle travellers and driver stress. The option will have a beneficial impact on journey ambience. Driver views from the road will be adversely affected during construction and in the short term, however views will improve as roadside mitigation planting matures.
- 16.2.54 During construction, as a consequence of the online nature of the option, road users will experience the effects of temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion, particularly during peak hours. However, these impacts will be temporary.
- 16.2.55 Traveller speeds and journey times will be impacted by construction works and this will consequently impact upon fear of accidents. Construction traffic leaving the construction site and entering the road network has the potential to deposit mud and debris onto road surfaces. Spray rising from moving traffic has the potential to land on vehicle windscreens and reduce driver vision potentially increasing the fear of accidents. Changes to traffic management measures during the construction phase may also generate confusion leading to a fear of accidents.
- 16.2.56 Users of the road network are likely to experience route uncertainty because of temporary lane or road closures and diversion routes. Lane restrictions in certain areas during construction could increase route uncertainty, particularly during peak hours and a temporary minor adverse effect will be experienced by travellers attributed to increased route uncertainty. When operational, Option 1 will improve route uncertainty.
- 16.2.57 At this stage, impacts on people and communities from Option 1 are considered to be **moderate adverse**; however, with NMU access provision this can be reduced to **minor or neutral**.

Mitigation

- 16.2.58 Severance of PRoWs should be reinstated where affected. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility around the local villages. Alternative means of access would also be provided where existing access points are disrupted by the proposed options.
- 16.2.59 Mitigation measures should include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with HE and other appropriate stakeholders. The appointed Contractor will adhere to current best practice techniques during the construction phrase. Appropriate landscape planting will be implemented to minimise visual impacts.

Geology, Soils and Materials

- 16.2.60 Option 1 is not anticipated to have any impacts on the bedrock geology or the superficial deposits within the study area.
- 16.2.61 The A1 off-slip and the dualling of the existing road will require the acquisition of agricultural land, which has been designated as Grade 2 and 3 (moderate-good) by Natural England. Option 1 will have a slight adverse impact due to the loss of agricultural land and fertile soils.
- 16.2.62 Option 1 is expected to create a minimal volume of waste soils and would require a minimal volume of imported materials due to the online nature of the scheme. Therefore, the scheme

would not have significant adverse impacts on waste infrastructure sites as a result of construction works.

16.2.63 It is considered that Option 1 could result in adverse contaminated land impacts following accidental spillages/pollution events during the construction phase and/or excavation works which could mobilise potentially existing contaminants (current and historical contaminative land uses along the A47 include dismantled railway, agriculture and livestock farms and a commercial petroleum site).

16.2.64 However, impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical, geochemical conditions beneath the site including for Waste Acceptance Criteria.

16.2.65 There is potential for retention and use on site of excavated materials pending appropriate testing for contaminants and geotechnical suitability. Unsuitable materials will require appropriate off site waste management.

16.2.66 At this stage, impacts on geology, soils and materials from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.67 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.

16.2.68 Where contamination is identified, or suspected, appropriate sampling, analysis and risk assessment should be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors.

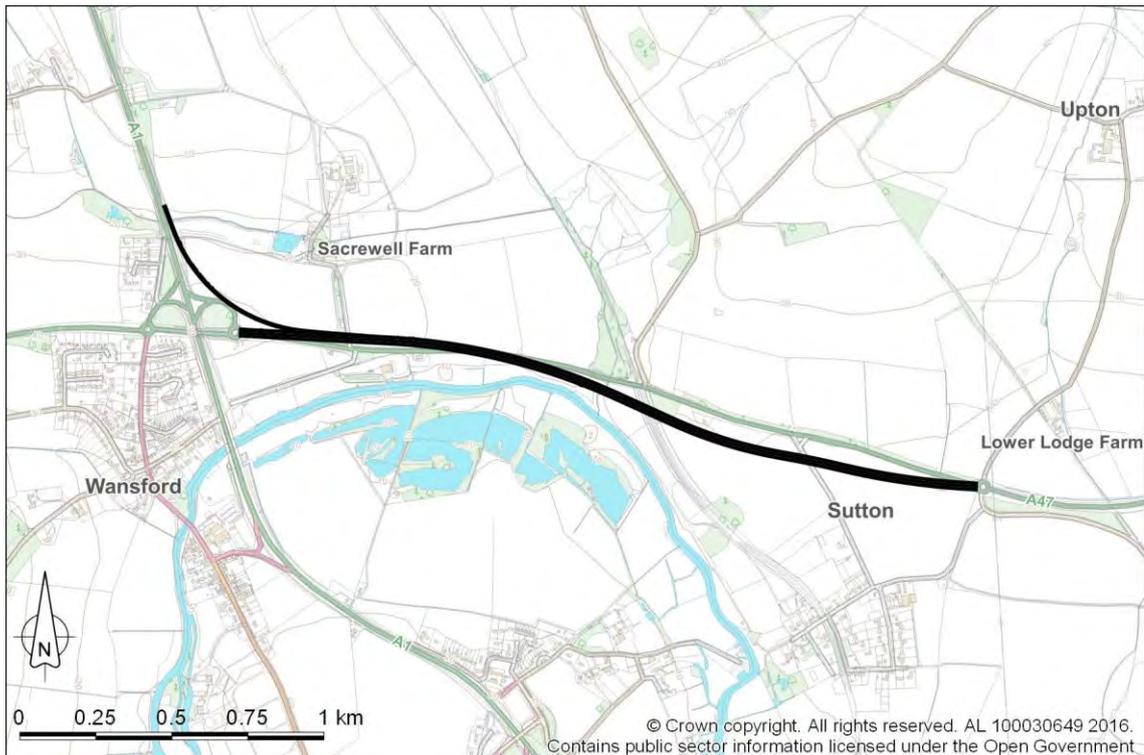
16.2.69 Maximising the reuse of materials on site through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.

16.3 Option 8

16.3.1 Option 8 is Part Offline to the North Part Offline to the South plus Free flow slip road from the A1 Southbound. The proposed option is offline to the north for approximately the first 25% of the route. The route crosses over the existing carriageway and goes offline to the south of the existing A47 to a point approximately 25m from the River Nene.

16.3.2 Option 8 is shown in **Figure 16-2**

Figure 16-2: Option 8



Air Quality

- 16.3.3 The A1 off-slip would shift the road alignment closer to a number of residents located near Thackers Close and Old North Road. However, option 8 is not expected to result in any adverse impacts on these residents, as they are situated in close proximity to the A1, the main source of air pollution.
- 16.3.4 The offline section to the south moves negligibly closer to residential receptors within Sutton and negligibly further away from residential receptors along the existing A47 and approximately 150m away from the Sutton Heath and Bog SSSI. The dualling of the A47 is expected to improve traffic flow and reduce low speed traffic and congestion and subsequently it may reduce greenhouse gas emissions and improve the local air quality. Therefore, unless significant changes in traffic occur on the main roads no significant effects at these receptors would be anticipated.
- 16.3.5 There are no AQMAs recorded within the study area and Option 8 is not expected to result in the exceedance of air quality objectives.
- 16.3.6 During construction, it is possible that the construction works associated with option 8 and the subsequent dust emissions could impact people and property, human health and ecological receptors as a result of dust inhalation and dust soiling.
- 16.3.7 Provided appropriate mitigation measures are implemented, the impacts on air quality resulting from Option 8 are considered to be neutral.

Mitigation

- 16.3.8 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.

16.3.9 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Cultural Heritage

16.3.10 Option 8 shifts the road alignment away from the Bronze Age Crop marks Scheduled Monument (NHLE No. 1006796) located adjacent to the existing A47, west of Sutton Heath Road. Thus the proposed route alignment will have no direct impact on the monument.

16.3.11 There are 139 Listed Buildings within the study area. The A1 off-slip has the potential to impact the setting of a Grade II* Listed Building (Sacrewell Millhouse and Stables (NHLE No. 1127493)) and two Grade II Listed Buildings (Sacrewell Farmhouse (NHLE No. 1266496) and Sacrewell Lodge (NHLE No. 1331233)).

16.3.12 There are a further 206 recorded archaeological sites located within the study area. The number of known archaeological sites recorded within the study area suggests that there is a high potential for further unrecorded subsurface archaeological remains to survive within the footprint of the scheme. Given that Option 8 has two sizeable offline sections, there is a considerable potential for the scheme to impact unknown archaeological sites.

16.3.13 Within the study area, there are seven Conservation Areas. Option 8 will not impact any of the conservation areas.

16.3.14 At this stage, impacts on cultural heritage from Option 8 are considered to be minor adverse, primarily as a consequence of avoiding the National Monument.

Mitigation

16.3.15 It is recommended that a detailed assessment be undertaken in line with DMRB to assess in detail the potential effects of the final route option. This assessment should include a programme of archaeological evaluation works to be developed as part of the ongoing assessment. This should be undertaken in consultation with the archaeological advisor for Peterborough/Huntingdon District Council and, if appropriate, Historic England. Further archaeological evaluation may be required as a result of these surveys.

16.3.16 Should archaeological finds be encountered, they would necessitate investigation and recording, potentially requiring considerable time and expertise. As such, suitable preliminary mitigation measures, such as geophysical survey and trial trenching, should be proposed to prevent delays during the construction phase.

16.3.17 Consultation with the archaeological advisor for Peterborough/Huntingdon District Council will be undertaken in regards to possible control measures to mitigate potential impacts on the listed buildings within the study area.

16.3.18 All work will be subject to an agreed written scheme of investigation or project design.

Landscape and Visual

16.3.19 There are a number of designated landscape features (two national character areas, six local landscape character areas, seven conservation areas and 139 listed buildings) within the study area. The A1 off-slip has the potential to impact the setting of the listed buildings at Sacrewell Farm and Country Centre. However, given that the off-slip is already in the vicinity of a significant junction and hence a recognisable feature in the local landscape, it is considered unlikely that the off-slip would have a significant effect on the local landscape.

- 16.3.20 The offline sections will result in the disruption or loss of significant landscape features (including hedgerows, lowland calcareous grassland and agricultural land) which contribute to the designated landscape character areas. The scheme would encroach into the rural landscape and subsequently effect the pattern, and appearance and tranquillity of the landscape could be affected.
- 16.3.21 Option 8 moves the road alignment closer to Sutton introducing the possibility of visual impacts for those properties on the northern boundary of Sutton. Option 8 will have a negative impact on the property east of the Sutton Heath Road Junction (Deep Springs) as the residential receptor would experience views of both the existing A47 (to become a local access route) and the new A47 dual carriageway. Option 8 would shift the road alignment closer to many PRowWs effecting the amenity and views from these (including footpaths/trails near the Sacrewell Farm and Country Centre and along the River Nene).
- 16.3.22 At this stage impacts on landscape and visual receptors from Option 8 are considered to be Large adverse due to the impacts of the offline sections on visual receptors and loss of significant landscape features; however, with sensitive design and mitigation planting to restore field boundaries and screen visual receptors this is reduced to Moderate.

Mitigation

- 16.3.23 Mitigation should seek to integrate the scheme and associated structures into the landscape as far as possible. Potential mitigation could consist of screen planting or reinstatement of hedgerows and woodland to limit views of this from the wider area and to integrate structures (bridges, embankments, cuttings) into the landscape. It is likely that over time the establishment of planting applied as mitigation would decrease the level of effect from some but not all receptors.

Nature Conservation and Biodiversity

- 16.3.24 There are three national statutory designated sites (including Sutton Heath and Bog SSSI, Wansford Pasture SSSI and Old Sulehay Forest SSSI) and eight non-statutory designated sites within the study area. Option 8 is not expected to impact any of the statutory designated nature conservation sites within the study area. Furthermore Option 8 will shift the road alignment further away from the Sutton Heath and Bog SSSI which could subsequently reduce existing impacts (noise, air quality, water and drainage).
- 16.3.25 However, the construction and operation of Option 8 would result in direct impacts on Sutton Meadows North CWS, Sutton Disused Railway CWS and the A47/A1 Interchange Road Verges CWS and the loss of habitats and species associated with them.
- 16.3.26 There is also a potential that, due to the proximity, Option 8 could impact on the aquatic habitats associated with the River Nene during construction and operational phases through water quality impacts.
- 16.3.27 In addition, the direct loss and severance of habitat has the potential to adversely affect various species including bats, badger, reptile, water vole, birds, aquatic and terrestrial invertebrates, and botanical species.
- 16.3.28 Indirect impacts of noise, watercourse pollution / sediment dust, lighting, increased human disturbance, potential for invasive non-native species from works at various locations and operational traffic also have potential to adversely affect various species. Some of the resulting effects may be temporary or permanent, and of varying magnitude, which may in turn be significant or not significant.
- 16.3.29 At this stage, impacts on nature conservation and biodiversity from Option 8 are considered to be major adverse given the significant loss of habitat associated with non-statutory designated nature conservation sites.

Mitigation

- 16.3.30 Options to avoid/reduce/mitigate/compensate for any potential adverse effects on designated sites, and protected/notable habitats and species should be undertaken as the scheme evolves. Standard HE mitigation measures are also to be considered which include for example; legislative compliance; no-net loss in biodiversity in regards to habitats and species; pollution prevention control measures; standard control measures to control dust from construction activities; preconstruction surveys; Ecological Construction Environmental Management Plan (EcoCEMP); and production of a Handover Environmental Management Plan (HEMP).
- 16.3.31 Additional mitigation measures to also consider during the scheme design, construction and operation, include:
- Retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and HE BAPs;
 - Off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary); biodiversity no net loss assessment;
 - enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design; Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and
 - on-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.
- 16.3.32 Specifically, to protect the CWS, the works areas shall be kept to the minimum required, vegetation clearance will be minimised where possible and the site compound will be sited away from notable/protected habitats
- 16.3.33 It is anticipated that the impacts on the CWS will require the establishment of compensatory habitat elsewhere and where possible replacement planting within road land take. Net-gains in biodiversity could potentially be achieved, which would meet objectives in the Highways England Biodiversity Plan ahead of the 2040 target.
- 16.3.34 Further baseline surveys are required at PCF Stage 2 to inform fully mitigation proposals. Consultation will also be required with ecological stakeholders on the mitigation proposed.

Noise and Vibration

- 16.3.35 The proposed A1 off-slip would shift the road alignment closer to a number of residents located near Thackers Close and Old North Road. However, Option 8 is not expected to result in any adverse impacts on these residents, as they are situated in close proximity to the A1, the major noise source in the area.
- 16.3.36 The offline section to the south moves the road alignment negligibly closer to residential receptors within Sutton and negligibly further away from residential and commercial receptors along the existing A47 and approximately 150m further away from the Sutton Heath and Bog SSSI. It is anticipated that any changes in noise levels would not be perceptible provided no significant changes in traffic occur on the main roads.
- 16.3.37 The proposed alignment of Option 8 would remain approximately, with respect to noise, the same distance from Sacrewell Farm and Country Centre and the 24-hour service station. Given that these receptors are the same distance from the existing route, the impact is considered to be neutral.
- 16.3.38 There are four Noise Important Areas (NIAs) within the study area designated due to their high levels of traffic noise (ID no. 5303, 5304, 5305 and 12125). Option 8 will shift the road alignment away further from the NIA at Sutton Heath Road (NIA ID no. 5304).

16.3.39 No details of the construction works required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.

16.3.40 At this stage, impacts on noise and vibration from Option 8 are considered to be **neutral**.

Mitigation

16.3.41 Mitigation measures that could be considered to reduce the impact of traffic noise on local receptors, if required, include:

- Maximising the distance between new/realigned sections of road and nearby receptors;
- Minimising changes in traffic on existing roads due to the scheme;
- Earth bunds/noise barriers to screen nearby receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of new/realigned sections of road into the surrounding area. This can also provide visual mitigation;
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
- Noise insulation of individual properties to protect the internal noise environment.

16.3.42 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

Road Drainage and Water Environment

16.3.43 The A1 off-slip and the dualling of the A47 are likely to require the widening of the existing culverts located to the west of Sacrewell Farm and the construction of a new culvert to the west of Sutton Heath Road. The construction works associated with the culverting of the drainage channels have the potential to result in adverse impacts on the surface water quality and flow and surface water abstractions as a result of accidental spillage/pollution events. The extension of the culverts may also result in operational impacts on the flow and the biological potential of surface water features.

16.3.44 The culvert works may also require the alteration of flood defences of streams which are located in flood zones (Flood Zones 2 & 3). As a result, it is considered that the construction works could lead to subsequent increases in flood risks during the construction phase. The extension of the culverts may also increase flood risk during the operational phase.

16.3.45 Option 8 would shift the road alignment closer to the River Nene and subsequently increase the risk of spillage/pollution events during the construction and operational phases.

16.3.46 Option 8 has the potential to adversely impact the groundwater features within the study area (including the Northampton Sands Unit and the Nene Mid Lower Jurassic Unit) during the construction and operational phases as a result of accidental spillages/pollution events. Option 8 does not encroach on a groundwater protection zone.

16.3.47 At this stage, without knowing drainage design or construction methods, impacts on road drainage and the water environment from Option 8 are considered to be **moderate adverse**.

Mitigation

16.3.48 The scheme would require a HAWRAT assessment to quantitatively assess potential impacts to the water environment from the junction. A HAWRAT assessment would indicate if spillage

containment is required to satisfy the spillage risk assessment and whether attenuation of pollution is required for routine runoff.

- 16.3.49 Mitigation requirements would be those needed to reduce impacts (identified in DMRB HD45/09 assessments) to an acceptable level and may require attenuation measures to be included within the drainage design which may require additional land take. Mitigation requirements would need to take into account sustainable drainage principles and the advice of the EA and IDB.
- 16.3.50 A Flood Risk Assessment should be undertaken in PCF Stage 2, with particular attention to be given to the capacity of the culvert designs. Consultation with the Lead Local Flood Authority or Internal Drainage Board/ Local Authority may also be required.
- 16.3.51 The procedures for managing the water resources implications during scheme construction would be defined in the CEMP, and would therefore comply with current planning policies / regulations for the protection of water resources. This document would be compiled, reviewed and revised when the project progresses to the construction stage.

People and Communities

- 16.3.52 Option 8 will impact a significant element of the local PRoW network, including the track between the A1 and Sacrewell Farm and Country Centre, the footways at the Sacrewell Farm and Country Centre and the footway and picnic area located south of the A47 along the River Nene. Option 8 will also impact the PRoW along the River Nene. In addition to direct impacts there will be a loss of amenity and visual impacts for NMUs.
- 16.3.53 The dualling of the carriageway could result in local severance restricting access to facilities on the south side of the A47 (such as the petrol station and community facilities (the lorry park and picnic area)).
- 16.3.54 At operation, improved traffic flow and reduced congestion will have beneficial effects on vehicle travellers and driver stress. The option will have a beneficial impact on journey ambience. Driver views from the road will be adversely affected during construction and in the short term, however views will improve as roadside mitigation planting matures.
- 16.3.55 During construction road users will experience the effects of temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion, particularly during peak hours. However, these impacts will be temporary and as the option is significantly online these impacts should not be significant.
- 16.3.56 At this stage, impacts on people and communities from Option 8 are considered to be **moderate adverse**; however with NMU access provision this can be reduced.

Mitigation

- 16.3.57 Severance of PRoWs should be reinstated where affected. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility around the local villages. Alternative means of access would also be provided where existing access points are disrupted by the proposed options.
- 16.3.58 Mitigation measures should include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement HE and other appropriate stakeholders. The appointed Contractor will adhere to current best practice techniques during the construction phase. Appropriate landscape planting will be implemented to minimise visual impacts.
- 16.3.59 Screen planting or reinstatement of hedgerows and woodland to limit views of option 8 from the NMU tracks and PRoWs could also be implemented.

Geology, Soils and Materials

- 16.3.60 Option 8 is not anticipated to have any impacts on the bedrock geology or the superficial deposits within the study area.
- 16.3.61 The A1 off-slip and the offline A47 dual carriageway will require the acquisition of agricultural land, which has been designated as Grade 2, 3 and 4 (good to poor) by Natural England. Option 8 will have a moderate adverse impact due to the loss of agricultural land and fertile soils.
- 16.3.62 Given the offline nature of Option 8, it is considered that the scheme would create waste soils as a result of earthworks and that a large quantity of materials would need to be imported. Option 8 would have slight adverse impacts on material resources and waste receptors.
- 16.3.63 It is considered that Option 8 could result in adverse contaminated land impacts following accidental spillages/pollution events during the construction phase and/or excavation works which could mobilise potentially existing contaminants (current and historical contaminative land uses along the A47 include dismantled railway and agricultural and livestock farms).
- 16.3.64 However, impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical, geochemical conditions beneath the site including for Waste Acceptance Criteria.
- 16.3.65 There is potential for retention and use on site of excavated materials pending appropriate testing for contaminants and geotechnical suitability. Unsuitable materials will require appropriate off site waste management.
- 16.3.66 At this stage, impacts on geology, soils and materials from Option 8 are considered to be **minor adverse**.

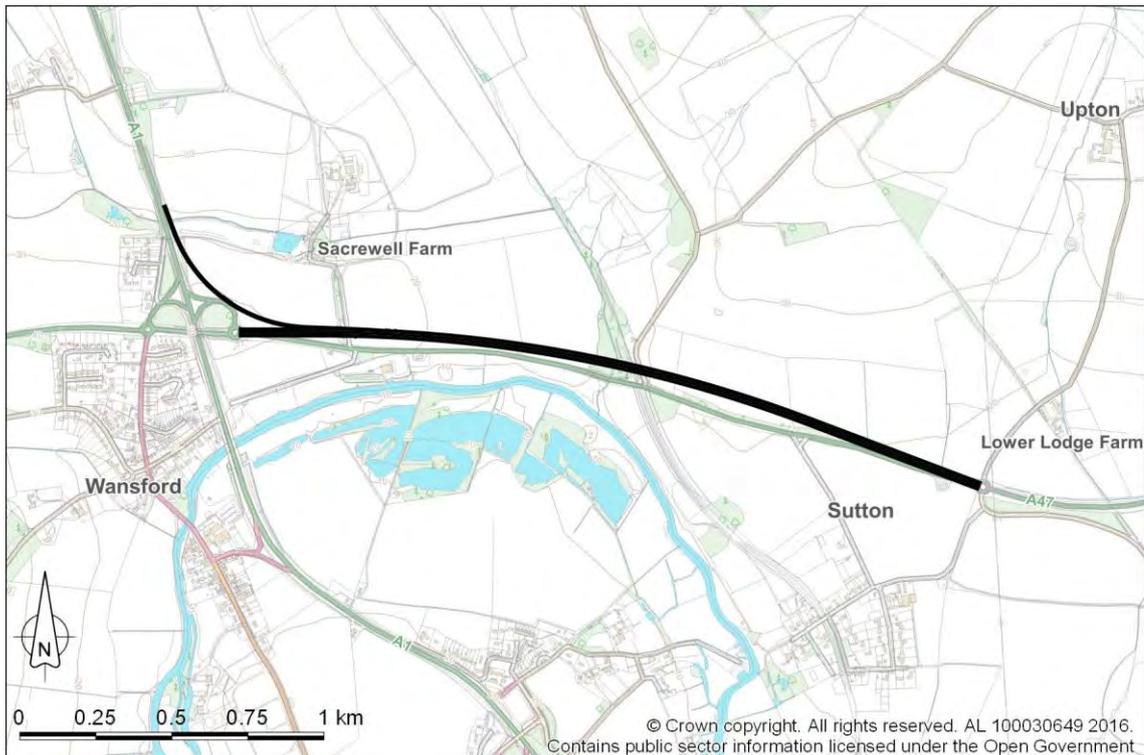
Mitigation

- 16.3.67 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.
- 16.3.68 Where contamination is identified or suspected, appropriate sampling, analysis and risk assessment should be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors.
- 16.3.69 Maximising the reuse of materials on site through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.

16.4 Option 10

- 16.4.1 The proposed new dual carriageway would be constructed offline to the north of the existing A47 and would tie in to the existing carriageway at the eastern roundabout at the A1 / A47 interchange and at the Nene Way roundabout at the eastern end of the scheme.
- 16.4.2 Option 10 can be seen in **Figure 16-3**

Figure 16-3: Option 10



Air Quality

Potential Impacts

- 16.4.3 The A1 off-slip would shift the road alignment closer to a number of residents located near Thackers Close and Old North Road. However, it is not expected to result in any adverse impacts on these residents, as they are situated in close proximity to the A1.
- 16.4.4 The offline dual carriageway will move the road alignment further away from a commercial receptor (fuelling station) and the residential receptors in Sutton and Stibbington and The Drift. Any potential improvement in air quality is considered to be negligible.
- 16.4.5 Conversely Option 10 would move the alignment closer to Sacrewell Farm and Country Centre, closer to two residential receptors on Sutton Heath Road (although both properties may be acquired as directly impacted) and closer to the SSSI (Sutton Heath and Bog SSSI). Option 10 would adversely impact these receptors; however, the only possible significant effects would be experienced at Sutton Heath Road and the SSSI.
- 16.4.6 The dualling of the A47 is expected to improve traffic flow and reduce low speed traffic and congestion and subsequently it may reduce greenhouse gas emissions and improve the local air quality. Therefore, unless significant changes in traffic occur on the main roads no significant effects at these receptors would be anticipated.
- 16.4.7 It is possible that the construction works associated with Option 10 and the subsequent dust emissions could impact people and property, human health and ecological receptors as a result of dust inhalation and dust soiling.
- 16.4.8 Provided appropriate mitigation measures are implemented, the impacts on air quality resulting from Option 10 are considered to be **minor adverse**.

Mitigation

- 16.4.9 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.
- 16.4.10 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Cultural Heritage

- 16.4.11 The proposed road alignment of Option 10 will directly and substantially impact on the Bronze Age Crop marks scheduled monument (NHLE No. 1006796). The earthworks associated with the construction of option 10 and operational impacts of the proposed route alignment would result in the direct disturbance and loss of a sizeable proportion of the total site (4.865ha). The impacts on the scheduled monument would be in direct conflict with the National Planning Policy Framework (NPPF) as paragraph 133 states that:

“Where a proposed development will lead to substantial harm to or total loss of significance of a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or loss is necessary to achieve substantial public benefits that outweigh that harm or loss”.

- 16.4.12 There are 139 Listed Buildings within the study area. The proposed offline section of option 10 (A1 off-slip) has the potential to impact the setting of a Grade II* Listed Building (Sacrewell Millhouse and Stables (NHLE No. 1127493)) and two Grade II Listed Buildings (Sacrewell Farmhouse (NHLE No. 1266496) and Sacrewell Lodge (NHLE No. 1331233)).
- 16.4.13 There are a further 206 recorded archaeological sites located within the study area. The number of known archaeological sites recorded within the study area suggests that there is a high potential for further unrecorded subsurface archaeological remains to survive within the footprint of the scheme. Given that Option 10 is primarily offline, there is a considerable potential for the scheme to impact unknown archaeological sites.
- 16.4.14 Within the study area, there are seven Conservation Areas. Option 10 will not impact any of the conservation areas.
- 16.4.15 At this stage, even with mitigation, impacts on cultural heritage from Option 10 are considered to be **major adverse**.

Mitigation

- 16.4.16 It is recommended that a detailed assessment be undertaken in line with DMRB to assess in detail the potential effects. This assessment should include a programme of archaeological evaluation works to be developed as part of the ongoing assessment. This should be undertaken in consultation with the archaeological advisor for Peterborough /Huntingdon District Council and, if appropriate, Historic England. Further archaeological evaluation may be required as a result of these surveys.
- 16.4.17 Any disturbance of a scheduled monument would require scheduled monument consent (SMC) from the Secretary of State or Heritage England and, if issued, a detailed investigation and recording would need to be undertaken.

- 16.4.18 Should archaeological finds be encountered, they would necessitate investigation and recording, potentially requiring considerable time and expertise. As such, advance archaeological investigation, such as geophysical survey and trial trenching, should be proposed to prevent delays during the construction phase.
- 16.4.19 Consultation with the archaeological advisor for Peterborough/Huntingdon District Council will be undertaken in regards to possible control measures to mitigate potential impacts on the listed buildings within the study area.

Landscape and Visual

- 16.4.20 There are a number of designated landscape features (two national character areas, six local landscape character areas, seven conservation areas and 139 listed buildings) within the study area. The A1 off-slip has the potential to impact the setting of the listed buildings at Sacrewell Farm and Country Centre. However, given that the off-slip is already in the vicinity of a significant junction and hence a recognisable feature in the local landscape, it is considered unlikely that the off-slip would have any impact on the local landscape.
- 16.4.21 Given that Option 10 is completely offline to the north, it is considered that scheme would result in the disruption or loss of significant landscape features (including hedgerows, woodland copses and agricultural land which contribute to the designated landscape character areas. The option would encroach into the rural landscape and subsequently the landscape pattern, scale and appearance and tranquillity of the landscape would be affected.
- 16.4.22 Visually Option 10 would have a negative effect on Sacrewell Farm and Country Centre a significant tourism offering in the locality. It will also have a substantial effect on the visual amenity of the properties on Sutton Heath Road if they are retained. Conversely there would be a beneficial effect for the property on The Drift.
- 16.4.23 Option 10 will also impact the views from a number of PRowWs (including footpaths/trails near the Sacrewell Farm and Country Centre).
- 16.4.24 At this stage impacts on landscape and visual receptors from Option 10 are considered to be **moderate adverse** due to the offline nature of the route and the significant loss of existing vegetation.

Mitigation

- 16.4.25 Mitigation should seek to integrate the scheme and associated structures into the landscape as far as possible. Potential mitigation could consist of screen planting or reinstatement of hedgerows and woodland to limit views of this from the wider area and to integrate structures (bridges, embankments, cuttings) into the landscape. It is likely that over time the establishment of planting applied as mitigation would decrease the level of effect from some but not all receptors.

Nature Conservation and Biodiversity

- 16.4.26 There are three national statutory designated sites (including Sutton Heath and Bog SSSI, Wansford Pasture SSSI and Old Sulehay Forest SSSI) and eight non-statutory designated sites within the study area. Option 10 would potentially directly impact Sutton Heath and Bog SSSI in addition to having a potential indirect hydrological impact. As with all options there will be an impact on the Road Verges CWS.
- 16.4.27 Option 10 avoids any direct impact on Sutton Meadows North CWS and Sutton Disused Railway CWS, however it will result in the direct loss of an element of priority habitat (woodland) to the east of Sutton Heath Road and the associated ponds. It will also require a new or extended culvert over the watercourse.

16.4.28 The direct loss and severance of habitat has the potential to adversely affect various species including bats, badger, reptile, water vole, birds, aquatic and terrestrial invertebrates, and botanical species.

16.4.29 Indirect impacts of noise, watercourse pollution / sediment dust, lighting, increased human disturbance, potential for invasive non-native species from works at various locations and operational traffic also have potential to adversely affect various species. Some of the resulting effects may be temporary or permanent, and of varying magnitude, which may in turn be significant or not significant.

16.4.30 At this stage, impacts on nature conservation and biodiversity from Option 10 are considered to be **moderate adverse** as a consequence of the likely impact on the SSSI.

Mitigation

16.4.31 Options to avoid/reduce/mitigate/compensate for any potential adverse effects on designated sites, and protected/notable habitats and species should be undertaken as the scheme evolves. Standard HE mitigation measures are also to be considered which include for example; legislative compliance; no-net loss in biodiversity in regards to habitats and species; pollution prevention control measures; standard control measures to control dust from construction activities; preconstruction surveys; Ecological Construction Environmental Management Plan (EcoCEMP); and production of a Handover Environmental Management Plan (HEMP).

16.4.32 Additional mitigation measures to also consider during the scheme design, construction and operation, include:

- Retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and HE BAPs;
- Off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary);
- Biodiversity no net loss assessment;
- Enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design;
- Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and
- On-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.

16.4.33 It is anticipated that the impacts on the CWS will require the establishment of compensatory habitat elsewhere and where possible replacement planting within road land take. Net-gains in biodiversity could potentially be achieved, which would meet objectives in the Highways England Biodiversity Plan ahead of the 2040 target.

16.4.34 Further baseline surveys are required at PCF Stage 2 to inform fully mitigation proposals. Consultation will also be required with ecological stakeholders on the mitigation proposed.

Noise and Vibration

16.4.35 The A1 off-slip would shift the road alignment closer to a number of residents located near Thackers Close and Old North Road. However, Option 10 is not expected to result in any adverse impacts on these residents, as they are situated in close proximity to the A1.

- 16.4.36 The alignment of Option 10 moves the proposed route marginally north of the existing A47 alignment and as such it would have positive impacts on the commercial receptor (fuelling station) and the residential receptors located south of the A47 and in Sutton and Stibbington.
- 16.4.37 The alignment of Option 10 will move the alignment to the north of the noise important area at Sutton Heath Road (ID no. 5304). It is considered that the alignment would continue to impact the properties to which this NIA applies. It also moves the alignment closer to the more northern property on Sutton Heath Rd.
- 16.4.38 Option 10 would also move the road alignment closer to Sacrewell Farm and Country Centre (approximately 250m north of the proposed alignment). This alignment change is unlikely to result any perceptible change in noise levels at this receptor.
- 16.4.39 No details of the construction works required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.
- 16.4.40 At this stage, impacts on noise and vibration from Option 10 are considered to be **minor adverse**.

Mitigation

- 16.4.41 Mitigation measures that could be considered to reduce the impact of traffic noise on local receptors, if required, include:
- Maximising the distance between new/realigned sections of road and nearby receptors;
 - Minimising changes in traffic on existing roads due to the scheme;
 - Earth bunds/noise barriers to screen nearby receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of new/realigned sections of road into the surrounding area. This can also provide visual mitigation;
 - Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
 - Noise insulation of individual properties to protect the internal noise environment.
- 16.4.42 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

Road Drainage and Water Environment

- 16.4.43 The A1 off-slip and the dualling of the A47 are likely to require the widening of the existing culverts located to the west of Sacrewell Farm and to the west of Sutton Heath Road. The construction works associated with the culverting of the drainage channels have the potential to result in adverse impacts on the surface water quality and flow. The extension of the culverts may also result in operational impacts on the flow and the biological potential of surface water features.
- 16.4.44 The culvert works may also require the alteration of flood defences of streams which are located in planning flood zones (Flood Zones 2 & 3). As a result, it is considered that the construction works could lead to subsequent increases in flood risks during the construction phase. The extension of the culverts may also increase flood risk during the operational phase.

- 16.4.45 The alignment of Option 10 would shift the proposed route further away from the River Nene (approximately 70m of proposed alignment). As a result, there would be a neutral impact on the River Nene.
- 16.4.46 Option 10 has the potential to adversely impact the groundwater features within the study area (including the Northampton Sands Unit and the Nene Mid Lower Jurassic Unit) during the construction and operational phases as a result of accidental spillages/pollution events. The scheme does not encroach on a groundwater protection zone.
- 16.4.47 At this stage, impacts on road drainage and water environment for Option 10 are considered to be **neutral** primarily as a result of the increased distance from the River Nene and the ability to therefore apply effective Suds drainage design.

Mitigation

- 16.4.48 The scheme would require a HAWRAT assessment to quantitatively assess potential impacts to the water environment from the junction. A HAWRAT assessment would indicate if spillage containment is required to satisfy the spillage risk assessment and whether attenuation of pollution is required for routine runoff.
- 16.4.49 Mitigation requirements would be those needed to reduce impacts (identified in DMRB HD45/09 assessments) to an acceptable level and may require attenuation measures to be included within the drainage design which may require additional land take. Mitigation requirements would need to take into account sustainable drainage principles and the advice of the EA and IDB.
- 16.4.50 A Flood Risk Assessment should be undertaken in PCF Stage 2, with particular attention to be given to the capacity of the culvert designs. Consultation with the Lead Local Flood Authority or Internal Drainage Board/ Local Authority may also be required.
- 16.4.51 The procedures for managing the water resources implications during scheme construction would be defined in the CEMP, and would therefore comply with current planning policies / regulations for the protection of water resources. This document would be compiled, reviewed and revised when the project progresses to the construction stage.

People and Communities

- 16.4.52 Option 10 will impact local PRow network, including the track between the A1 and Sacrewell Farm and Country Centre and the footways at the Sacrewell Farm and Country Centre. However once operational there is an opportunity to enhance NMU and cycle facilities utilising the existing A47.
- 16.4.53 The dualling of the carriageway could also result in local severance or an increase in local journey times as the vehicle access will comprise a left-in-left-out arrangement; however, it is likely that this will be off-set by the maintenance of local access along the existing A47.
- 16.4.54 At operation, improved traffic flow and reduced congestion will have beneficial effects on vehicle travellers and driver stress. The option will have a beneficial impact on journey ambience. Driver views from the road will be adversely affected during construction and in the short term, however views will improve as roadside mitigation planting matures.
- 16.4.55 During construction road users' will experience minimal effect as the option is almost entirely offline and can be constructed with only very limited interference on the existing A47.
- 16.4.56 At this stage, impacts on people and communities from Option 10 are considered to be **minor adverse**.

Mitigation

- 16.4.57 Severance of PRowS should be reinstated where affected. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility around the local villages. Alternative means of access would also be provided where existing access points are disrupted by the proposed options.
- 16.4.58 Mitigation measures should include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement HE and other appropriate stakeholders. The appointed Contractor will adhere to current best practice techniques during the construction phase. Appropriate landscape planting will be implemented to minimise visual impacts.

Geology, Soils and Materials

- 16.4.59 Option 10 is not anticipated to have any impacts on the bedrock geology or the superficial deposits within the study area.
- 16.4.60 The off-slip and off-line dualling will require the acquisition of agricultural land, which has been designated as Grade 2 and 3 (moderate-good) by Natural England. Option 10 will have a moderate adverse impact due to the loss of agricultural land and fertile soils.
- 16.4.61 Option 10 could result in adverse contaminated land impacts as a result of accidental spillages/pollution events during the construction phase and/or excavation works which could mobilise potentially existing contaminants. However, impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical, geochemical conditions beneath the site including for Waste Acceptance Criteria.
- 16.4.62 There is potential for retention and use on site of excavated materials pending appropriate testing for contaminants and geotechnical suitability. Unsuitable materials will require appropriate off site waste management.
- 16.4.63 Given the offline nature of Option 10, it is considered that the scheme would create waste soils as a result of earthworks and that materials would need to be imported. Option 10 would have minor adverse impacts on material resources and waste receptors.
- 16.4.64 At this stage, impacts on geology, soils and materials from Option 10 are considered to be **minor adverse**.

Mitigation

- 16.4.65 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.
- 16.4.66 Where contamination is identified, or suspected, appropriate sampling, analysis and risk assessment should be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors.
- 16.4.67 Maximising the reuse of materials on site through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.

17 Detailed Cost Estimate of Sifted Options

17.1 Introduction

17.1.1 As a project develops through the PCF Stages the scheme costs are estimated based on the level of detail available at that time. For PCF Stage 1 an estimate was undertaken for each of the options as recommended by the sifting review meeting. The estimates were produced to demonstrate the affordability of the project. The Options Estimates were used in the decision-making process by Highways England to determine whether the scheme progressed into PCF Stage 2.

17.1.2 During PCF Stage 1, an options estimate was prepared for the one identified as being the most viable. Option 10 was selected as being viable to be put forward into PCF Stage 2 based on the option being offline along the whole length of the route hence would be less disruptive during construction. Approximate relative estimates for Options 1, 8, 1A and 1B were derived from the Option 10 estimate which was produced by Highways England Commercial. These are discussed in section 17.5.

17.2 The Options Estimate

17.2.1 The Options Estimate for the scheme, prepared in accordance with the Highways England Commercial Cost Estimation Manual, produces a three-point range estimate that identifies:

- The minimum;
- The most likely; and
- The maximum cost.

17.2.2 The Options Estimate includes a consideration of uncertainties associated with the scheme via an assessment of risk. Project risks have been identified and recorded within the scheme risk register. The risk register has been considered in the three-point range estimate.

17.3 Review of the Estimate

17.3.1 The estimate has been reviewed in accordance with the Highways England Cost Estimating Manual. The reviews include independent peer reviews, Estimating Manager reviews and a review by the Head of Cost Planning.

17.3.2 In addition to these reviews, the estimate was presented to the project team for their input and confirmation of correct approach and assumptions. **Table 17-1** below presents the range cost estimates for Option 10 received in October 2016.

17.4 Summary of Estimate

Table 17-1: Option Estimates

Option:	Min (£M)	Most Likely (£M)	Maximum (£M)
Option 10	85	113.75	159.87
Option 1	**	**	**
Option 8	**	**	**

**Option price not available at this point in PCF Stage 1

17.4.1 The Range Estimates for the Proposed Scheme at PCF Stage 0, derived from the Order of Magnitude Estimate, are as detailed below in **Table 17-2** below.

Table 17-2: Stage 0 Order of Magnitude Estimate

Representative Scheme	Min (£M)	Most Likely (£M)	Maximum (£M)
Outturn Costs (Oct 15)	82.0	96.9	118.1

17.4.2 The outturn range estimate prepared for the 2014 route Feasibility Study (published in February 2015) reported a range estimate of £66m to £95m.

17.4.3 There are a number of reasons for the increase in the cost estimate between PCF Stage 0 and PCF Stage 1 – some of these are listed below:

- Price Base of base estimate higher as Q1 2014 figures were used (In PCF Stage 0 Q2 2011 figures were used) increasing the overall costs
- Increased construction duration by 4 months
- Higher DV land's estimate
- Increased direct construction costs due to additional structures, additional pavement treatment works and additional environmental mitigation measures
- Increased indirect construction costs due to new commercial services preliminary model used and bigger team size
- Increased Project risk costs
- Increased NR VAT costs

17.5 Relative Estimates for other Options

17.5.1 At PCF Stage 1 the most likely cost estimate for Option 3 was £113.75 million. This was in excess of the estimate undertaken for the DfT Feasibility Study (published in February 2015) which had a range estimate of £66m to £95m.

17.5.2 As noted in **Table 17-1** above at the end of PCF Stage 1, a cost estimate for Option 10 was the only cost estimate that had been produced and signed off by Highways England Commercial and the Highways England Project Manager.

17.5.3 Approximate relative estimates for Options 1, 8, 1A and 1B were derived from the Option 10 estimate which was produced by Highways England Commercial. The estimates used the Option 10 data and cost estimate provided by Highways England as a base to provide comparative estimates for the remaining options. **Table 17-3** below presents a summary of the appraisal for all the options including an assessment of the key differences which are reflected by the variance in cost between the options.

17.5.4 Those key differences include factors such as scheme length, online/offline, construction period, traffic management, land take, volume of earthworks and treatments required, accommodation works required, number of structures, de-trunking required and statutory undertaker costs. In each instance the differences in the schemes were appraised and assessed to calculate the likely cost variance.

17.5.5 It was assumed that the percentage split of overall costs over time for each category of expenditure (Preparation, Supervision, Works and Land) was the same as that for Option 10.

Table 17-3: Derivation of Scheme Costs

	Estimate Status	Relative estimate based on most likely Option10	% (Option10 100%)	Key Differences / Comparators to Option 10
Option 1	Approximate estimate based on Option 10 (Below) adjusted for appraised key scheme differences	£123,887,245	108.92%	Similar scheme length. Online so increased construction period thus increased labour costs, increased traffic management costs, reduced land costs, reduced volume of earthworks and treatments, increased accommodation costs. Similar number of structures Minimal de-trunking required. Increased stats costs
Option 8	Approximate estimate based on Option 10 (Below) adjusted for appraised key scheme differences	£114,837,407	100.96%	Similar scheme length, Similar construction period, Increased traffic management costs for tie-ins, Similar land costs increased volume of earthworks and treatments for increased number of ponds. Similar accommodation costs Fewer structures required Similar de-trunking required Similar stats costs
Option 10	Estimate from HE Commercial	£113,746,675	100.00%	HE Commercial estimate (Base)
Option 1A	Approximate estimate based on Option 10 (Above) adjusted for appraised key scheme differences	£131,855,500	115.92%	Similar scheme length, Online so increased construction period thus increased labour costs, increased traffic management costs, reduced land costs, reduced volume of earthworks and treatments. Online so increased accommodation costs Increased number of structures Minimal de-trunking required Increased stats costs
Option 1B	Approximate estimate based on Option 10	£123,388,724	108.48%	Similar scheme length minus free flow slip road from A1

	Estimate Status	Relative estimate based on most likely Option10	% (Option10 100%)	Key Differences / Comparators to Option 10
	(Above) adjusted for appraised key scheme differences			<p>Online so increased construction period thus increased labour costs, increased traffic management costs, reduced land costs, reduced volume of earthworks and treatments</p> <p>Increased accommodation costs</p> <p>Similar number of structures</p> <p>Minimal de-trunking required</p> <p>Increased stats costs</p>

17.5.6 These estimated costs were used to calculate comparative BCRs for Options 1, 8, 1A and 1B detailed in Section 18.4.

18 Economic Assessment of Sifted Options (Stage 1)

18.1 Introduction

18.1.1 This chapter describes the economic assessment of the scheme at PCF Stage 1.

18.2 Methodology

18.2.1 Assessments of the monetised benefits in the design option models compared to the Do-Minimum scenario were performed using the Transport Users Benefit Appraisal (TUBA) and Cost and Benefit to Accidents - Light Touch (COBALT) software packages.

18.2.2 Economic benefits have been calculated over a 60-year appraisal period, standard for a transport scheme as per WebTAG Unit A1.1 "Cost-Benefit Analysis". All values have been converted to 2010 costs and values to allow direct comparability between effects occurring in different years.

18.2.3 Models representing the Do-Minimum and three Do-Something scenarios were run for each of the three modelled time periods and two modelled future years. Journey times, link distances and any input time delays (e.g. for level crossings) were extracted from each model run using SATURN's SATTUBA module for use, along with the demand matrices for each model, as inputs into TUBA.

18.2.4 TUBA version 1.9.7 was used in the baseline economic assessment of the design options, utilising inputs from the WebTAG Data Book version 1.5 which was current as of July 2016. Accident savings were assessed using COBALT version 2013.2, updated with baseline economic parameters from WebTAG dated January 2016.

Journey Time Benefits

18.2.5 Travel time savings are monetised as a perceived benefit reflecting users' willingness to pay for a quicker journey. Savings are assigned different monetary values depending on whether the trip is performed on employer's business, is a workplace commute or is a non-commuting private trip. In the absence of specific data for this scheme the national averages of journey purpose described in WebTAG Data Book Table A1.3.4 have been assumed.

Options Estimate

18.2.6 The Options Estimate for the scheme was prepared by Highways England's commercial team. The construction costs were inflated to outturn costs using construction-specific inflation projected by Highways England, and then rebased to 2010 values using the GDP deflator series in the WebTAG Data Book. 2010 is the DfT's standard base year for economic assessment and ensures that all values, costs and economic inputs are directly comparable.

18.2.7 The estimated construction costs pertain to Design Option 10. It was the only construction cost estimate that had been delivered at PCF Stage 1. It was anticipated that given the differences between the design options the outturn costs for the schemes would vary significantly.

18.2.8 The estimated cost for Option 10 was £92.382 million in 2010 prices. This excluded any sunk costs prior to October 2016. The cost was subdivided as £9.218 million for preparation, £1.643 million for supervision, £79.034 million for construction works and £2.486 million for land.

Annualisation factors

- 18.2.9 The outputs from the PTM SATURN model represent three hours of a typical weekday in each modelled year: the busiest hour of the AM peak, interpeak and PM peak respectively as described in Chapter 12 paragraph 12.2.9. To correctly represent the benefits of the scheme over longer periods, it is necessary to expand each of the three modelled hours to represent a full typical weekday and then a year full of weekdays using a process of annualisation.
- 18.2.10 To determine the benefits for a full day, the hourly outputs must be expanded to cover the entire peak periods, defined in TUBA as:
- AM peak period: 07:00 to 10:00;
 - Interpeak period: 10:00 to 16:00; and
 - PM peak period: 16:00 to 19:00.
- 18.2.11 To expand a modelled hour to represent the whole three- or six-hour period as necessary, the manual classified traffic count performed at Sutton Heath Road junction on the A47 on Thursday 25th June 2015 was used to estimate the traffic profile on the A47 through the scheme extents through the full 12 hour period. A daily factor was then derived equal to the proportion of the full period flow that occurs in the modelled peak hour, using bidirectional through traffic on the A47.
- 18.2.12 The daily factor was calculated separately for each of the three modelled time periods and then multiplied by 253, the average number of typical weekdays in a year, to obtain an annualisation factor. These calculations are shown in **Table 18-1**.

Table 18-1: Calculation of annualisation factors for each time period

Model	Modelled hour		Full period		Daily factor	Annualisation factor
	Time	Flow	Time	Flow		
AM peak	1 hour 08:00 to 09:00	1,970	3 hours 07:00 to 10:00	5,628	$\frac{5628}{1970} = 2.857$	$2.857 \times 253 = 723$
Inter-peak	1 hour 14:00 to 15:00	1,591	6 hours 10:00 to 16:00	9,012	$\frac{9012}{1591} = 5.664$	$5.664 \times 253 = 1433$
PM peak	1 hour 17:00 to 18:00	2,297	3 hours 16:00 to 19:00	6,186	$\frac{2297}{6198} = 2.693$	$2.693 \times 253 = 681$

Constraints

- 18.2.13 No modelling has been performed for the off-peak period (19:00 to 07:00) or weekend traffic. No benefits will be synthesised for these time periods and they will be excluded from the economic assessment. Although this represents best practice for modelling benefits, it provides a conservative estimate of the benefits as even at off -peak times it will be expected that some benefit will accrue due to improved journey times owing to an increased speed limit of 70mph for a dual carriageway.

18.3 Assessment Results

Maintenance and Construction Impacts

- 18.3.1 The impacts of the scheme for maintenance and construction have not been assessed at this stage as there was no data available. See Section 29.2 for work done in PCF Stage 2 with regards to impacts from construction.

Impact on Accidents

18.3.2 The change in accident rates for each option, and the economic benefits resulting from such, are shown in **Table 18-2**. The number of accidents and their cost are totalled over the 60-year appraisal period. As Options 1, 8 and 10 were considered identical within the traffic model, only Option 1 and its sub options are presented below.

Table 18-2: Scheme benefits resulting from reduction of accidents

Design option	Type	Location	Do-Minimum accidents		Do-Something accidents		Accidents prevented	
			No.	Cost	No.	Cost	No.	Benefit
Option 1	Link	A47 Eastbound	55.5	-5,032	50.3	-3,289	5.2	1,743
		A47 Westbound	71.6	-6,481	41.0	-2,696	30.6	3,786
		A1 Southbound	67.6	-4,443	36.1	-2,372	31.5	2,071
		A1-A47 existing slip	2.1	-188	0.1	-11	2.0	178
		A1-A47 direct slip	0.0	0	6.7	-442	-6.7	-442
	Junction	Wansford	76.8	-2,835	35.0	-1,287	41.8	1,549
		Sacrewell Farm	78.3	-5,238	0.0	0	78.3	5,238
		Sutton Heath Road	62.4	-3,819	0.0	0	62.4	3,819
		The Drift	34.4	-2,110	0.0	0	34.4	2,110
	Combined	Sutton	87.3	-3,201	130.2	-4,772	-42.9	-1,571
Combined	All accidents	535.9	-33,348	299.4	-14,867	236.5	18,480	
Option 1A	Link	A47 Eastbound	55.5	-5,032	50.4	-3,304	5.1	1,728
		A47 Westbound	71.6	-6,481	42.2	-2,775	29.4	3,707
		A1 Southbound	67.6	-4,443	36.2	-2,377	31.4	2,066
		A1-A47 existing slip	2.1	-188	0.1	-10	2.0	178
		A1-A47 direct slip	0.0	0	7.0	-457	-7.0	-457
	Junction	Wansford	77.2	-2,852	35.2	-1,296	42.0	1,556
		Sacrewell Farm	78.3	-5,238	0.0	0	78.3	5,238
		Sutton Heath Road	62.4	-3,818	0.0	0	62.4	3,818
		The Drift	34.4	-2,112	0.0	0	34.4	2,112
	Combined	Sutton	86.9	-3,188	33.5	-1,279	53.4	1,909
Combined	All accidents	536.0	-33,352	204.6	-11,498	331.4	21,854	
Option 1B	Link	A47 Eastbound	55.5	-5,032	46.8	-3,069	8.7	1,963
		A47 Westbound	71.6	-6,481	36.8	-2,414	34.8	4,068
		A1-A47 existing slip	2.1	-188	2.5	-226	-0.4	-38
	Junction	Wansford	77.2	-2,852	155.4	-5,711	-78.2	-2,858
		Sacrewell Farm	78.3	-5,238	0.0	0	78.3	5,238
		Sutton Heath Road	62.4	-3,818	0.0	0	62.4	3,818
		The Drift	34.4	-2,112	0.0	0	34.4	2,112
	Combined	Sutton	86.9	-3,188	119.6	-4,387	-32.7	-1,200
Combined	All accidents	468.4	-28,909	361.1	-15,806	107.3	13,103	

18.3.3 **Table 18-2** shows that link accidents on the A47 westbound are higher than on the A47 eastbound, and that the reduction in accidents as a result of the scheme are greater in the westbound direction than the eastbound direction. This is likely to be due to upstream impacts of the westbound right turners into and out of Sutton Heath Road priority junction. The eastbound traffic has a much easier left turn manoeuvre into and out of Sutton Heath Road.

Wider Impacts

18.3.4 The economic assessment of the scheme considers a series of wider economic impacts out with those directly impacting road users. Of these, two categories of wider impacts are monetised directly in the assessment: greenhouse gas emissions and changes to indirect government tax revenues.

18.3.5 The economic effects of greenhouse gas emissions and of changes to indirect government tax revenues form part of the economic summary contained within the Analysis of Monetised Costs and Benefits shown in **Table 18-6**.

18.3.6 Further wider and distributional impacts to the economy will be assessed qualitatively within the Appraisal Summary Tables (AST) for the scheme.

Sectorisation

18.3.7 Sectorisation was undertaken to determine if the benefits or disbenefits of the scheme are localised in any geographical area within the model. In particular, the test was performed to determine if disbenefits in Peterborough or areas distant from the scheme were having a significant effect on the BCR.

18.3.8 The economic impacts that are output from TUBA can be presented from each origin zone to each destination zone. However, as the PTM SATURN model includes almost 200 zones, this is not a practical method of assessing how the scheme costs and benefits are distributed geographically. Sectorisation is a process of grouping zones together to form a smaller number of sectors. It is then much easier to see how the scheme benefits and disbenefits are distributed between each sector to sector pair.

18.3.9 For the purposes of the sensitivity test, the model was divided into six sectors representing different areas within the model. The six sectors represented are:

- Sector 1 includes Stamford and the rural west of Peterborough and encompasses the scheme. Significant scheme benefits would be expected to be observed in this area;
- Sector 2 represents the rural north of Peterborough, including many locations accessible from journeys via Sutton Heath Road. Moderate scheme benefits would be expected in this area;
- Sector 3 represents all locations north accessible from the A1. Significant scheme benefits would be expected in this area;
- Sector 4 represents the rural east of Peterborough. Effects from the scheme in this area would be expected to be low;
- Sector 5 represents locations reached from the A1 south of the scheme. Moderate effects would be expected in this area; and
- Sector 6 represents the Peterborough urban area. Although journey time benefits would be expected for trips to and from here via the A47, significant “noise” in the form of unexpected large delays is observed here in the future year models which cannot be logically attributed to the scheme, casting doubt on the results observed in this area.

18.3.10 A run of TUBA with the sectors defined then divides all benefits accruing in the scheme between the origin and destination sectors dependent on the zone definitions. The overall benefits for trips between each O-D sector pair are shown in Table 18-3 for Option 1 which is also representative of Options 8 and 10. Note that the sectorisation does affect the way TUBA divides benefits, and so there are small differences between the total benefits predicted in the AMCB and the full sectorised run of the model.

Table 18-3: Economic benefits by origin and destination sector

Options 1,8,10		Destination Sector						
		Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Total
Origin Sector	Sector 1	-114	10,133	1,013	2,005	1,283	31,289	45,609
	Sector 2	401	-163	3,094	1,430	2,419	5,686	12,867
	Sector 3	-287	6,496	-1,128	1,913	2,610	42,686	52,290
	Sector 4	-1,383	-74	1,137	456	-72	1,959	2,023
	Sector 5	476	447	875	165	50	5,268	7,281
	Sector 6	6,703	-1,466	6,149	-1,318	-517	-11,014	-1,463
	Total	5,796	15,373	11,140	4,651	5,773	75,874	118,607

18.3.11 **Table 18-3** shows that disbenefits are experienced for most journeys to central Peterborough, which is represented in the model by single large delays in certain locations, e.g. grade-separated junction merges, as a result of SATURN calculating individual links to be over-capacity. Trips that have both their origin and destination within Sector 6 produced significant and unexpected disbenefits. These trips were within central Peterborough and would not normally be expected to be affected by the proposed schemes. Therefore, they were removed from the calculation of the scheme benefits.

18.4 Economic Summary Tables

18.4.1 The calculations of Net Present Value of benefits and Benefit Cost Ratio for Option 10 are detailed in **Table 18-4** (Transport Economic Efficiency), Table 18-5 (Public Accounts) and Table 18-6 (Analysis of Monetised Costs and Benefits).

18.4.2 To inform the PCF Stage 1 Stage Gate Review in November 2016 and the Investment Decision Committee (IDC) meeting in December 2016 a separate “A47 Wansford VfM Support Technical Note” was prepared. The Value for Money assessment in this Technical Note was based on the data for Option 10 and the way in which the key differences vary from Option 10 determined whether the cost for each of the other options decreased or increased Non-Monetised Benefits as detailed in Section 17.5.

18.4.3 The Present Value of Costs (PVC) figures in Table 18.6 were factored based on the Option 10 estimate using the calculated figures in **Table 17.3** to provide an estimated PVC figure per option. This then allowed an estimated BCR to be generated for each of the options.

Table 18-4: Transport Economic Efficiency (TEE)

User type	Benefit type	Option 1 (£000's)	Option 8 (£000's)	Option 10 (£000's)	Option 1A (£000's)	Option 1B (£000's)
Non-business: Commuting	Travel Time	30,144	30,144	30,144	32,172	5,416
	Vehicle operating costs	-184	-184	-184	-93	-485
	User charges	82	82	82	-137	614
	Net benefits	30,042	30,042	30,042	31,942	5,545
Non-business: Other	Travel Time	38,485	38,485	38,485	42,896	14,587
	Vehicle operating costs	-2,237	-2,237	-2,237	-2,287	-2,296
	User charges	1,095	1,095	1,095	996	1,490
	Net benefits	37,343	37,343	37,343	41,605	13,781
Business	Travel Time	61,953	61,953	61,953	66,903	16,291
	Vehicle operating costs	1,184	1,184	1,184	1,231	-1,531

User type	Benefit type	Option 1 (£000's)	Option 8 (£000's)	Option 10 (£000's)	Option 1A (£000's)	Option 1B (£000's)
	User charges	445	445	445	355	677
	Private sector revenue	-1,846	-1,846	-1,846	-1,377	-3,181
	Net benefits	61,736	61,736	61,736	67,112	12,256
Present Value of Transport Economic Efficiency Benefits (TEE)		129,121	129,121	129,121	140,659	31,582

Table 18-5: Public Accounts

	Option 1 (£000's)	Option 8 (£000's)	Option 10 (£000's)	Option 1A (£000's)	Option 1B (£000's)
Wider Public Finances (Indirect Tax Revenues)	-498	-498	-498	-473	-1,946
Central Government Broad Transport Budget	TBC	TBC	76,117	TBC	TBC

Table 18-6: Analysis of Monetised Costs and Benefits

Category	Monetised Benefits and Costs (£000's)				
	Option 1	Option 8	Option 10	Option 1A	Option 1B
Greenhouse gas emissions	-163	-163	-163	-156	-692
Accident benefits	18,480	18,480	18,480	21,854	13,103
Economic efficiency: commuters	30,042	30,042	30,042	31,942	5,545
Economic efficiency: other users	37,343	37,343	37,343	41,605	13,781
Economic efficiency: business users	61,736	61,736	61,736	67,112	12,256
Indirect taxation revenues	498	498	498	473	1,946
Present Value of Benefit (PVB)	147,936	147,936	147,936	162,830	45,939
Present Value of Costs (PVC)	82,903	76,847	76,117	88,235	82,569
Net Present Value (NPV) = PVB - PVC	65033	71089	71819	74595	-36630
Benefit to Cost Ratio (BCR) = PVB ÷ PVC	1.78	1.93	1.943	1.85	0.56

18.5 Non-Monetised Benefits

18.5.1 The qualitative element of the economic assessment outlines the potential use benefit of impacts which have not been monetised at this stage. It is recognised that there is the potential for benefits to be derived from the scheme, including:

- Benefits in journey time savings will improve resilience and reliability which directly affect journey quality, predominantly associated with traveller stress;
- The increase in reliability results in fuel efficiencies for all users and;
- The improvements in journey times may benefit the users of facilities located nearby the scheme.

18.6 Value for Money

18.6.1 Value for Money assessments are produced to support scheme and programme decisions, whereby the performance of the scheme, utilising the BCR can be appraised on a common scale. That scale is defined in the DfT's Value for Money Framework as follows in **Table 18.7**.

Table 18-7: Value for Money Categories

Rating	BCR
Poor	< 1.0
Low	> 1.0 and < 1.5
Medium	> 1.5 and < 2.0
High	> 2.0 and < 4.0
Very High	> 4.0

18.6.2 The only option for which scheme costs were available was Option 10. This had a BCR of 1.94 representing medium value for money.

18.6.3 The BCRs for Options 1, 8, 1A and 1B were estimated and are also shown in **Table 18-6**.

18.6.4 Options 1, 8 and 1A represented medium value for money.

18.6.5 Although Option 1A represented medium value for money, the comparative high cost estimated and shown in Table 17-3 makes this option economically unviable.

18.6.6 Option 1B represented poor value for money which showed that the lack of free flow slip lane from the A1 southbound resulted in a significant reduction in scheme benefits.

18.7 Non-Monetised Benefits

18.7.1 The qualitative element of the economic assessment outlines the potential benefit of impacts which have not been monetised at this stage. It is recognised that there is the potential for benefits to be derived from the scheme, including:

- Expected journey time benefits for business users will help support planned residential and employment regeneration in the Peterborough Area;
- Improvements in journey times will improve access to services in Peterborough from the areas local to the scheme, including the villages to the north of the A47 and to the west of the A1;
- Benefits in journey time savings will improve resilience and reliability which directly affect journey quality, predominantly associated with traveller stress; and
- The increase in reliability results in reduced stress and thus improved journey quality for drivers and their passengers.

19 Assessment Summary of Sifted Options

19.1 Introduction

19.1.1 At the end of PCF Stage 1, as instructed by Highways England the reporting process was drawn to an early conclusion in order to facilitate governance and decision making processes. Therefore, an assessment summary and comparison of the options was deferred and agreed to be undertaken early in PCF Stage 2. It was intended that these would be fully produced once this information was available as an addendum to this report, but events in PCF Stage 2 superseded this approach (see Chapters 20 & 21).

19.2 Appraisal Summary Table (ASTs)

19.2.1 At the end of PCF Stage 1 only one AST has been produced for Option 10; this can be found in **Appendix L**.

19.2.2 As stated above the option comparisons were not completed. As a result, AST's for Option 1 and 8 were not produced.

19.3 Engagement with Public Bodies.

19.3.1 A summary of completed stakeholder PCF Stage 1 is detailed below.

19.3.2 For details of stakeholder engagements completed during PCF Stage 2, please refer to Chapter 32.

Peterborough City Council and Cambridgeshire County Council

19.3.3 There have been several meetings with PCC and CCC where discussions have been undertaken around A47 Wansford to Sutton scheme, progress and details of the options, including meetings with Technical Officers.

- 23 February 2016 – A47 Programme Progress
- 10 May 2016 – Technical Officers Meeting to discuss options
- 13 September 2016 - Meeting with Councillors to discuss A47 Programme progress

Other Stakeholders

- 02 June 2016 – Meeting with Peterborough Cycle West Project Team
- 10 August 2016 – Meeting with Sustrans
- 25 August 2016 – Meeting with HCA

Environmental Bodies

19.3.4 A meeting was held on 31 August 2016 with the Environment Agency, Natural England and Historic England where an introduction and update on all the 6 schemes in the A47 Programme was given.

Other Public Bodies

The Planning Inspectorate (PINS)

19.3.5 Meetings have been held with PINS to discuss the relevant planning conditions that need to be taken into consideration for all the A47 Schemes including Wansford to Sutton.

- 20 April 2016
- 21 June 2016
- 13 July 2016

A47 Alliance

19.3.6 A meeting was held with the A47 Alliance on 26 January 2016 and 12 July 2016 when discussions were held regarding the A47 Programme and schemes contained in this including Wansford to Sutton.

Members of Parliament

19.3.7 There have been two meetings with Members of Parliament where details of the A47 Schemes have been discussed.

- 19 January 2016
- 07 July 2016

20 Stage 1 Conclusions and Transition to Stage 2

20.1 Stage 1 Conclusions

20.1.1 This study has confirmed the transport problem. The likely increase in traffic flow will lead to increased congestion.

20.1.2 In seeking to resolve the transport problem, a number of potential options have been developed that have been considered in this report.

20.1.3 Options 1A and 1B were tested for operational performance only and showed:

- Option 1A - the additional benefits gained by grade separation would not justify the significant additional cost associated with this scheme (as shown in Table 17.3), and for that reason it will not be assessed further at PCF Stage 2.
- Option 1B - The removal of the free flow slip road from the A1 southbound resulted in a significant reduction in scheme benefits. Given the magnitude of reduction in benefits, the scheme would not deliver value for money and will not be assessed further in PCF Stage 2. This justifies the need for the free flow slip road from the A1 southbound.

20.1.4 Options 1, 8 and 10 are all expected to resolve the transport problem in so much that they will increase the capacity of the link and reduce congestion allowing for a safer, swifter movement of traffic along the route.

20.1.5 Indications based on economics assessment in PCF Stage 1 was that a medium BCR value (1.5 to 2) is likely.

20.1.6 There were a number of areas identified that need further investigation as the Scheme moves forward in to PCF Stage 2, they include:

- The SATURN model did not include a lot of detail of the local area and the validation was not strong in the locality of the scheme. Going forward into PCF Stage 2 the traffic modelling methodology will need to be reviewed.
- The options taken forward to PCF Stage 2 will be assessed further in order to make a recommendation on the preferred route.
- More detailed environmental investigations to enable completion of an Environmental Assessment giving greater understanding of the impacts on the sensitive designated sites in the area.
- Affordability and Value Management – A Value Management exercise will be carried out with the buildability contractors early in PCF Stage 2 and the outputs detailed in the Value Management Workshop Report. Further value management interventions will be carried out as the Scheme progresses to refine the Scheme costs.
- An appropriate level of flood risk assessment.
- Topographical survey data to be obtained to enable a greater understanding of the topography of the area and link in with the construction process.
- Ground Investigation data to be obtained to assess the local ground conditions and to inform potential geotechnical solutions.
- More detailed investigations and recommendations regarding NMU provisions at the junction.
- Buildability of the options and understanding the arrangements in regards to Traffic Management required during construction to minimise disruption.

20.2 Transition to Stage 2

- 20.2.1 As explained in Chapter 1, in order to meet a March 2020 start on site date the programme dictated that PCF Stage 1 could not extend beyond November 2016 to allow adequate time for future stages. At the end of each PCF Stage, Highways England holds a Stage Gate review to enable the progress of the scheme to be reviewed, known as a Stage Gate Assessment Review (SGAR).
- 20.2.2 The SGAR review provides basic assurance that:
- The stage is complete and is within tolerance;
 - The project control framework (PCF) has been followed; and
 - The project is ready to proceed to the next stage, subject to investment authorisation.
- 20.2.3 As detailed at the start of the assessment Chapters 17, 18 and 19, at the time of SGAR 1 (end of PCF Stage 1), only one option estimate was available from HE commercial. It was therefore not possible for the detailed technical assessments to be completed for all three options and reported for the end of PCF Stage 1, however they were completed early in stage 2 and validated, with costs estimates undertaken in June and October 2017
- 20.2.4 In order to allow the Scheme to be reviewed at the SGAR, the assessments were concluded based on cost estimates that had been factored using Option 10 costs and updated local transport modelling which was reported to the SGAR by the production of a Technical Note, this was on the understanding that detailed estimates for the three options and updated strategic modelling would be completed in PCF Stage 2. This would allow the TAR to be completed and reported within the Scheme Assessment Report (SAR), this document, in PCF Stage 2.
- 20.2.5 A positive (green) status was received at the SGAR in November 2016 based on the submitted material which meant the Scheme could proceed to PCF Stage 2, subject to the agreement from the Investment Decision Committee (IDC), held in December 2016.
- 20.2.6 The IDC gave a qualified approval for the scheme to progress into PCF Stage 2. On the basis that the estimate produced in PCF Stage 1 for Option 10 was well in excess of the RIS budget, the IDC required a review of the affordability and value for money of the scheme early in PCF Stage 2.
- 20.2.7 At the end of PCF Stage 1, Highways England Investment Committee indicated that the scheme would progress to PCF Stage 2 with the caveat that at the start of PCF Stage 2 a review of the affordability and value for money of the scheme was undertaken to demonstrate that a scheme could be delivered within the budget which was likely to achieve a BCR in excess of 1.5. The results of the review were presented to the Investment Committee for sign off prior to public consultation launch.
- 20.2.8 A process of value management and an affordability review was therefore undertaken. This allowed a review of the construction cost estimates provided by Highways England Commercial, to re-engineer the outline design to reduce the construction costs of the project with the aim of bringing the scheme costs within budget
- 20.2.9 Chapter 21 which follows presents the Value Management Deep Dive undertaken as a result of the IDC request at the start of PCF Stage 2.
- 20.2.10 Chapters 22 onwards reports the work completed in PCF Stage 2 between January 2017 and December 2017.

21 Scheme Value Management Deep Dive

21.1 Introduction

- 21.1.1 During PCF Stage 1, on the basis that all three options would be estimated in further detail in PCF Stage 2, it was decided to undertake a single estimate for the scheme based on one of the route options which could be used to assess the overall viability of the scheme in terms of cost.
- 21.1.2 The PCF Stage 1 range estimate undertaken for Option 10 gave a most likely outturn cost of £113.85m. This was in excess of the estimate undertaken for the DfT Feasibility Study (published in February 2015) which had a range estimate of £66m to £95m.
- 21.1.3 At the end of PCF Stage 1, Highways England Investment Decision Committee (IDC) indicated that the scheme should progress to PCF Stage 2 with the caveat that at the start of PCF Stage 2, a review of the affordability and value for money of the scheme was undertaken to demonstrate that the scheme could be delivered within the RIS budget and was likely to achieve a BCR in excess of 1.5. The results of the review were to be presented to the IDC for sign off prior to public consultation launch. Full details on the Value Management Deep Dive process is detailed in the PCF Product 'Value Management Workshop Report', document reference A47 IMPS2-AMY-WS-ZZ-DO-J0041.

21.2 Value Management Deep Dive Process

- 21.2.1 The Value Management Deep Dive process followed a series of Value Management (VM) workshops which started with a review of the high-level breakdown of the estimate prepared in PCF Stage 1 and a review of the scheme to determine where potential savings could be made.
- 21.2.2 A series of VM workshops were held between Amey, Highways England and Taylor Woodrow for all schemes to review and develop the value engineering option and achieve the required cost reduction. These are detailed in **Table 21-1** below.

Table 21-1 VM Workshop Dates

Value Management Workshop Date	Attendees
04/01/2017	Amey/Highways England
10/01/2017	
18/01/2017	
25/01/2017	Amey/Highways England/Taylor Woodrow
02/02/2017	
08/02/2017	

- 21.2.3 To produce an estimate for the review, the PCF Stage 1 estimate was used as a basis. The estimate was then adjusted for the changes from the Value Engineering initiatives and any assumptions and high level engineering judgments made, were recorded in the report. This was undertaken for a single option (see below) with the agreed assumption that the outcomes from the Value Management Deep Dive could be applied in equal measure to all options.
- 21.2.4 The areas identified which offered potential savings were as follows:

- Review of the base estimate scope of works – review and proposal to change vertical alignment, technology requirements, junction requirements, structure requirements, earthworks solutions, length of scheme and construction durations.
- Review of the PCF Stage Gate programme – proposal to condense the timeframe for completing milestones
- Review of project risk registers – current risks against the proposed changes
- Other Savings - Consequential reductions in direct costs leading to savings in NR VAT, Inflation, Unscheduled Items, Risk and Contractors Costs

21.2.5 For the purposes of the estimate, it was agreed that Cost Planning would complete their assessment of costs using the same tools and processes that were in place at the time of the officially released estimates, to enable like-for-like comparisons across the outputs.

21.2.6 The results from the value engineering exercise are presented in the **Table 21-2** below:

Table 21-2 Cost Estimates for Value Engineered Solution

Released Most Likely Outturn PCF Stage1 Estimate (£M)	Value Engineered Most Likely Outturn Estimate (£M)	Potential Most Likely Costs Savings from VE Works (£M)
£113.75	£78.4	£35.35 (+/-25%)

21.2.7 Cost Planning advised the project teams, in advance of issuing the figures, that the figures provided were highly indicative and carried a low level of assurance. The information provided did not represent a standard Commercial Services Division output and should not be treated as such.

21.3 Review Outcomes and Impact on Previous Assessments

21.3.1 An unassured assessment of the BCR based on a limited assessment of the change in benefits from the feasibility assessment was undertaken to support the Value Management Deep Dive. The unassured BCR calculated indicated that the scheme would be likely to outturn a high value for money.

21.3.2 The Value Management Deep Dive provided sufficient evidence to the Investment Committee to demonstrate that the scheme should be taken through the non-statutory public consultation and the options further assessed during PCF Stage 2.

21.3.3 The potential changes to the options from the Value Management Deep Dive process have not changed the assessments undertaken during the initial sifting process described in the SAR. The changes made at Value Management Deep Dive review have not changed the option alignments of the routes.

21.3.4 The high-level assessments showed that the revised option met the criteria set out in the RIS, appeared to be economically viable and solved the transport problem.

21.4 Options for Stage 2 Assessment

21.4.1 The principles from the value management exercise were used to update the option layouts for the three route options to allow fully assured estimates to be developed for each of the options. These option layouts show indicative junctions and side road arrangements for estimating and route assessment purposes only. The side road and junction strategy will be developed in PCF Stage 3 during preliminary design.

22 Option Renumbering for Consultation

22.1.1 For simplicity in gathering public comment and for presentation at public consultation it was decided that the 3 options to be taken forward should be renumbered 1 to 3.

22.1.2 The Options were renumbered as shown in the **Table 22-1** below.

Table 22-1 Option Re-numbering

Option Number at Stage 1	Option Number at consultation	Route Plan (see section 9 & 11)
Option 1	Option 1	
Option 8	Option 2	
Option 10	Option 3	

23 Engineering Overview of Affordable Options Stage 2

23.1 Introduction

23.1.1 The following sections describe the engineering features assessment and key comparison between the three options following on from the Scheme Value Management Deep Dive carried out and described in Chapter 21 and feedback received from the PIE event.

23.1.2 The alignments for the three options, (Options 1, 2 and 3) have not changed from PCF Stage 1 however the indicative side road and junction layout strategies have changed. This indicative side road and junction layout has been included to allow Highways England Commercial team to price the options. Junction strategy and side road strategy are not fully developed and considered until later PCF Stages so the layouts should be treated as indicative only. The option layouts for Options 1, 2 and 3 with indicative junction and side road layouts are included in **Appendix M**.

23.2 Highways Alignment

23.2.1 The Highways Alignment has not changed since PCF Stage 1 – please see sections 13.2.1 to 13.2.8 for details.

Junctions Strategy

23.2.2 The proposed A47 dual carriageway would tie in to the existing A47 carriageway at the western end of the scheme via the existing eastern dumbbell roundabout of the A1 / A47 interchange.

23.2.3 A new proposed connecting road to the south would be added to this roundabout to access the Picnic area / Truck stop and Sacrewell Farm and Country Centre.

23.2.4 A proposed A1 southbound exit slip road from the A1 would provide a free flow link between the A1 southbound carriageway and the proposed new A47 eastbound carriageway.

23.2.5 The proposed A1 southbound exit slip road from the A1 would also provide a connection to the existing eastern roundabout of the A1/A47 interchange and would facilitate A1 southbound traffic wishing to access the A47 westbound carriageway.

23.2.6 Traffic travelling in either direction of the A47 would be able to gain access to the A1 southbound carriageway via the eastern dumbbell roundabout of the A1/A47 interchange, as is currently the case. Traffic travelling on the A1 northbound carriageway and wishing to access the A47 would do so via the western dumbbell roundabout of the A1 / A47 interchange which would be unaffected by the scheme.

23.2.7 A new at grade roundabout has been proposed for all options in the vicinity of the existing junction of The Drift with the A47. Sutton Heath Road would be realigned to connect with the north side of the proposed new roundabout and The Drift would be realigned locally to connect to the south side of the proposed new roundabout. As a consequence, the existing roundabout at the eastern end of the scheme at Nene Way would be removed and the new dual carriageway would tie directly in with the existing dual carriageway immediately to the east of the existing Nene Way roundabout. Alternative arrangements for each option would be made for traffic to access the A47 from Upton and Castor.

23.3 Departures from Standard

23.3.1 Early engagement with the Highways England Safety, Engineering and Standards (SES) specialist is recommended in PCF Stage 3 with respect to potential Departures from Standards once a preferred route is developed further.

Option 1

23.3.2 The online improvement proposal would be to upgrade the existing single carriageway A47 to a dual two-lane carriageway by primarily online widening, with discrete offline sections to avoid or minimise the impact on a number of constraints. The existing vertical alignment is undulating with some non-compliant, but short in length vertical crest and sag curves. The proposed alignment would also have vertical crest and sag curves that would be several steps below the Desirable Minimum for crests and below Absolute Minimum for sag curves. The requirement for Stopping Sight Distance (SSD) would be less than the Desirable Minimum at three locations (discussed in section 13.3.3) so these would be Departures from Standard.

Option 2

23.3.3 The proposed dual two-lane carriageway would be constructed part offline to the north and part offline to the south of the existing A47. The alignment would have horizontal curves exceeding the Desirable Minimum for the design speed but it is expected that the vertical alignment would have a vertical crest curve one step below the Desirable Minimum combined with SSD less than the Desirable Minimum so the available SSD on the approach to a junction would be classified as a Departure from Standard.

Option 3

23.3.4 The proposed dual two-lane carriageway would be constructed offline up to 30m to the north of the existing A47.

23.3.5 The alignment would include Relaxations from Standard for SSD. Once junction locations are determined these Relaxations could possibly be classified as Departures from Standards if they occur on the approach to a junction.

23.4 NMU Provision

23.4.1 Proposed NMU access has been discussed in section 13.4 for the three options.

23.4.2 An NMU context report has been prepared in PCF Stage 2 (refer to document A47 IMPS2-AMY-WS-ZZ-DO-J0059); The findings from this Report will be used at PCF Stage 3 to inform and develop the designs further.

23.4.3 This report has established the background information on current and potential NMU issues related to the A47 Wansford to Sutton dualling scheme. Based on the review of the current NMU provision, desire lines and potential use, the recommended key scheme objectives are to:

- Maintain the PRoWs within the study area and provide suitable NMU crossing facilities where PRoWs are crossed by the new A47 alignment with minimal diversion;
- Provide NMU linkage between Wansford and Sutton;
- If an offline solution is selected, ensure the legacy A47 roadway is suitable for the use of NMUs;
- Provide NMU crossing facilities over the A47 at any new junctions; and

- Cater for cyclists to make east-west trips between the ends of the scheme and this should link to the advisory cycle routes that are designated either side of the trunk road.

23.4.4 It is proposed that NMU audits should be carried out at the end of each PCF stage.

23.5 Side Roads, Access and Accommodation Works

General

23.5.1 The full extent of accommodation works, side roads and access can only be determined after detailed consultation with land owners and occupiers as to how the surrounding land and properties are accessed and used. High level assumptions have been made for each of the three options. The section starts with statements that are common to all options followed by each option where they are different.

23.5.2 A proposed new at grade roundabout is being considered for all options in the vicinity of the existing junction of The Drift with the A47 as described in Section 23.2.7.

23.5.3 The proposed southbound free-flow slip road between the A1 southbound carriageway and the new A47 eastbound carriageway alignment would be located on the northeast side of the existing A1 / A47 junction within the existing agricultural landscape.

23.5.4 Access to Sacrewell Farm and Country Centre, north of the A47 and interests to the south, including Wansford Picnic Area, would be reconfigured with a connecting bridge under the A47. Access to the A47 eastbound and westbound would be via a modified eastern roundabout at the A1 / A47 junction. Subject to design compliance, the fuel station would be retained with a modified access / egress layout.

23.5.5 The existing roundabout at Nene Way would be removed and the side road connections from Upton to the north and Castor to the south east would be stopped up. Traffic from Upton would access the A47 via Church Walk, Langley Bush Road and the proposed new side road connection to the proposed roundabout at The Drift.

Option 1

23.5.6 As this option would be online along its entire length, the existing A47 single carriageway would be incorporated within the construction of the new dual carriageway. Existing accesses would be affected; however, direct access onto the new highway is not proposed so alternative access via new side road or service road links would be required.

23.5.7 The Drift would connect into the proposed new roundabout and access would be provided from The Drift to the property known as Deep Springs (Please note impact on Deep Springs following PRD Decision in Chapter 27). A proposed new road alignment would be provided from the Sutton Heath Road / Langley Bush Road junction to connect with the proposed roundabout.

23.5.8 Traffic from Castor would access the A47 via Nene Way towards Sutton and The Drift to the proposed roundabout on the A47.

23.5.9 Access to the Old Station House would be affected. A new access would have to be provided to the property from Sutton Heath Road.

Option 2

23.5.10 This option is off line, running to the north of the existing A47 for the first 700m then crossing to run to the south. Much of the existing A47 carriageway could be retained to maintain local access to adjacent fields and properties to the north. Access to the fuel station to the south would be via a section of the existing A47 carriageway connected by a proposed new link to

the eastern roundabout of the A1/A47 junction. Where the proposed new carriageway is to the south of the existing A47, access into land between the proposed highway and the River Nene would require links bridging across the new carriageway.

23.5.11 The Drift would connect into the proposed new roundabout. A proposed new road alignment would be provided from the Sutton Heath Road / Langley Bush Road junction to connect with the proposed roundabout. Access to the property known as Deep Springs would be maintained from a retained section of the existing A47.

23.5.12 The Old Station House would not be directly affected by the new route and access to the property would be from the section of the existing A47.

23.5.13 Traffic from Castor would access the A47 via Nene Way towards Sutton and The Drift to the proposed roundabout on the A47.

Option 3

23.5.14 This option would be offline to the north of the existing A47 therefore much of the existing A47 carriageway could be retained to maintain local access to adjacent fields and properties to the south between the proposed highway and the River Nene. Access to the north would require links bridging across the proposed carriageway.

23.5.15 East of Sutton Heath Road the proposed A47 alignment would run up to 75 metres north of its existing alignment before connecting with the existing dual carriageway to the east of Nene Way.

23.5.16 The Drift would connect into the new roundabout and access to the property known as Deep Springs would be maintained from a retained section of the existing A47. A new road alignment would be provided from the Sutton Heath Road / Langley Bush Road junction to connect with the proposed roundabout.

23.5.17 The Old Station House would be directly on the line of the new A47 and would have to be demolished if Option 10 was selected as the preferred route.

23.5.18 Traffic from Castor would access the A47 via a revised alignment of Peterborough Road connecting to a retained section of the existing A47 that then connecting into the proposed roundabout. The Drift would be locally realigned to form a 'T' junction with the proposed new connecting road from Castor.

23.6 Drainage and Flooding

General

23.6.1 Following the Value Management Deep Dive exercise, alternative methods of draining the carriageway were sought in which overall savings would be made in the construction of the proposed drainage system. The main difference to the PCF Stage 1 drainage proposals as described in Section 13.6 is that where 'positive drainage' methods were proposed, alternative 'over edge drainage' methods are now proposed.

23.6.2 Most of the requirements/constraints remain the same as described in Section 13.6. These include flood zones/plains etc.; soakaways; limiting flows to existing/greenfield flows through the use of storage structures; sub surface drainage; culvert extension/protection; and dealing with severed field drainage.

23.6.3 Positive drainage systems would have included extensive use of kerbs and gullies; carrier drain pipes; some filter drain pipes; combined kerb drains (at roundabouts); concrete channels etc. It is now proposed for water from the carriageway to flow over the carriageway edge and directly into perforated (carrier/filter) drains in the verges and central reserves (thus

eliminating the requirements for most of the gullies, kerbs, channels associated with positive drainage). Where fields drain towards the carriageway, the flows would be intercepted through the use of ditches rather than filter drains.

- 23.6.4 The use of ‘over edge’ drainage would have a major advantage over ‘positive drainage’ methods by reducing construction costs. However, it is worth bearing in mind that there are adverse impacts to consider as well. ‘Over edge’ drainage systems would require greater maintenance to control the overgrowth of grass in the verges and central reserve that would prevent water from flowing from the carriageway onto the grass verge, thus resulting in ponding along the edge of the carriageway. Also, the scatter of filter media from the verge onto the carriageway would be more prevalent with ‘over edge’ drainage. Thus, there would be a greater requirement for clearing the carriageway of scattered media stones and to treat top of the filter drain trenches. There would also be a requirement for regular cleansing or replacement of the top layer of filter media above filter drains that are likely to clog up with silt washed from the carriageway.
- 23.6.5 The proposed route options would require some elements of ‘positive drainage’ through the use of kerb drains at roundabouts; and carrier drains for road crossings.
- 23.6.6 Drainage surveys will be carried out in PCF Stage 3.
- 23.6.7 Environment Agency needs to be consulted in PCF Stage 3 with regards to the need for a Flood Risk Assessment.

23.7 Geotechnical Considerations

- 23.7.1 The primary geological risk anticipated at this stage is a lack of ground investigation information within the study area and this has been further confirmed by the Preliminary Sources Study Report (PSSR). While the basic geological make up beneath the site is understood there is no detailed information available that could be used to assess the potential impact of geological features in any significant detail. Ground investigations will be carried out early in PCF Stage 3 – preliminary design.
- 23.7.2 Preliminary Sources Study Report was produced (Road Investment Strategy, East Area 6, Geotechnical Preliminary Sources Study Report, A47 Wansford to Sutton, Document reference: A47IMPS2-AME-WS-ZZ-DO-J0049 dated June 2017 HAGDMS Ref: 29538).

23.8 Structures – High Level Structures Strategy

- 23.8.1 The structures for each option are described in Section 13.8. There are some changes to the structures proposed in PCF Stage 1:
 - The first is the removal of the proposed overbridge connecting The Drift and Sutton Heath Road. Due to the high costs, it has been value engineered out.
 - The second is the proposed overbridge connecting to Sacrewell farm which is now a proposed underbridge. Having carried out more in depth analysis on the geometry and alignment of the area, an underbridge is proposed. It would also have less of a visual impact.
- 23.8.2 The proposed structures required along with the location for each option can be found in **Table 23-1** below:

Table 23-1: Structures for all Options

S.No	Structure	Chainage (m)		
		Option 1	Option 2	Option 3

S.No	Structure	Chainage (m)		
		Option 1	Option 2	Option 3
1	Culvert near A1 slip road	Approx 50	Approx 50	Approx 50
2	Single Carriageway Underbridge	Approx 265	Approx 290	Approx 290
3	Culvert	Approx 1175	Approx 1195	Approx 1140
4	Wansford Sluice	Approx 1225	-	-
5	Railway Under Bridge	Approx 1400	Approx 1400	Approx 1350
6	Culvert	Approx 2110	Approx 1210	Approx 1225
7	Culvert	Approx 2350	Approx 2360	Approx 2110
8	Culvert	-	-	Approx 2375

23.9 Public Utilities

23.9.1 Details for each option can be found in Chapter 13.9.

23.9.2 Further statutory undertaker's requests would be made in PCF Stage 3 and future stages to check for detailed positions of utilities and to obtain more accurate estimates for utility diversions.

23.10 Topography, Land Use, Property and Industry

23.10.1 Details for each option can be found in Chapter 13.10.

23.10.2 Topography surveys will be carried out in PCF Stage 3.

23.11 Effective Construction Management – Construction (Design and Management) Regulations 2015

23.11.1 Amey were appointed as PD, by Highways England, for PCF Stage 2 to plan, manage, monitor and co-ordinate health and safety in the pre-construction phase of the project. The PD therefore:

- sought to ensure that the Design Risk Register identified, eliminated and controlled the foreseeable risks. All identified risks were captured and recorded in the project risk register;
- ensured that designers carried out their duties, by means of design reviews, meetings, and assessments on PCF Stage 2 drawings (route options); and
- prepared and provided relevant information to other duty holders (e.g. Principal Contractor) such as the Pre-construction Information documents (see PCF Product Pre-Construction Information, document reference A47IMPS2-AMY-WS-ZZ-DO-J-0019). Data was obtained from existing asset information databases and residual risk data bases (asbestos register for example) as well as data gathered from site surveys and ground investigations which could be used by the principal contractor to help them plan, manage, monitor and co-ordinate health and safety in the construction phase.

23.11.2 Amey were also appointed as Designer, by Highways England, for PCF Stage 2. As Designer, the main responsibilities included the preparation/modification of designs to eliminate, reduce or control the foreseeable risks that may arise during design, construction and the maintenance of the constructed schemes. This was achieved through the following tasks:

- CDM audits followed by CDM workshops;
- CDM compliance workshop; and
- Design reviews, with changes captured on the design review form and translated into the Pre-construction information where necessary.

23.12 Operational, Technology, Safety and Maintenance Assessment

23.12.1 The information contained in this section updates the information from Chapters 14 and 15 of this report.

Operational Assessment

23.12.2 The operational assessment described in Section 14.1 is still applicable to all options.

Technology Assessment

23.12.3 The Technology described in Section 14.2 of this report has not been developed any further at this time and is therefore still applicable to all options.

Maintenance Assessment

23.12.4 Maintenance considerations have been detailed in the PCF Stage 2 Maintenance and Repair Strategy Statement PCF Product, document reference A47IMPS2-AMY-WS-ZZ-DO-J0030.

Safety Assessment

23.12.5 The safety of the road user has been considered to a level appropriate to this stage in the design process. Neither an NMU survey nor Road Safety Audit (RSA) has been completed and so specific safety concerns have not been developed any further during PCF Stage 2. These surveys will be conducted during later PCF stages to inform and develop the design.

23.12.6 Further consideration has been given to the safety of the design and is detailed in the PCF Stage 2 Safety Plan Product, document reference number A47IMPS2-AMY-WS-ZZ-DO-J-0008.

24 Non-Statutory Public Consultation

24.1 Introduction

- 24.1.1 The three options identified in Chapter 22 were put forward in a non-statutory public consultation exercise.
- 24.1.2 The purpose of the public consultation was to seek views on the outline proposals from the public, statutory consultees, including local authorities, and other interested bodies.
- 24.1.3 Comments received as a result of the consultation process will be considered by Highways England as the scheme progresses.
- 24.1.4 The Public Consultation period for the scheme was from 13 March 2017 to 21 April 2017.
- 24.1.5 This section provides an overview of the public consultation. There is a separate more comprehensive report on the consultation process which has been produced as part of PCF Stage 2 entitled "A47 Wansford Consultation Report" (document reference A47IMPS2-AMY-WS-ZZ-DR-J-0007).

24.2 Public Consultation Process

Advertising

- 24.2.1 The public consultation was intended to seek the views of the public and other stakeholders on the scheme proposals and the four options being considered. The public consultation was advertised by Highways England as follows:
- Highways England website for the A47 Improvement:
<http://www.highways.gov.uk/a47Improvement>;
 - Highways England press notice (published on 15 March 2017):
<https://www.gov.uk/government/news/have-your-say-on-plans-to-dual-and-improve-junctions-on-the-a47>;
 - Invitation to local MPs, local councillors and other key stakeholders to attend a preview of the Exhibition before it opened to the public, sent on 02 March 2017;
 - Advertisements in local newspapers ('EDP', 'Norwich Evening News', 'Diss Wymondham & Attleborough Mercury', 'Norwich Extra') on 16 March 2017;
 - Interviews on local television news and radio;
 - Notices posted at strategic locations around the Wansford and Sutton area before the Exhibition;
 - Leaflet drops were undertaken around the Wansford and Sutton area;
 - Notices posted at the exhibition venue on the days of the exhibition;
 - A 'static' advertisement was set up at Peterborough Town Hall and Sacrewell Farm (after the PIE).
- 24.2.2 Details on those invited to the preview event and the distribution of the advertising leaflet and further details on the advertising of the Public Consultation Exhibitions are included in the "A47 Wansford Consultation Report".

24.2.3 The public and other stakeholders were asked to provide feedback on the information presented in the brochure and at the public consultation events via the questionnaire which was available online and in hard copy at the public information exhibitions.

24.2.4 Consultation responses were handled differently according to the format in which they were received. Every consultation response was assigned a unique reference number and recorded in a bespoke consultation database. Responses were received in several formats as follows:

- Responses via the website;
- Paper response forms and letters received via the freepost address;
- Email responses; and
- Responses containing non-text elements.

24.2.5 These were captured in the database. For submissions containing images, maps and other non-text content a reference to a PDF version of the original submission was made available to analysts so this information could be viewed when necessary. For further details see the Report on Public Consultation.

Analysis of Responses

24.2.6 A coding framework was created to ensure a thorough and fair analysis of the views expressed by respondents. The coding framework enabled analysts to organise responses by themes and issues so that key ideas as well as specific points of detail could be captured and reported.

24.2.7 A senior analyst reviewed an early set of responses to formulate an initial framework of codes. A two-tier approach was taken to coding, starting with high level themes and then specific codes. The top-level themes are listed below. The full coding framework is available in the Report on Public Consultation.

- Improvements Needed;
- Proposed Option;
- Non-motorised users (NMUs);
- General;
- Consultation Process; and
- Other.

24.2.8 Each code within a theme represents a specific issue or argument raised in responses. Natural language codes were used (rather than numeric sets) as this allows analysts to suggest refinements as well as aiding quality control and external verification.

24.2.9 The application of a code to part of a response was done by highlighting the relevant text and recording the selection. A single submission could receive multiple codes. Where similar issues were raised, care was taken to ensure that these were coded consistently.

24.2.10 The results of the analysis are contained in detail in the “A47 Wansford Consultation Report” with a summary and overview in Section 25.

24.3 Public Consultation Material

Brochure and Questionnaire

24.3.1 A brochure was produced and available on request and copies were available online on Highways England website and hard copies at the exhibitions. The brochure included:

- Information on the scheme proposals;
- Details of the exhibition dates and venues; and
- Contact details to enable comments to be made to Highways England. These consisted of postal address, email and website address, and telephone number.

24.3.2 A questionnaire document for respondents to complete and return to Highways England was available online or in hard copy at exhibitions. The questionnaire included questions asked to gain information such as type and location of user, frequency and purpose of use, and to obtain feedback on the options shown. Respondents were also invited to make additional comments if they wished to do so.

24.3.3 The consultation brochure and questionnaire were distributed to the general public at the Public Information Events (PIEs) which were held between 23rd and 25th March.

24.3.4 Brochures and Questionnaires were also left at Peterborough City Council and Sacrewell Farm and Country Centre (after the PIE).

Illustrative Design Drawings and Display Material

24.3.5 Presentation pull-ups were displayed at the exhibitions based on the information and drawings in the brochure. The display material contained information about the scheme and the issues surrounding it. The display material included the following:

- Welcome board (including an introduction to the scheme);
- A47 Wansford to Sutton (including details of why the scheme is needed);
- Objectives of the scheme;
- Proposed Option 1 (with an illustrative layout drawing of the proposed option);
- Proposed Option 2 (with an illustrative layout drawing of the proposed option);
- Proposed Option 3 (with an illustrative layout drawing of the proposed option);
- Environmental constraints plan;
- What happens next? (with board details of the overall scheme programme); and
- How to respond? (with details of the various methods for completing the questionnaire).

Additional Material on Display

24.3.6 An additional 'static' panel was set up at Peterborough Town Hall, and following the PIE the key display material regarding the options were left on show at Sacrewell Farm Centre until the end of the public consultation. The panel provided details of the proposed PIE along with details of how to access the consultation material and respond to the questionnaire. Copies of the brochure and questionnaire were also made available at this event for the public to pick-up.

24.4 Public Consultation Exhibition

24.4.1 The Public Consultation Exhibition was held on 23rd, 24th and 25th March 2017. The total numbers of visitors that attended the exhibition is shown in **Table 24-1** below:

Table 24-1 Public Information Exhibition Details

Venue	Date	Opening Times	Number of Visitors
Peterborough Town Hall	Tue 14 Mar	9am – 5pm MPs, Councillor and stakeholder Preview	Not recorded
Haycock Hotel, Wansford	Thurs 23 Mar	3pm – 8pm	68
Sutton Church, Sutton	Fri 24 Mar	10am – 5pm	70
Sacrewell Farm Centre, Wansford	Sat 25 Mar	10am – 2pm	33

24.5 Meetings with affected parties

24.5.1 As part of the consultation process, Highways England actively sought to discuss the proposals with parties directly affected by the proposals, such as landowners and those with business interests or development proposals in the scheme area.

24.5.2 Meetings took place with Wansford Parish Council, The William Scott Abbott Trust & Sacrewell Farm Ltd and Homes and Communities Agency.

24.5.3 Consultations will continue as the design progresses.

24.6 No. of Responses

24.6.1 A total of 170 responses were received which included responses from stakeholders and members of the public. Therefore, the findings set out in the Consultation Report and in Section 25 should be treated with caution and not be interpreted as representative of the views of the wider population of Wansford to Sutton and the surrounding areas.

25 Assessment of Consultation Responses

25.1 Introduction

25.1.1 Feedback from consultations was collated and analysed by Dialogue by Design – a company that specialises in bespoke public and stakeholder engagement and consultation services. Further detail can be found in the A47 Wansford Consultation Report.

25.1.2 Dialogue by Design received feedback via:

- Completed Questionnaires sent by post;
- Completed Questionnaire online via Highways England website; and
- Email responses via Highways England;

25.1.3 A high-level summary of the Public Consultation Report is provided below.

25.2 Key Response Statistics

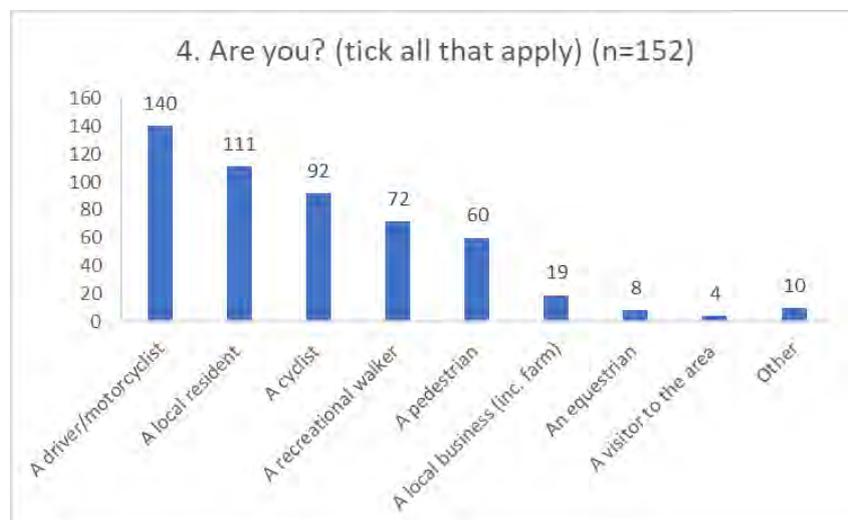
25.2.1 A total of 170 responses were received which includes responses from stakeholders and members of the public. Therefore, the findings set out in the Report for Public Consultation and in this section, should be treated with caution and not be interpreted as representative of the views of the wider population of Wansford to Sutton and the surrounding area.

25.2.2 The following are the key response statistics from the returned questionnaires. Statistics from the consultation questionnaire responses and more detailed analysis and commentary can be found in the “A47 Wansford Consultation Report”.

Type of Road User

25.2.3 Question 4 asks respondents to select from a set of descriptions which they feel best applies to them, and allows for them to make multiple selections. The responses are shown in the **Figure 25-1** below. Of the 152 respondents who answered this question, 140 identified themselves as drivers/motorcyclists, 111 as local residents and 92 as cyclists. 72 respondents identified themselves as recreational walkers, and 60 as pedestrians. 19 respondents identified themselves as a local business or farm, and a small proportion of respondents selected other descriptions.

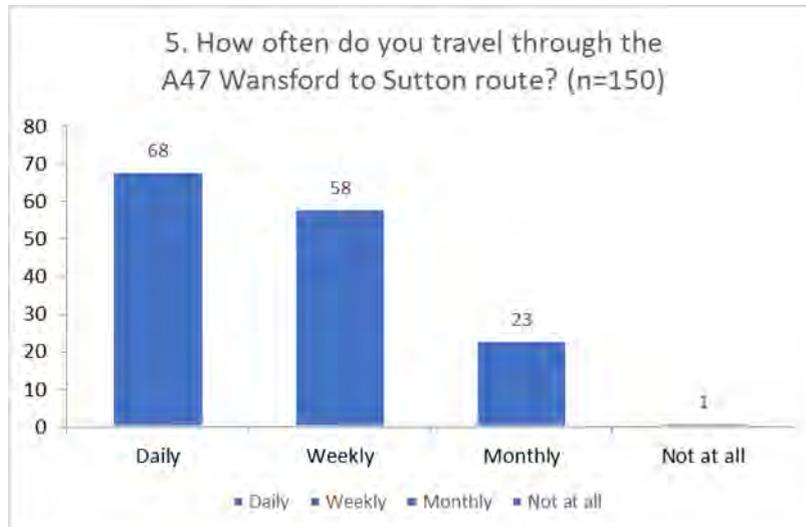
Figure 25-1 Types of Road User



Frequency of Travel along the A47 Wansford to Sutton Route

25.2.4 Question 5 asks respondents to select how often they travel along the A47 Wansford to Sutton route and these responses are shown in **Figure 25-2** below:

Figure 25-2 Frequency of Travel along the A47 Wansford to Sutton Route

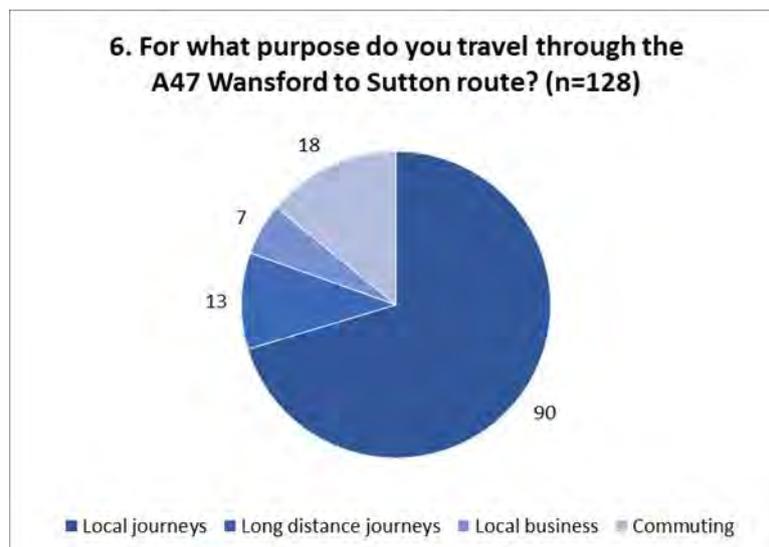


25.2.5 Of the 150 respondents to this question, 68 indicated that they travel along the A47 Wansford to Sutton route daily, with 58 indicating that they travel along this route weekly. The remaining 24 respondents indicated that they travel along this route monthly (23) or not at all (1).

Purpose of Travel along the A47 Wansford to Sutton Route

25.2.6 Question 6 asks respondents to select the purpose of their travel along the A47 Wansford to Sutton route and these responses are shown in **Figure 25-3** below.

Figure 25-3 Purpose of Travel along the A47 Wansford to Sutton Route

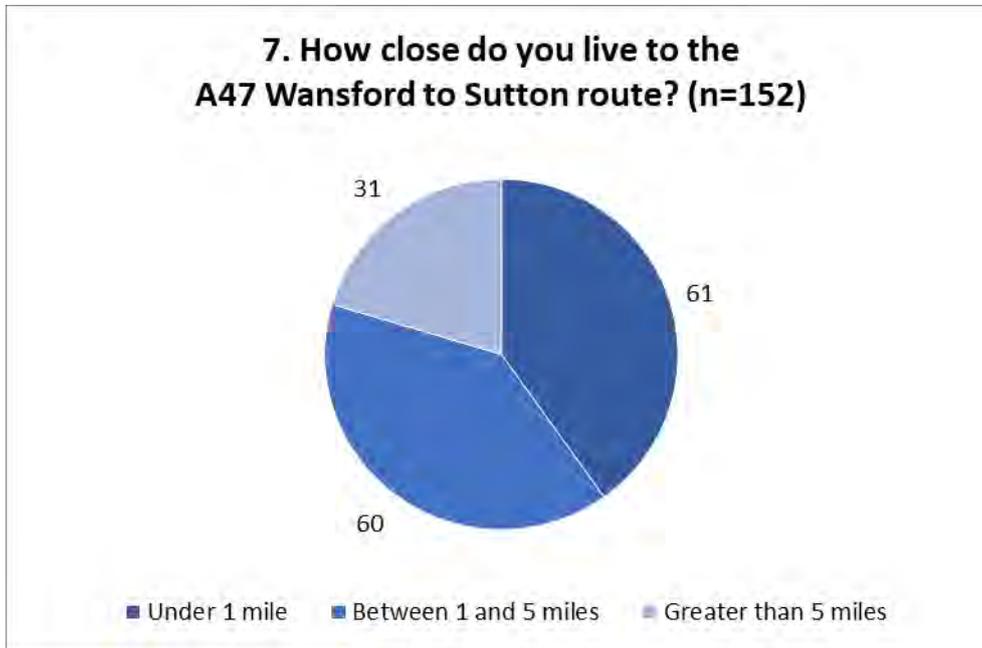


25.2.7 Of the 128 respondents to this question, 90 indicated that they travel along the A47 Wansford to Sutton route on local journeys. 18 said that they travelled along this route on their commute. 13 respondents selected long distance journeys and 7 respondents selected local business as their reasons for travelling along the A47 Wansford to Sutton route.

Proximity to Wansford to Sutton Route

25.2.8 Question 7 asks respondents to select their proximity to the A47 Wansford to Sutton route. These responses are shown in **Figure 25-4** below.

Figure 25-4 Proximity to the Wansford to Sutton Route



25.2.9 Of the 152 respondents who answered this question, 61 indicated that they live under 1 mile away, and 60 indicated that they live between 1 and 5 miles away. 31 indicated that they live more than 5 miles away.

The Need for Improvement

25.2.10 Question 8a asks respondents to select whether they agree or disagree that improvements are needed to the A47 Wansford to Sutton route and these responses are shown in **Figure 25-5** below.

Figure 25-5 The need for Improvement on the Wansford to Sutton Route

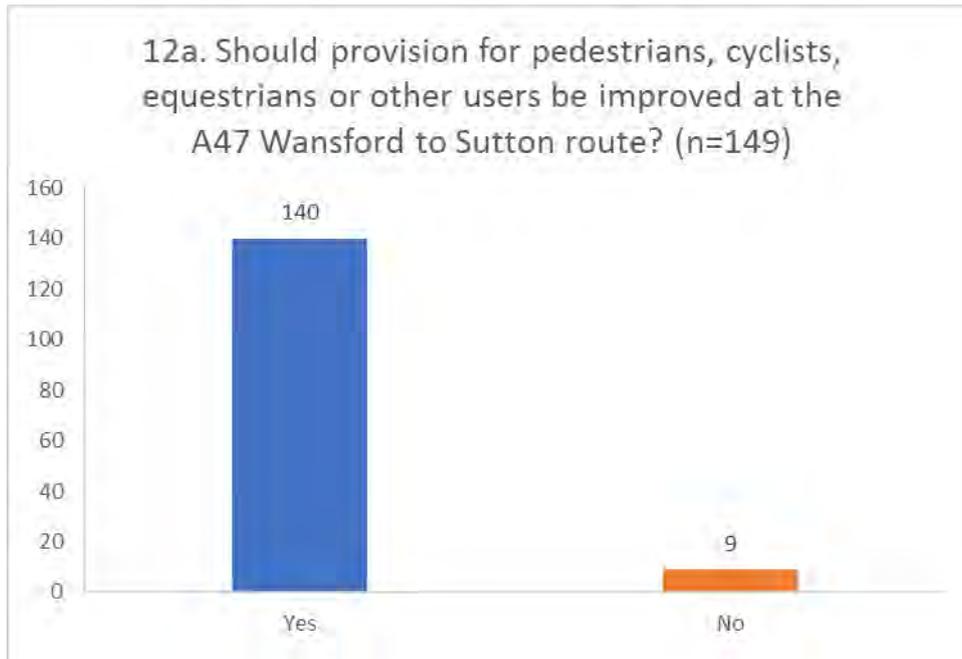


25.2.11 Of the 152 respondents to this question, 147 indicated that ‘yes, improvements are needed’, while five respondents selected no.

Provision for Pedestrians, Cyclists, Equestrians and/or Other Users

25.2.12 Question 12a asks respondents to comment on whether they believe that provisions for pedestrians, cyclists, equestrians and/or other users need to be improved along the A47 Wansford to Sutton Route. These responses are shown in **Figure 25-6** below.

Figure 25-6 Responses on the provision for pedestrians, cyclists, equestrians and/or other users

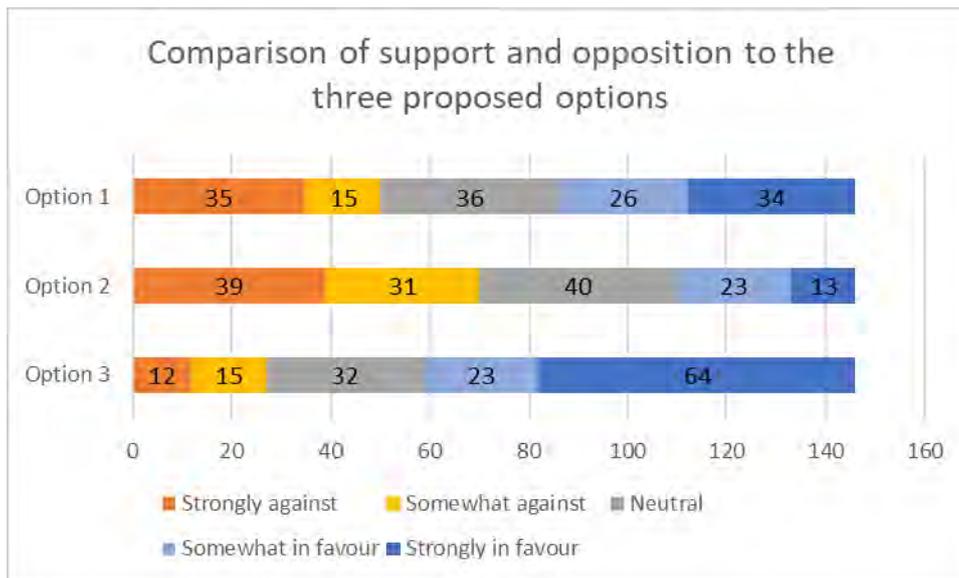


25.2.13 Of the 149 respondents who answered this question, 140 indicated that improvements to provisions for pedestrians, cyclists, equestrians and/or other users were needed, whereas 9 indicated that they were not required.

Support for Options

25.2.14 Comparison of support and opposition for the proposed options is summarised in **Figure 25-7** below:

Figure 25-7 Comparison of Support and Opposition to Proposed Options



25.2.15 The main reason for support for Option 1 by respondents was that it followed the existing road layout, minimised the land-take and environmental impact and did not leave a 'dead road' behind. Others argued this option would cause disruption during construction, force agricultural traffic to mix with long-distance traffic and create 'rat-runs' through local villages. Concerns were also expressed about flooding and damage to local habitats as well as the impact on existing junctions.

25.2.16 Support for Option 2 came from those who believed it would have the least impact during construction and would allow Sutton Heath Road to connect directly to the Sutton roundabout using the old A47 road. Respondents also welcomed the removal of a lay-by which is a location for criminal activity. Those who oppose this option were concerned about its proximity to the village of Sutton and the impact on local residents and businesses. They also said this route could be at risk from flooding and would remove valuable farmland and wildlife habitats.

25.2.17 Option 3 was the preferred option for many respondents who felt it was the best option for addressing congestion and welcomed the conversion of the old A47 route into a route for local traffic including cyclists. Respondents said this northerly option would take noise and air pollution away from Sutton and be at less of a risk from flooding. Those who opposed this option were concerned about the land-take required and the impacts on Sacrewell Farm and local heritage assets such as Bronze Age crop marks and the old railway station.

25.3 Key Stakeholder Responses

25.3.1 This section discusses responses from key stakeholders. They have been grouped into Local Councils & Constabulary, Cycling Groups and Landowners with substantial land holdings.

Local Councils & Constabulary

Barnack Parish Council

25.3.2 They had concerns about Traffic turning from the A47 to Sutton Heath Road and vice versa. *This is a well-used route particularly for commuters and although the junction is extremely dangerous at the moment, it would benefit from a new layout and should definitely be retained. If it is closed it will just move the traffic to other country roads and junctions in the area creating serious problems for them, which will in turn have to be improved.*

25.3.3 They stated Option 1 would appear to be the best route by dualling the existing road and so taking up less land. However, it is essential that the Sutton Heath Road has easy access to the A47.

Cambridgeshire Constabulary

25.3.4 They were concerned with A1/A47 junction with delays and back log of traffic in the mornings and evenings to and from Peterborough.

25.3.5 They stated *trying to cycle between Wansford and Sutton is dangerous. A safe cycle and pedestrian path is needed.*

25.3.6 They were strongly in favour of Option 1.

Cambridgeshire County Council

25.3.7 The Council supported the principle of early delivery of a scheme to dual the A47 between Wansford and Sutton, in order to support economic growth, reduce congestion, improve journey times and journey time reliability and improve safety.

25.3.8 The Council had no route preference at this stage, but recognised the environmental constraints in the area. *This requires further detailed investigation and assessment by Highway England. Further information is also required on the proposed new junctions.*

Campaign to Protect Rural England (CPRE) Cambridgeshire and Peterborough

25.3.9 They were concerned that spending large amounts of money on road building is not the answer to these national problems. *It is not a cost-effective solution and causes great damage to our countryside. Road schemes fail to deliver the boost to jobs and local economies so often promised.*

25.3.10 *More road capacity encourages more traffic. The more capacity is increased the more capacity is needed.*

25.3.11 They rejected all three options and asked for consideration to be given to making the existing road safer by slowing down traffic as it approaches Sutton and Sutton Heath Road turns.

Peterborough City Council

25.3.12 PCC were strongly in favour of all options – they did not express a preference. However – they made the following general comments on all options:

- *Potentially significant impacts on designated sites e.g. Sutton Meadows County Wildlife Site (CWS) located immediately to the south of existing road between A1 & Sutton Heath Road, Sutton Disused Railway CWS (immediately south of A47), River Nene CWS, A47/A1 Interchange Road Verges CWS, Sutton Heath & Bog SSSI immediately north of A47, therefore advise NE is consulted at earliest opportunity. Section of Ancient Hedgerow present along Sutton Heath road likely to be affected by scheme.*
- *Disused railway bridge is a building of local importance.*
- *The viability of Sacrewell Farm as a leisure resource is heavily dependent on visitors who value its safe, quiet and historic environment. Any proposals for the A47 improvement must be capable of maintaining the seclusion of Sacrewell and at the same time, giving safe access for both motorists and also walkers /cyclists.*
- *The proposed scheme is likely to affect important buried remains, with particular reference to the Roman period, as indicated by cropmarked remains visible on aerial photographs and stray finds recovered from the general area.*

- *Particular attention needs to be given to Scheduled Monument List Entry Number 1006796 - Site revealed by aerial photography W of Sutton Heath (PE 201), The site consists of various circles and enclosures visible on aerial photographs. Some of these features are likely to be prehistoric (by typology) and/or Roman (as various Roman objects and sites have been found in the area).*
- *Consideration should be given to securing a programme of archaeological work, in consultation with historic England.*

25.3.13 They stated that Option 1 – although most disruptive during construction, had less impact on environment and historic landscape.

25.3.14 They also stated the current cycling provision on this route was poor and inadequate.

Sutton Parish Council

25.3.15 They were supportive of the scheme for the following reasons:

- *The road itself is dangerous due to its narrowness, its twisting nature and vertical alignment near the Sutton Heath Road junction. (The latter is especially dangerous on winter evenings when there is low sun).*
- *The road junctions with the A47 and individual accesses off it have been the scene of fatal accidents, injury accidents and numerous other accidents due mainly to right-turning movements at times of high traffic flow.*
- *This section of road is unexpectedly narrow for traffic flowing from dual carriageway sections of the A47 and A1. This sudden change has itself led to accidents.*
- *There is no provision for cyclists and the road's narrowness and lack of any verge refuge is especially dangerous for them.*
- *This section of road has a strategic function for all traffic but is a major constraint on cycle traffic of all forms seeking to travel east-west.*
- *The recently installed traffic lights at the Wansford junction have failed to fully address the problem of vehicles queuing back onto the A1 during peak hours.*
- *Structurally the road is unsound; the pressure of large HGV's leads to subsidence.*
- *Traffic approaches the Sutton roundabout at high speed causing danger to vehicles or cycles and horses crossing between the old A47 and the Upton Road. The Sutton roundabout must be reconfigured not only to accommodate the dualling but also to effectively slow traffic down.*

25.3.16 They were strongly against Option 1 for the following reasons:

- *The implications for the side roads are not evident. The closing off of the junction with Sutton Heath Road, which seems to be proposed, would produce intolerable strains on the totally unsuitable Upton road and on living conditions for Upton residents. Closure of The Drift is also considered undesirable, likely to attract antisocial behaviour and constrain school bus access into Sutton.*
- *It is not a practical solution as the twisting alignment at the old railway bridge needs to be addressed.*
- *It is unlikely to deliver cycle facilities so easily.*
- *It makes no provision for local traffic movements to take place without joining the dual carriageway.*

25.3.17 They were strongly opposed to Option 2 for the following reasons:

- *This option brings the new road closer to Sutton increasing noise impact on its residents.*

- *It takes land from the floodplain and runs too close to the river.*
- *There is no clear cycleway route- the existing road at the Eastern end is on the wrong side of the new road to readily serve as a cycle link with cycle movements to and from the old A47 road into Ailsworth/ Castor and points east.*

25.3.18 They were strongly supportive of Option 3 for the following reasons:

- *The route takes noise impact further away from Sutton than the other options.*
- *It offers options for linking in side roads safely, preserving The Drift as an access point and utilising the existing surface for some local traffic movements.*
- *It offers the opportunity to utilising the existing road surface for cycles.*
- *Running on the south side of the new road, the cycleway could pass through the truck stop and beneath the A1 into Wansford, providing a safe and inexpensive link to points west.*
- *It is a better route in relation to the flood-plain*
- *Some woodland can be retained to screen the road.*

25.3.19 They had the following concerns:

- *Apart from the slip road from the A1 no proposals are shown to address the problems of long tailbacks which occur during peak times in both directions on the A47 itself.*
- *The future of the Buildings of Local Importance (the old station building and Heath House, the former station masters house) and we urge that impact on them is minimised and efforts made to retain them. If directly affected they would like to see their being resited nearby. Failing that, at least a comprehensive photographic survey should be undertaken and made publically available as an historic record.*
- *The existing truck stop is notorious locally as a major centre for open-air sexual behaviour. This gives rise to problems of litter and unexpected and embarrassing confrontations for families taking an innocent walk on the Nene Way. They urge that it be closed as part of this project. This would enable its vehicular access to the A47 to be closed off and the strategic cycleway link into the Northamptonshire countryside taken through it and under the A1 into Wansford. It would also enable the section of the long-distance footpath The Nene Way which passes through the truck-stop to be used again, rather than avoided.*

Wansford Parish Council

25.3.20 Their views were:

- *Considering the three options presented, WPC prefers Option 3 as it fits best with the needs of the local community. Option 1 would be impossibly disruptive during construction and Option 2 does not seem to bring any advantages while causing almost as much disruption as Option 1.*
- *The A47/A1 junctions need careful consideration to alleviate the morning and evening traffic congestion and allow free flow of vehicles.*
- *There are resident's suggestions of changing the Wansford northbound access of the Old North Road into the A47 western roundabout, and this would solve "rat running" issues within the village, also maybe allowing dual carriageway status of the A47 over the A1 flyover, again improving traffic flow.*
- *They state the vital features to be included in any scheme are:*
 - *A proper examination and upgrading of both the roundabouts on the A1/A47 junction and the road that links them.*

- *Provision of a good access into Sacrewell Mill.*
- *Retaining the Sutton Heath Road connection.*
- *Provision of a cycle route linking Wansford to Castor and the Peterborough Green Wheel network.*

Cycling Groups

Cycling UK and Peterborough

25.3.21 *Whilst this work is being carried out it would be of great advantage to cyclists if a dedicated cycle track alongside the A47 be constructed to improve/facilitate a route from Peterborough to the countryside west of the A1. The A1 forms a barrier for cyclists endeavouring to access areas to the west.*

25.3.22 They have not expressed a preference to any of the options and remain neutral.

Fenland Cycling Club

25.3.23 *All Peterborough Cycling clubs use this stretch of the A47 as the only way to the vast area accessed through Wansford as well as casual cyclists and cycle commuters who also take their lives into their own hand using this route as there is no foot/cycle path to Wansford.*

25.3.24 They were neutral to Option 1, somewhat in favour of Option 2 and strongly in favour of Option 3.

Peterborough Cycle West

25.3.25 They would support any improvements to the A47 that also made better and safer provision for cyclists to travel directly from Peterborough to Wansford. They state *the present road is simply not suitable for cyclists and to make major changes without also considering their needs would not be advisable.* They believe that any improved cycle route alongside the new A47 would complement their chosen route rather than replace it.

25.3.26 They would not support Option 1 *as using the line of the existing road would create major difficulties during the construction phase. It would also mean there was no readily available route alongside the new carriageway that could be used by cyclists or as a local 'feeder road'.*

25.3.27 They stated *both options 2 and 3, by building a new carriage way that is separate from the existing road, would presumably present fewer difficulties at the construction phase. It would also mean that the existing road could possibly become a 'feeder road' for local traffic from Sutton and the Sutton Heath road as well as a ready-made cycle route.*

25.3.28 Their preference would be to support Option 3 for the A47, *as it offers the best possibility of using the 'old road' as a cycle route and / or a local feeder road. If it were to be a feeder road as well as a cycle route, then certain measures would have to be taken to safeguard it for cyclists.*

Yaxley Riders

25.3.29 They state *it is a very dangerous route for cyclists with no easy alternative to access the attractive cycling country to the West of the A1. Dualling of the road could easily incorporate a high-quality cycle path at little extra cost.*

25.3.30 *This would be an ideal opportunity to provide a safe route for cyclists (as well as walkers and horses) between Sutton and Upton to Wansford and the attractive countryside and villages to the West of the A1.*

25.3.31 One user said he regularly use this stretch of road to cycle on as it is the only link to the west that crosses the A1 from Peterborough. *There needs to be a cycle path incorporated into the upgrade to make this deadly stretch of road safer for cyclists in the area.*

Land Owners with Substantial Landholdings/Tenants

Homes and Communities Agency (HCA)

25.3.32 The HCA supported the principle of the upgrading of this section of the A47 but was concerned that one option in particular (Option 3) had a material impact on its proposal for its land to be allocated in the review of Peterborough's local plan. The HCA would wish to see an improvement scheme that minimises the impact on its western landholding so that it can meet its responsibility of increasing the number of new homes that are built in England. They were most supportive of Option 2.

25.3.33 They supported the free flow lane from the A1 southbound but were concerned about locations and form of junctions on the scheme.

25.3.34 In terms of potential loss of land, a roundabout rather than a grade separated interchange, would be preferable to the HCA. When looking at the options for the form of this junction the HCA would request that, if taking land owned by it, consideration is given to the potential traffic generation of the land uses being promoted.

Milton Peterborough Estates Company & Leyland BT

25.3.35 They would like to see plans for the road junctions at Sutton Heath and The Drift.

25.3.36 They were concerned about:

- Disruption during construction for Option 1.
- Option 2 going through county wildlife site.
- Option 3 going through a scheduled monument and being closer to the SSSI but recognised it would be easier to construct as offline.

25.3.37 Based on level of disruption and topography Option 2 would be their preferred route.

Processors and Growers Research Organisation (PGRO)

25.3.38 At key parts of the day the A1/A47 junction regularly causes traffic congestion past their business premises entrance on the south bound carriageway of the A1. The main entrance and exit to their premises are directly on the side of the A1 south bound just 600m from the exit slip road for the A47. The backing up of traffic past their entrance makes access even more hazardous.

25.3.39 They were neutral about any of the proposed routes as they all have the same impact on their main concern. The main access to their premises is directly onto the south bound A1 and is just 600m north of the existing A47 junction.

25.3.40 They stated the entrance was poorly provided for with only a very short slip road, making entry into the fast-moving traffic of the A1 a potentially serious hazard.

25.3.41 They stated *all of the proposed routes seem to indicate a new fast exit is proposed from the A1 to the newly dualled A47, bringing the start of the exit even closer to our current entrance. This will make exit onto the A1 south increasingly hazardous and a major safety issues than normal.*

25.3.42 The concluded by saying the scheme was required but something must be done to ensure the hazards for entry and exit to the main premises of PGRO and Riverford Organics are not increased.

The William Scott Abbott Trust and Sacrewell Farm Ltd

25.3.43 The William Scott Abbott Trust (WSAT) is a charity founded in 1964, established with the aim of providing farming and countryside education to people of all ages; Sacrewell is the public face of the charity receiving over 113,000 visitors in 2016.

25.3.44 They state; *Safety of visitors, staff and tenants using the site access is an absolute priority for the trustees, along with minimal disruption and site restoration. Sacrewell has been inhabited since the Bronze Age and it is therefore also a priority for the trustees that the new road scheme should not disturb the environment, heritage or ecosystems on the site. As a charity, the WSAT is clear that the new road layout should not bring with it additional burdens in terms of pollution (light, sound, vibration, gasses, road run off) or further islands; the WSAT seeks to divest ownership of islands of land within the existing junction at Wansford.*

25.3.45 They stated that any new scheme must take into account accessibility of HGV's, double decker buses/coaches, large agricultural machinery, caravans and NMUs.

25.3.46 They were somewhat in favour of Option 2, somewhat against Option 3 and neutral to Option 1.

Summary of Key Stakeholder Responses

Table 25-1 summarises option preference of key stakeholders.

Table 25-1 Key Stakeholder Option Preference

Key Stakeholder	Opinion on need for Improvements	View on Option 1	View on Option 2	View on Option 3
Barnack Parish Council	Not answered	Preferred	Difficult to say without junction detail	Difficult to say without junction detail
Cambridgeshire Constabulary	Yes	Strong Preference	Neutral	Neutral
Cambridgeshire County Council	Yes	No preference expressed		
Campaign to Protect Rural England (CPRE) Cambridgeshire and Peterborough	Not answered	Reject all 3 options		
Peterborough City Council	Yes	Strongly in favour	Strongly in favour	Strongly in favour
Sutton Parish Council	Yes	Strongly against	Strongly against	Strongly supportive
Wansford Parish Council	Yes	Against	Against	Preferred
Cycling UK and Peterborough	Yes	Neutral	Neutral	Neutral
Fenland Cycling Club	Yes	Neutral	Somewhat in favour	Strongly in favour
Peterborough Cycle West	Not answered	Not supportive	Difficulties in constructing to south	Preferred
Homes and Communities Agency (HCA)	Yes	Supportive	Most supportive	Least supportive
Milton Peterborough Estates Company & Leyland BT	Not answered	Difficult to say without junction detail	Preferred	Difficult to say without junction detail
Processors and Growers Research Organisation (PGRO)	Yes	Neutral	Neutral	Neutral
The William Scott Abbott Trust and Sacrewell Farm Ltd	Yes	Neutral	Somewhat in favour	Somewhat against
Yaxley Riders	Yes	Somewhat in favour	Strongly in favour	Neutral

25.4 Main Response Themes

Safety Issues

25.4.1 A lot of respondents raised concerns regarding safety issues for NMUs along the current A47. Wansford and Sutton Parish Councils both argued that the road between their villages is too

dangerous for use by NMUs, with fast traffic and poor facilities for those not in a vehicle. These respondents believe that adequate provision must be made for NMUs to ensure their safety along these stretches of the A47. Several respondents suggested that if either Option 2 or 3 are chosen, then the old A47 route could be used exclusively for NMUs and local traffic, which would be much safer for these groups, separating them from the dual carriageway. A few respondents suggested implementing safe crossing points and dedicated bridleways for NMUs to ensure their safety.

25.4.2 Several respondents raised concerns regarding the safety of the proposed development, specifically when joining or leaving the main road onto a slip road. They felt that the elimination of congestion and the subsequent speeding up of traffic will make any turns off and onto the A47 or A1 extremely hazardous. The Processors and Growers Research Organisation argued that a fast exit from the A1 onto the A47 will directly impact on the safety of the entrance to their site.

25.4.3 A few respondents opposed provision for NMUs on the basis that they do not believe it would be possible to remove safety risks from merging NMU travel and a dual carriageway. They believe that such a compromise would remain dangerous and should therefore not be considered. A few of these respondents argued that there are already recreational routes for pedestrians, equestrians and cyclists, so by improving these, NMUs will have no need to travel on the A47.

Issues at A1/A47 Roundabout

25.4.4 This junction causes issues in the morning and evening peak with tail backs onto the A1. The whole junction needs looking at, not just the Eastern roundabout to solve rat running issues and congestion.

Issues with turning in and out of Local roads.

25.4.5 Access into Sacrewell Farm and the fuel station is dangerous particularly when turning right.

25.4.6 Turning in and out of Sutton Heath Road and The Drift is dangerous with near misses and accidents occurring.

Issues at Sutton Roundabout

25.4.7 Travelling east to west during peak time there are issues as the dual carriageway on the approach to Sutton roundabout becomes single carriageway causing long tailbacks.

Lack of Safe Cycling Route

25.4.8 There are a large number of cyclists in the area and they emphasise the need for a safe cycling route along this stretch.

25.4.9 Many respondents argued that provision should be made especially for cyclists as part of the proposed scheme. They argued that as it stands, the current A47 is a major hazard for cyclists, comprising of high speed vehicles, multiple corners and narrow pinch points. As such, Yaxley Riders, Fenland Clarion Cycling Club, Peterborough Cycle West and several other respondents argued that a safe cycle path should be installed at the same time the A47 is developed. They hope that this will keep cyclists safe and separate from the busy traffic on the new dual carriageway.

25.4.10 Several respondents opposed the implementation of Option 1, as they believe that it will not provide any advantages to cyclists during the dualling of the road. They argued that if Option 1 was selected, a separate, safe cycle path will have to be constructed alongside the new A47 to ensure the safety of cyclists. Sutton Parish Council was among those who raised concerns regarding Option 2, as they believed cycle access to the new or old road will both be limited.

25.4.11 Option 3 was the popular choice amongst respondents when providing for cyclists, as several respondents argued that it would 'create favourable conditions for incorporating a cycle way'. Peterborough Cycle West and Sutton Parish Council both suggested using the old A47 as a route for cyclists alongside the new A47. They believe that this would be significantly safer after traffic had been reduced and provide the ideal corridor in between Sutton and Wansford.

Pedestrians

25.4.12 Several respondents supported provision being included in the proposals for pedestrian's access and amenity. They felt that pedestrian access should be extended from Sutton to Wansford, increasing the possibilities for all walkers and encouraging recreational pedestrians. Several respondents argued that at present, amenities for walkers have been lost as traffic along the A47 and the lack of accessible footpaths have restricted pedestrian's options.

25.4.13 Some respondents expressed their support for Options 2 and 3, as they see their construction as an opportunity to use the old A47 as a footpath. They believe these options will provide pedestrians with a pleasant walkway connecting Wansford and Sutton, whereas Option 1 offers no such amenity. A few respondents opposed Option 2 as they believe that its position will threaten the peaceful River Nene footpath, spoiling one of the few remaining footpaths in the area.

25.4.14 A few respondents opposed any provision for pedestrians during the development of the scheme, as they do not believe that pedestrians should mix with vehicles on a fast-dual carriageway. These respondents argued further that the benefits for walkers are not worth the perceived environmental damage brought about by such a development.

Public Transport

25.4.15 A few respondents suggested that the provision of public transport should be vital to the ongoing development of the scheme. One of the primary reasons Sutton Parish Council opposed the selection of Option 1 was their belief that this will constrain bus access through The Drift and into Sutton. Option 3, on the other hand, was praised for providing better accessibility to Sutton and Sacrewell Farm by bus. Wansford Parish Council and a few other respondents suggested the bus service needs to serve Sacrewell Farm or have a bus only access onto the Old North Road to ensure that NMUs can still access public paths, bridleways and amenities.

Environment and Heritage

25.4.16 Many respondents who commented generally on the proposals raised concerns regarding their impact on the environment of the local areas between Wansford and Sutton and along the A1, (for example Sacrewell Farm and properties on Windgate Way and Stibbington), arguing that the noise levels along the A47 and around the surrounding properties would increase significantly with a rise to four lanes of traffic. A greater number of vehicles travelling at a greater speed would, in their view, make the noise levels in the local area intolerable. Some argued that the impact of four lanes of traffic on the visual landscape of the area would be significantly increased.

25.4.17 Campaign to Protect Rural England and some members of the public were concerned that the expansion of the road network will encourage more car dependant developments such as business parks and retail centres in the area, blighting their countryside.

25.4.18 A few respondents, including Peterborough City Council, raised concerns regarding the impact of the proposed development on heritage sites in the area, saying that they do not believe that buildings of local importance and character should be sacrificed to make way for this development.

25.4.19 With regards to the whole development, several respondents objected to the proposals as they felt that the land take is significant and that Highways England must minimise the impact of the scheme upon local land. The HCA suggested this should be done by constructing a roundabout, instead of a grade separated interchange.

Equestrians

25.4.20 Several respondents suggested that provision for equestrians must be included in the proposals, primarily due to the number of horses they see being ridden around the area. These respondents argued that stables exist on either side of the A47 meaning that equestrians must be allowed to cross and travel safely. A few respondents supported either Options 2 or 3 as they believed that equestrians will be able to use the old A47 once the new road has been constructed.

25.4.21 Some respondents expressed concerns about any provision for equestrians to be provided at all. They argued that equestrians should not be permitted to travel on the A47 at all, as they consider it to be far too dangerous on a busy road with significant HGV traffic.

Socio-Economic

25.4.22 Some respondents raised concerns regarding the developments impact on the local residents and their villages and communities. They argued that any disruption to local roads would have a massive impact on local villages, causing rat runs to develop through previously peaceful village centres and cutting off access to local amenities for residents, such as the doctor's surgery and local shops.

25.4.23 Some respondents expressed concerns regarding the impact on the local economy that these proposals may have. Wansford Parish Council believe that construction may cut off access to local tourist attractions and amenities such as Burghley Park, where key events are held.

Traffic/Congestion

25.4.24 Several respondents, including Barnack Parish Council, raised concerns that the current A47 will be inaccessible during construction, leading to significant delays and congestion. They fear this could lead to rat runs developing through local villages, creating bottle necks in country lanes. A few respondents expressed further concerns that increased capacity will encourage more traffic overall rather than addressing problems.

25.5 How Responses were taken Forward

25.5.1 The responses, and suggestions made by the public were used and considered as part of the PCF Stage 2 assessment work and during the preferred route selection process (see Chapter 27).

26 Detailed Cost Estimate of Affordable Options (PCF Stage 2)

26.1 Introduction

26.1.1 Following the value management exercise undertaken early in PCF Stage 2, the three route options as described in Chapter 23 along with other background information was used by Highways England Commercial as a basis to produce the Options Estimate for the scheme. Refer to Chapter 17 for Options estimate process.

26.2 Summary of Estimate

26.2.1 The Range Estimates for the Proposed Scheme at PCF Stage 2, derived from the Order of Magnitude Estimate, are as detailed below in **Table 26-1** below. These were calculated as outturn costs.

Table 26-1: Option Estimates PCF Stage 2

Option:	Min (£M)	Most Likely (£M)	Maximum (£M)
Option 1	£58.24	£88.83	£141.30
Option 2	£54.42	£81.16	£129.45
Option 3	£51.53	£75.11	£127.40

26.2.2 Risk was assessed in several broad categories: those occurring within the PCF options and development phases, project overheads, method-related costs, roadworks, contractor fees and statutory undertakings, plus an allowance for non-recoverable VAT.

26.2.3 Uncertainty adjustments were applied to agent and contractor fees and for the purpose of statutory undertakings as it may be necessary to perform additional studies and undertakings as the project progresses. Uncertainty adjustments are set to zero in the minimum cost scenario with increasing estimates for the most likely and maximum scenarios respectively.

26.2.4 Range Estimates for the Proposed Scheme at PCF Stage 1, derived from the Order of Magnitude Estimate, is as detailed below in **Table 26-2** below.

Table 26-2: Option Estimates PCF Stage 1

Option:	Min (£M)	Most Likely (£M)	Maximum (£M)
Option 3	85	113.75	159.87

26.2.5 The difference in estimated costs between PCF Stage 1 and PCF Stage 2 are largely due to the value management deep dive exercise carried out early in PCF Stage 2 detailed in Chapter 21 of this report and in the PCF Product 'Value Management Workshop Report', document reference A47 IMPS2-AMY-WS-ZZ-DO-J0041.

26.3 Derivation of Costs for Economic Assessment

26.3.1 The costs estimated by Highways England's commercial team in Table 26-1 were divided between those for preparation, supervision, works and lands and assigned to dates between the present and the scheme opening year of 2021. All sunk costs incurred in previous stages of the PCF have been excluded as per WebTAG Unit A1.2.

26.3.2 The cost and expenditure profile for each option is shown in **Table 26-3**. Construction costs were inflated to outturn costs using HE's construction-specific inflation projection and then rebased to 2010 values and prices using the GDP deflator series in the WebTAG Data Book.

Table 26-3: Estimated costs for Wansford to Sutton scheme at 2010 values and prices

Design option	Cost category	Total expenditure	Percentage of cost spent in				
			2017	2018	2019	2020	2021
Option 1	Preparation	£8,410,839	28.5%	27.3%	35.6%	8.5%	-
	Supervision	£1,595,205	-	-	-	54.6%	45.4%
	Works	£54,981,500	-	-	-	52.5%	47.5%
	Land	£3,761,292	-	-	-	100.0%	-
	Total	£68,748,836	3.5%	3.3%	4.4%	49.7%	39.1%
Option 2	Preparation	£8,348,323	33.4%	22.3%	38.2%	6.1%	-
	Supervision	£959,903	-	-	-	75.7%	24.3%
	Works	£51,314,098	-	-	-	68.2%	31.8%
	Land	£2,378,452	16.6%	-	-	83.4%	-
	Total	£63,000,776	5.1%	3.0%	5.1%	60.7%	26.3%
Option 3	Preparation	£8,108,507	33.6%	22.2%	38.1%	6.1%	-
	Supervision	£899,182	-	-	-	81.8%	18.2%
	Works	£46,726,802	-	-	-	74.2%	25.8%
	Land	£2,566,946	15.4%	-	-	84.6%	-
	Total	£58,301,437	33.6%	22.2%	38.1%	6.1%	-

26.3.3 Further information on the Economic Assessment of the three options is detailed in Chapter 29.

27 Preferred Route Decision Process

27.1 Introduction

27.1.1 Highways England undertook a more detailed programme review of PCF Stage 3 and determined that in order to meet the March 2020 start on site date that PCF Stage 3 work would need to commence in September 2017. To facilitate a September 2017 start of PCF Stage 3, the preferred route would need to be announced in mid-August 2017. In order to give sufficient time for internal Highways England governance, preparation of PRA leaflets and DfT reviews, a preferred route decision (PRD) would be needed by mid-June 2017.

27.1.2 The purpose of the PRD was to ensure all evidence available at the time was presented and discussed with all views aired and recorded, including expectations for Preferred Route Announcement. The outcome of the PRD was an unqualified decision on the preferred route.

27.1.3 Due to the timing of the PRD being part way through PCF Stage 2 all of the PCF Stage 2 information assessments and reporting were not available to inform the meeting. A list of PCF Stage 2 Products and their status was tabled and discussed. The table showed the status of each of the products which were complete, or incomplete including limitations. Refer to **Appendix N** – ‘Exceptions and Limitations Document’.

27.1.4 Complete PCF products included:

- Appraisal Specification Report (ASR);
- F10 Notification of Construction Project;
- Public Consultation Leaflet;
- Public Consultation Publicity Checklist; and
- Public Consultation Exhibition Checklist.

27.1.5 Where assessments were incomplete at the time of PRD, they were supplemented with PCF Stage 1 assessment information and/or qualitative assessments. The limitations and risks of making an early decision based on the available information were highlighted to the PRD workshop to allow an informed decision to be made.

27.2 Preferred Route Decision Workshop

27.2.1 Preferred Route Decision (PRD) Workshop took place on 15th June 2017. This was attended by senior representatives from Highways England, Amey and the PCF Stage 3 Supplier Mott MacDonald Sweco (MMS).

27.2.2 The minutes of the PRD meeting are included in **Appendix O**. The following information was presented at the PRD Workshop:

- Key Constraints
- Alignment to Highways England Strategic Objectives
- Transport Economics and Environmental Assessments via Appraisal Summary Table (AST)
- PIE Summary
- Buildability Analysis
- Key Risks and Opportunities

- Cost and BCR

27.3 Key Constraints

27.3.1 The key constraints are summarised below:

Environmental Constraints

- Scheduled Monument (cropmarks) to the north adjacent to existing carriageway and is a designated site.
- There are other cropmarks and potential heritage sites in the vicinity at the eastern end of the scheme to the north and south of the existing A47
- Sutton Heath and Bog SSSI to the north
- A number of County Wildlife sites alongside the A47
- River Nene to the south
- Number of Listed Buildings
- Areas of potential ecological importance
- Two noise important areas: one at the junction of the A47 and Sutton Heath Road and another At Wansford along the A1 from the dumb bell roundabout extending South to where the A1 crosses the river.

Engineering Constraints

- There are statutory undertakers in the existing verges (including fibre optics) and 11kV overhead lines in the area.
- Wansford Pumping Station at the western end of the scheme just south of the existing A47
- Pumping main (1800mm diameter) running directly north from the pumping station passing east of Sacrewell farm to a reservoir 14km to the north
- Ground Conditions – there is a risk of differential settlement of earthworks along the whole area south of the A47 around the River Nene. Ground Investigation is needed.
- Potential poor geotechnical conditions to the south with the potential for ground settlement during and post construction.

Existing Properties and Buildings

- Villages of Wansford to the west & Sutton to the south east
- Fuel Station to the south
- Picnic Area to the West
- 3 Properties of which 2 are directly accessed from the A47
- Sacrewell Farm and Country Centre – tourist attraction attracting over 100,000 visitors a year.

27.3.2 The scheduled monument is a key constraint and was discussed in more detail. National Policy Statement for National Networks (NPSNN) states:

“Substantial harm to or loss of designated assets of the highest significance, including World Heritage Sites, Scheduled Monuments, grade I and II* Listed Buildings, Registered Battlefields, and grade I and II* Registered Parks and Gardens should be wholly exceptional.”

27.3.3 In order for the route to go through the scheduled monument a wholly exceptional case would need to be demonstrated.

27.4 Alignment to Highways England Strategic Objectives

27.4.1 Each option was assessed against alignment with Highways England Delivery Outcomes:

- Managing the Network Safer
- Improving User Satisfaction
- Supporting the Smooth Flow of Traffic
- Encouraging Economic Growth
- Delivering Better Environmental Outcomes
- Helping Cyclists, Walkers and Other Vulnerable Users
- Achieving Real Efficiency
- Keeping the Network in Good Condition

27.4.2 The results are shown in **Table 27-1**.

Table 27-1 KPI Assessment

Option	Fit with wider transport and government objectives							
	Managing the network safer	Improving user satisfaction	Supporting the Smooth Flow of Traffic	Encouraging Economic Growth	Delivering better environmental outcomes	Helping cyclists, walkers and other vulnerable users	Achieving real efficiency	Keeping the Network in Good Condition
1	4	3	3	4	4	3	3	4
2	4	4	4	4	3	4	3	4
3	4	4	4	4	3	4	3	4

27.4.3 Options 2 and 3 performed marginally better than Option 1 for:

- Improved user satisfaction
- Supporting the smooth flow of traffic
- Helping cyclist, walkers and other vulnerable users

27.4.4 This is because Option 1 is online which would result in significant delays during construction. Options 2 and 3 are mostly off line so the existing route could be used for local access and NMUs.

27.4.5 Option 1 performed better for:

- Delivering better environmental outcomes as it has the least impact on designated sites.

27.4.6 The overall KPI assessment showed Option 1 to be marginally worse.

27.5 Traffic and Economic Assessment Pre-PRD

27.5.1 The proposed methodology involved two models covering different aspects of the scheme:

- The strategic model was being developed in SATURN and based upon the existing updated Peterborough Transport Model (PTM), developed to assess the scheme in the forecast years and derive transport and economic benefits. The SATURN model included the scheme extents as well as a wider area of influence covering parallel routes between the A1 and Peterborough, to capture additional trip attraction to the A47 corridor from parallel routes.
- The microsimulation model was being developed in S-Paramics to perform a detailed operational assessment of the scheme and to account for the fine geometrical differences between the scheme design options which could not be assessed in detail in a strategic model.

27.5.2 The Traffic assessment had not been completed when the PRD workshop took place. The calibration and validation of the SATURN Model was still progressing so the results for the PVB used to calculate the BCRs in Section 27.10 were based entirely upon the S-Paramics model.

27.6 Environmental Assessment Pre-PRD

27.6.1 A Draft version of the Environmental Assessment was prepared for PRD. It was based on information from PCF Stage 1, supplemented with available PCF Stage 2 surveys and assessments that had been completed up to PRD.

27.6.2 In the first instance the Environmental Assessments were used to complete the environmental sections of a Department of Transport WebTAG AST table. WebTAG assessment encompasses engineering, economic, accessibility and environmental; it utilises eight environmental categories as listed below in **Table 27-2**. Each of the environmental categories were assessed based on an estimated impact based on a seven point scale as follows:

- Large adverse
- Moderate adverse
- Slightly adverse
- Neutral
- Slightly beneficial
- Moderate Beneficial
- Large Beneficial

27.6.3 The results of the environmental assessment were rated for presentation at the PRD. The results are summarised in **Table 27-2** below:

Table 27-2 Environment Assessment Summary (7 point scale)

Environmental Category	Scheme Options		
	Option 1 Assessment	Option 2 Assessment	Option 3 Assessment
Noise	Slight adverse	Slight adverse	Slight adverse
Air	Neutral	Neutral	Slight adverse
Greenhouse Gases	Neutral	Neutral	Neutral
Landscape	Slight adverse	Moderate adverse	Moderate adverse
Townscape	Neutral	Neutral	Neutral
Historic	Moderate adverse	Slight adverse	Large adverse

Environment			
Biodiversity	Slight adverse	Moderate adverse	Large adverse
Water	Slight adverse	Moderate adverse	Slight adverse

- 27.6.4 The initial AST assessment presents Option 1 as the preferred environmental solution and Option 3 as the least preferred.
- 27.6.5 The AST used environmental topics from the Department of Transport guidance to provide the environmental input to the AST which includes engineering, economic and accessibility assessments. The DMRB topics are broader based for environmental assessment to capture topics not included in the WebTAG guidance.
- 27.6.6 The Environmental Assessment Report applies DMRB Chapter 11 guidance and the associated nine environmental topics listed in **Table 27-3**; these topics are broader and capture topics not included in the WebTAG guidance.
- 27.6.7 In addition to the AST, the Environmental Assessment Report utilising the environmental topics within the DMRB, also assessed and ranked each of the options per environmental topic to give a comparison between the options, which was R-Y-G rated with green being the most preferred option, yellow second preferred and red least preferred. The results are summarised in **Table 27-3**:

Table 27-3 Environment Assessment Summary (based on Rankings)

Environmental Category	Scheme Options		
	Option 1 Assessment	Option 2 Assessment	Option 3 Assessment
Air Quality	Green	Yellow	Red
Cultural Heritage	Yellow	Green	Red
Landscape and Visual	Green	Red	Yellow
Biodiversity	Green	Yellow	Red
Noise and Vibration	Grey	Grey	Grey
Road drainage and water	Green	Red	Yellow
People and communities	Green	Yellow	Red
Geology and soils	Green	Yellow	Red
Materials	Green	Yellow	Red

- 27.6.8 Utilising the environmental topics contained within the DRMB, the assessment completed within the Draft Environmental Assessment Report also identified that Option 1 was the preferred environmental solution and Option 3 was the least preferred.
- 27.6.9 Following discussion during the PRD meeting it was agreed that the Environmental Assessment summary based on the rankings within the Environmental Assessment Report was a better way of comparing the options for the PRD.

27.6.10 The following sections give a brief overview of the environmental assessments completed and briefly highlights any additional baseline information and any data limitations. For more detailed information the Draft Environmental Assessment Report should be referenced.

Air Quality

Methodology and Limitations

27.6.11 Due to a lack of traffic data the methodology used for the draft report only partially followed the 'simple' assessment level described in HA207/07. This was combined with the application of professional judgement to evaluate the pros and cons to determine an option ranking.

Baseline update

27.6.12 To characterise the baseline air quality in the local area, Highways England data from their monitoring programme, which encompasses the A1 and the area around Wansford to Sutton was utilised. The data showed that the background and roadside site concentrations were all under the annual mean NO₂ objective of 40µg/m³; and the concentrations of pollutants were worst in the vicinity of the A1.

27.6.13 The study area was refined from Stage 1 according to DMRB HA207/07 and encompasses only those receptors within 200m of the affected roads. **Table 27-4** below shows the air quality receptor counts used in the assessment for the existing and proposed alignments.

Table 27-4 Receptor Counts*

Receptor Type	Quantity			
	0-50m	50-100m	100-150m	150-200m
Existing	3	1	4	10
Option 1	3	4	12	27
Option 2	2	6	12	27
Option 3	3	9	19	28

* Receptors counts for air and noise vary slightly due to assessment method – refer to EAR for further information

Options Review and Preference

27.6.14 Option 1 was considered to be the preferred option with respect to local air quality primarily because the carriageway, which is proposed to be predominantly online, provides no reason to acquire properties and results in no unacceptable exposures to new or existing sensitive receptors.

27.6.15 Option 3 was the least favoured option because it would require the removal of Old Station House where a major adverse impact was predicted. Option 3 also provides the highest net route assessment because of an increase in the number of receptors which would be impacted in the bands 50-100m, 100-150m and 150-200m.

Cultural Heritage

Methodology and Limitations

27.6.16 The methodology adopted was in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2 'Cultural Heritage', HA 208/07 (Ref 7.1) and hence examined archaeological remains, historic buildings and historic landscapes.

27.6.17 A meeting was held with Historic England and Peterborough City Council on 10th May 2017. Due to the significant archaeological interest present in the study area an Archaeological Mitigation Strategy was agreed. This strategy included the completion of Geophysical Survey of the National Monument area and archaeological analysis of available Aerial Photography and LiDAR data across the study area. The full results and assessment of these surveys were not available for the Draft assessment.

Baseline update

27.6.18 During PCF Stage 2 a site walkover was completed and the critical features more clearly defined as follows:

27.6.19 National Monument (1006796 – Bronze Age cropmarks) was present to the north of the A47; there were also a number of other recorded cropmark sites throughout the study area especially in the east to the north of Sutton village.

27.6.20 Of the listed buildings, only those located within the grounds of Sacrewell Farm and Countryside Centre (Sacrewell farmhouse and the millhouse and stables) have the potential to be impacted through effect on setting. There were also a number of locally significant structures present including Old Station House and Heath House on Sutton Heath Road and the Old Railway bridge over which the A47 travels.

Options Review and Preference

27.6.21 Option 3 would cut through the Scheduled Monument having a major adverse impact and is contrary to the guidance in NPPF and NPSNN. It would also result in the demolition of Old Station House and has the potential to affect the setting of Sacrewell Millhouse. For this reason, it was the least preferred option. While option 1 is primarily online widening, at the time of writing it was considered possible that the widening could impact on the scheduled monument. It was also considered that Option 1 may result in the destruction of the Old Railway Bridge. Option 2 was the preferred option as it moves away from the majority of recorded interest; although as with the other options there would be some impact on unrecorded archaeological remains.

27.6.22 With regards to non-designated sites NSPNN states:

- “Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to Scheduled Monuments should be considered subject to the policies for designated heritage assets. The absence of designation for such heritage assets does not indicate lower significance.”
- “The Secretary of State should also consider the impacts on other non-designated heritage assets (as identified either through the development plan process by local authorities, including ‘local listing’, or through the nationally significant infrastructure project examination and decision making process) on the basis of clear evidence that the assets have a significance that merit consideration in that process, even though those assets are of lesser value than designated heritage assets”

Landscape and Visual

Methodology and Limitations

27.6.23 The description of the baseline and the assignment of sensitivities follow the headings and Tables of IAN 135/10.

27.6.24 A winter landscape survey was undertaken in March 2017 to gain better understanding of the landscape character and to assess viewpoints. No summer survey had been completed at the time of the Draft assessment.

Baseline update

27.6.25 The local landscape character is split between the Nene Valley and the Northern Wolds throughout which arable farmland and the River Nene dominates.

27.6.26 The visual baseline is described with regards views to and from viewpoints and receptors in the study area, in particular residential receptors, Sacrewell Farm and Countryside Centre and the PRoWs.

Options Review and Preference

27.6.27 Option 1 was the most preferred from a landscape point of view as it would affect the least number of receptors. As it is an online widening, there would be no significant change in the number of receptors affected by the widening compared to the existing conditions. With the offline sections of Options 2 and 3, this introduces new features into the landscape and potentially moves the road closer to receptors that currently have no or limited view of the road. Option 2 was the least preferred as it had the greatest potential landscape and visual effects and impacts the Nene Valley and associated PRoW.

Nature Conservation and Biodiversity

Methodology and Limitations

27.6.28 A desk top study and extensive field surveys were completed during Stage 2 to inform the preferred route assessment. Planned surveys included Phase 1, botany and protected/notable species including aquatic invertebrates (Desmoulins Whorl snail), White clawed Crayfish, Badgers, bats, Great crested Newts, otter/water vole and wintering birds.

27.6.29 The following surveys were incomplete at PRD: Aquatic invertebrates, bat roost assessment and botanical surveys within the SSSI and CWS. In addition, land access was refused at The Old Station House and Sutton Meadows CWS which prevented completion of the badger surveys and bat roost surveys.

Baseline update

27.6.30 The key survey findings noted up to this point included:

- Two buildings (Old Station House and Heath House) possessed very high bat roost potential; 12 trees possessed high bat roost potential;
- The wetland habitat within the SSSI had high potential for Desmoulins Whorl snail;
- There were 5 active badger setts present in the area;
- Both the Mill Stream and Wittering Brook returned extensive otter field signs; and
- There were no GCN, Water Vole or White-clawed Crayfish present and the area was not of significant interest for Wintering Birds.

Options Review and Preference

27.6.31 Option 3 ranked worst as it has a potential impact on the critical hydrology of the SSSI and the associated wetland habitats. It also had a direct impact on Old Station House and the surrounding woodland which had very high bat roost potential. Option 2 was ranked second due to the substantive impact on Sutton Meadows North CWS and Sutton Disused Railway CWS. Option 1 was preferred as it had least ecological effects being primarily online within this area of high nature conservation interest.

Noise and Vibration

Methodology and Limitations

27.6.32 As traffic data was not available the methodology utilised guidance, professional judgement and the information currently available. Potential changes in noise levels were estimated at representative receptors as either beneficial, no perceptible change or adverse.

Baseline update

27.6.33 Noise Sensitive receptors are receptors potentially sensitive to noise or vibration. They typically include dwellings, hospitals, community facilities and designated areas. **Table 27-5** shows the noise sensitive receptors in distance bands up to 600m from each of the options.

Table 27-5: Noise Sensitive Receptor Counts

Layout	Band						Total
	0-50m	50-100m	100-150m	150-200m	200-300m	300-600m	
Existing	2	1	4	10	30	210	257
Option 1	3	4	11	26	40	244	328
Option 2	1	6	11	26	40	244	328
Option 3	2	8	18	28	43	210	309

Options Review and Preference

27.6.34 Due to the similarity of each of the options and the lack of traffic data to allow noise modelling to be completed, it was not possible to differentiate between the options and no ranking was specified.

Road Drainage and Water

Methodology and Limitations

27.6.35 The assessment was undertaken in line with HD 45/09 – Road Drainage and Water Environment and included a desk study and a site walkover in February 2017. Due to lack of traffic data no HAWRAT assessment was completed.

Baseline update

27.6.36 The River Nene with Wittering Brook and Mill Stream form the significant surface water bodies. The Nene is recorded as having moderate Water Framework Directive (WFD) status whereas the two streams have good WFD status. There are a number of aquifers and groundwater water bodies present and there are a number of springs and wells recorded; for example, at Sacrewell Farm and Countryside centre.

27.6.37 The area experiences extensive flooding with areas around the Nene and the Wittering Brook being categorised as Flood Zone 2.

Options Review and Preference

27.6.38 Option 2 ranked worst as it has a greater percentage of the route alignment within the River Nene floodplain (Flood Zone 2). Option 2 and Option 3 also have a greater impact on Wittering Brook. Option 1 is preferred.

27.6.39 Option 1 ranked best and Option 3 second best.

People and Communities

Methodology and Limitations

27.6.40 The term 'people and communities' refers to the interactions of local people with community facilities, roads, infrastructure and land use. It looks at land use impacts, Non-motorised users and Journey amenity.

27.6.41 The assessment of impacts on agricultural land was restricted by lack of information on individual farm units and potential land take.

Baseline update

27.6.42 The key issue identified was the extensive coverage of PRoWs and the restriction within the local area caused by the lack of access for cyclists and pedestrians along this stretch of the A47. In terms of agricultural land, the area is almost exclusively grade 2 and 3 Arable farm land. The attraction and usage of Sacrewell Farm and Countryside centre was also noted.

Options Review and Preference

27.6.43 Option 3 was least preferred due to extent of severance of existing PRoW and Option 1 the most preferred.

27.6.44 Please note this assessment was not fully complete at this time and was incorrect. Section 30.10.13 details the conclusion after the full assessment which showed Option 3 to be the most preferred and Option 1 to be the least preferred. This difference in assessment is also picked up in Section 35.2.8 and had no impact on the PRD.

Geology and Soils

Methodology and Limitations

27.6.45 This assessment was undertaken in accordance with the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 11 Geology and Soils, 1993 (Ref 13.1) methods for a PCF Stage 2 assessment. At the time of writing, the earthworks volumes and land take areas were not available; thus, the impacts to geology and soils could not be fully understood.

Baseline update

27.6.46 Overall the local geology was not considered a significant constraint and there were no sources of contamination of substantive concern. The primary issue was the quality of the soil which is principally freely draining shallow lime-rich soil over chalk or limestone providing for very good agricultural land.

Options Review and Preference

27.6.47 Option 1 was considered the optimal route option, as the magnitude of its impact on the existing soil materials was minimal; however, the impacts on the soils and geology resource is considered similar across all three options to such an extent that it is considered that the weighting of this topic as a deciding factor should be minimised.

Materials

Methodology and Limitations

27.6.48 This section assesses the impacts associated with material use in the construction of the options as well as the handling and disposal of waste produced by construction works.

27.6.49 As the design is ongoing, it is not possible to quantify the use of materials in absolute terms at this stage, for example, tonnes of primary aggregate, concrete or steel required for the scheme. Similarly, the projected volumes of waste, excavated material or potential reuse of materials cannot be quantified at this stage.

Baseline update

27.6.50 The route options will require the procurement of quantities of aggregates, pavement, concrete and steel. Given the high quantities of these materials on the UK market (i.e. low scarcity), the sensitivity of the material resources for this scheme was considered low. The sensitivity of the waste infrastructure within the study area was considered low given the availability of waste management sites within 30km of the scheme (i.e. high waste management capacity).

Options Review and Preference

27.6.51 Option 1 was considered the optimal route option, as there is a potential to re-use existing materials and to reduce the procurement of finite construction materials. Option 2 was preferred over Option 3 as it was anticipated to generate less waste. Option 2 had a smaller total chainage than Option 3; thus, site clearance was expected to produce less waste. Earthwork estimations also indicated that Option 2 would result in smaller cut volumes.

27.6.52 It is important to note that the impacts on materials and waste infrastructure are anticipated to be neutral or slight adverse and therefore they are not considered significant.

Overall Environmental Ranking

27.6.53 The options ranked from most to least preferred based on environmental effects considered within the Draft Environmental Assessment Report are as follows:

- Option 1 – most preferred
- Option 2 – second preferred
- Option 3 – least preferred

27.7 PIE Summary

27.7.1 170 responses were received following Public Consultation. These are discussed in Chapter 25.

27.7.2 There was an overwhelming support for the scheme. There were 152 responses to the question:

“Do you think improvements are needed to the A47 Wansford to Sutton Route?”

27.7.3 Of these, 147 responded yes and 5 responded no.

- Option 3 was the most favoured option with 64 strongly in favour and 23 somewhat in favour.
- Option 1 was the second favoured option with 34 strongly in favour and 26 somewhat in favour.
- Option 2 was the least favoured option with 13 strongly in favour and 23 somewhat in favour.

Key Stakeholder Preference

27.7.4 There were mixed feelings from key stakeholders such as local councils and parishes, land owners and cycling groups – refer to Table 25.1 in Chapter 25 - Wansford Key Stakeholder Preferences. Overall Option 3 ranked better.

27.8 Buildability Analysis

27.8.1 High level overview of information provided by the Buildability contractor Taylor Woodrow is summarised below:

- Construction programs included in cost estimates were thought to be robust:
 - Option 1 – 18 months;
 - Option 2 – 16 months; and
 - Option 3 – 16 months.
- Option 3 had least issues for construction and traffic management as it is offline the entire length of the route, Option 1 had the most issues as it is online the entire length of the route.
- There were additional environmental issues for Option 2 (County Wildlife Sites) and Option 3 (Bronze age cropmarks). Flood risk assessment would be required early in PCF Sage 3 for Option 2.
- Option 1 had the greatest impact on SU's.

27.8.2 Overall Option 1 had the most issues with regards to Buildability.

27.9 Key Risks and Opportunities

Benefits & Opportunities

- Meets RIS commitment;
- A safe and serviceable network by reducing accidents;
- A more free-flowing network with more reliable journey times;
- Supports economic growth by increasing capacity;
- Improved accessibility for NMUs. Consultations have taken place with local cycling group;
- Opportunity to work with land owners.

Issues & Risks

- Line of Preferred Route – Potential objections from local residents & business users (including Petrol station);
- Proximity of Scheduled Monument and the possibility of archaeological finds in the area;
- River Nene close by;
- Sutton County Wildlife site adjacent to carriageway; and
- SSSI in the vicinity.

27.10 Cost and BCR

27.10.1 During PCF Stage 1 cost estimate was prepared for one option due to limited capacity within the Highways England Commercial Team. Option 3 was selected as being representative of the options being put forward into PCF Stage 2. The most likely cost for Option 3 was £113.75 million. This was in excess of the estimate undertaken for the DfT Feasibility Study (published in February 2015) which had a range estimate of £66m to £95m.

27.10.2 A scheme Value Management Deep Dive was carried out as detailed in Chapter 21 to reduce scheme costs via a series of value engineering workshops.

27.10.3 Draft Cost estimates received from HE Commercial just prior to PRD Workshop are shown in **Table 27-6**.

Table 27-6: Draft Cost Estimates

	Min £m	Most Likely £m	Max £m
Option 1	58.24	88.83	141.30
Option 2	54.42	81.16	129.45
Option 3	51.53	75.11	127.40

27.10.4 Option 3 was the cheapest, Option 2 was second and Option 1 was the most expensive.

27.10.5 Indicative BCRs were calculated using S-Paramics model and most likely costs.

27.10.6 The BCR results are shown in **Table 27-7**.

Table 27-7: Indicative BCR values using Paramics

Option	BCR Value
Option 1	3.34
Option 2	3.56
Option 3	3.80

27.10.7 Option 3 had the highest BCR followed by Option 2. Option 1 had the lowest BCR. The BCRs were expected to reduce for all options once construction delay modelling was taken into account.

27.10.8 For Option 1 the BCR was expected to reduce the most as it is online along the whole length of the route causing major disruption during construction.

27.11 Overall Assessment Summary at PRD

Alignment to Strategic Outcomes & KPIs

27.11.1 The high level strategic assessment of KPIs aligned to the Delivery Plan showed Options 2 and 3 to be marginally better than Option 1 as they have offline sections that could be used for NMUs and for local traffic during construction whereas Option 1 is online along the whole route.

AST comparison

27.11.2 The only real differentiation from the AST was within the environmental section. The AST showed Option 1 to be the best as it had the least impact on environment and designated sites and Option 3 the worst as it goes through the scheduled monument and has a potential impact on the SSSI.

27.11.3 In terms of the Environmental ranking the options ranked 1, 2, 3 in order of preference:

- Option 1 was the environmentally preferred option
- Option 2 was the second preferred option
- Option 3 was the least preferred option

Consultation Feed back

27.11.4 Option 3 was the most favoured option by the public as they welcomed the conversion of the old A47 route into a route for local traffic including cyclists. It was also felt this northerly option will take noise and air pollution away from Sutton and be at less of a risk from flooding.

27.11.5 Option 2 was the least favoured option as it was closer to the village of Sutton and to the river with higher risk of flooding. It also affects valuable wildlife habitat.

27.11.6 In terms of consultation feedback the options ranked 3, 1, 2 in order of preference:

- Option 3 was the preferred option based on consultation feedback
- Option 1 was the second preferred option
- Option 2 was the least preferred option

Buildability

27.11.7 Option 3 ranked best as it is offline, Option 2 ranked second and Option 1 ranked worst as it is online along the whole route:

- Option 3 was the preferred option for Buildability
- Option 2 was the second preferred option
- Option 1 was the least preferred option

Costs & BCR

27.11.8 Option 3 was cheapest and within RIS budget and had the highest BCR (based on Paramics model). Option 1 was the most expensive and had the lowest BCR. Option 2 was just above the RIS budget:

- Option 3 was the cheapest option with the highest BCR
- Option 2 was the second cheapest option
- Option 1 was the most expensive option with the lowest BCR

27.12 Preferred Route Decision

27.12.1 A discussion took place on the impact of going through the scheduled monument.

27.12.2 It was agreed that although the whole area was of archaeological interest, the scheduled monument was a designated site.

27.12.3 Although the full assessment of Geophysical surveys was not available, the survey confirmed and mapped the cropmarks, identifying seven ring-ditches of varying size. Hence the presence of significant archaeological remains within the scheduled monument could not be ruled out. There was a risk that Historic England would object to the route going through the scheduled monument as there were two other viable routes avoiding the scheduled monument with less impact on the designated site where the identified engineering and environmental issues can be resolved. Therefore, a wholly exceptional case for progressing with Option 3 could not be demonstrated. Option 3 was rejected on these grounds.

27.12.4 Option 1 was ruled out due to higher cost, VfM and potential delays due to construction/traffic management and lack of suitable diversionary routes.

27.12.5 Option 2 had the second highest BCR. It was just above the RIS budget cost.

27.12.6 There was still a risk of hitting archeological remains for Option 2 but the risk of doing so was less than Option 3 which is a designated scheduled monument.

27.12.7 It was agreed that Option 2 would be taken forward as the preferred route.

27.13 Preferred Route Viability

27.13.1 The pros and cons of each option is summarised in **Table 27-8** below:

Table 27-8: Pros and Cons of Options

Option no.	Pros	Cons
1	<ul style="list-style-type: none"> a) Has least impact on environment and designated sites 	<ul style="list-style-type: none"> a) Online so big impact during construction – no easy diversion routes. b) Highest cost c) Lowest indicative BCR
2	<ul style="list-style-type: none"> a) Moves away from scheduled monument b) Cost only slightly over from budget c) Good indicative BCR d) Sections of the existing route could be used for NMUs 	<ul style="list-style-type: none"> a) Goes through Sutton Meadows CWS. b) Route too close to river - to be re-aligned so it's closer to existing carriageway c) Requires demolition of the property "Deep Springs" d) Least preferred route by public
3	<ul style="list-style-type: none"> a) Completely offline so easier to construct b) Existing route could be used for NMUs c) Cheapest of the 3 options d) Best indicative BCR 	<ul style="list-style-type: none"> a) Goes through scheduled monument – cannot demonstrate "wholly exceptional case" b) Affects southernmost tip of SSSI c) Requires demolition of the property "Old Station House" which is of historic interest

27.13.2 At Public Consultation residents of Sutton expressed concern about Option 2 being closer to their village.

27.13.3 There were also concerns about the impact on the Sutton Meadows CWS and proximity to the river.

27.13.4 It was therefore agreed that the route was to be re-aligned as far north as possible to the existing A47 after passing online at the scheduled monument acknowledging that this would require demolition of the property Deep Springs.

27.13.5 The Preferred Route Alignment Drawing can be found in **Appendix P**.

27.14 Interim SGAR 2

27.14.1 Following the PRD meeting an Interim Stage Gate Review was held to confirm the status of the scheme.

27.14.2 The Interim SGAR acknowledged the risk of making the Preferred Route Announcement (PRA) prior to the completion of the assessment work but concluded that the level of risk was acceptable and risk was sufficiently mitigated by the initial assessments made.

27.14.3 It was confirmed that the PCF Stage 2 Reporting should be concluded. Highways England confirmed that PCF Stage 2 environmental, transport and economic assessments should be completed and written up within transportation, economics and environmental reports and these to be summarised within the Scheme Assessment Report to verify the PRA decision. These completed assessments are presented in the following chapters:

- Chapter 28 Transportation Assessment
- Chapter 29 Economic Assessment
- Chapter 30 Environmental Assessment
- Chapter 31 Additional Assessment of Public Consultation
- Chapter 33 Appraisal Summary Tables

27.14.4 The above completed assessments will then be used to confirm and validate the assessments prepared for PRD.

27.14.5 Highways England requested the PCF Stage 3 supplier to start developing the scheme based on the PRA.

28 Traffic Analysis

28.1 Introduction

28.1.1 The option layouts for Options 1, 2 and 3 with indicative junction and side road layouts tested in the traffic model are included in Appendix M.

28.1.2 A legacy version of the PTM was used in the PCF Stage 1 assessment of the scheme. There were limitations to the use of this model but following proportionality of assessment, it was deemed suitable for a PCF Stage 1 assessment. Full details of the use of the model and its limitations are described in Chapter 12.

28.1.3 The PTM was independently revalidated by PCC to a 2016 base year in advance of PCF Stage 2. The accuracy of traffic flow data was significantly improved, however some changes to the road network such as the signalisation of Wansford East roundabout were not included, nor was the level of detail on the A47 Wansford to Sutton corridor increased. Origin-destination behaviour was not adjusted during the revalidation.

28.1.4 As the revalidated PTM failed to address some of the issues regarding the Stage 1 assessment, to improve the quality of assessment for PCF Stage 2 two new models were specified:

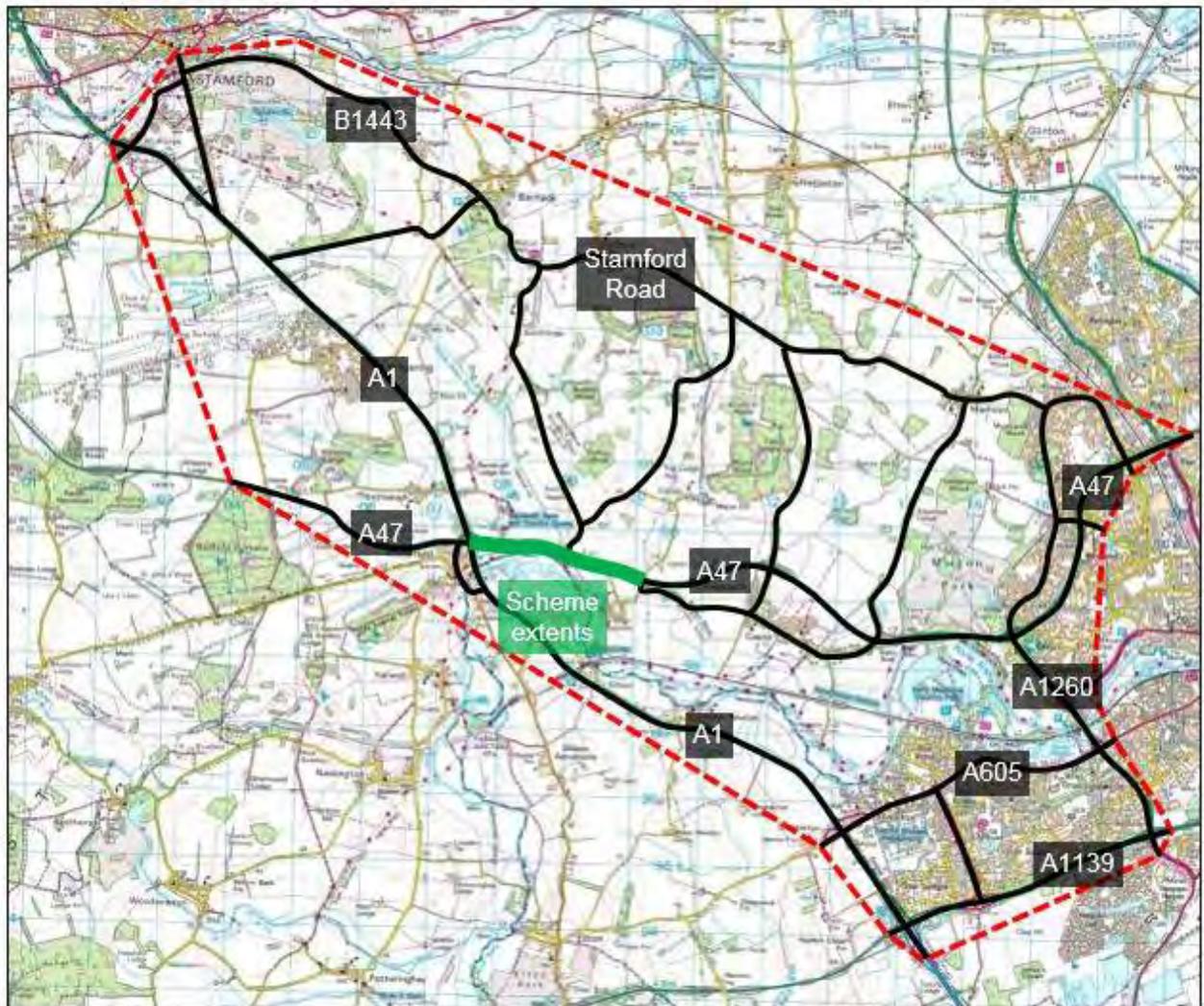
- A strategic model in SATURN to determine re-routing within the network;
- A microsimulation model in S-Paramics to assess the operational effectiveness of the scheme, the interaction between the junctions, and to test the impact of construction and operational maintenance over the lifetime of the scheme.

28.2 Modelling Approach - SATURN

Traffic Network

28.2.1 The Stage 2 SATURN model was constructed using the revalidated PTM as a template. An area of influence was first defined using the revalidated PTM, which showed that with scheme implemented changes in traffic levels were observed in an area of rural west Peterborough approximately bounded by the A1, B1443, Stamford Road, A47 Soke Parkway, A1260 Nene Parkway and A1139 Fletton Parkway as shown in **Figure 28-1**. This forms the scheme's area of influence.

Figure 28-1: Wansford to Sutton scheme Area of Influence



28.2.2 The scheme did not result in significant traffic effects in central Peterborough. This area does not form part of the area of influence and was excluded from the model extents.

28.2.3 After cordoning the model to the area shown in Figure 28-1, changes were made to improve the model's simulation capability particularly in the Wansford to Sutton area:

- The Sacrewell Farm access junction was included with new zone connectors for both the farm park and the picnic area to the south of the junction;
- The junction with The Drift was included, as has The Drift itself between the A47 and the existing zone connector representing Sutton;
- A more detailed representation of Wansford East roundabout was included, with the roundabout signalised in the AM peak and lane behaviour accurately defined;
- A zone was added to represent traffic entering Wansford from Yarwell Road, a route which attracts a significant volume of local traffic to the A1/A47 junction from the south-west.
- Zones in the Orton urban extension were rationalised so that one represents each exit from a junction on the A605 Oundle Road or A1139 Fletton Parkway;
- Zones in the Bretton area were rationalised in a similar manner, such that each exit from Bretton Way is modelled as a single zone;

28.2.4 The resultant model structure is shown in **Figure 28-2**.

Figure 28-2: Strategic model link structure



Traffic Data

28.2.5 In addition to the traffic counts described in Chapter 12, the traffic counts procured by PCC for use in the revalidation of the PTM were made available at PCF Stage 2. 110 MCCs were performed of which 27 fell within or on the periphery of scheme's area of influence. The locations of these counts are shown in **Figure 28-3** and listed in **Table 28-1**.

Table 28-1: MCCs Procured by PCC within Scheme's Area of Influence

MCC	Junction Arms
6	A47 Soke Parkway, A15 Bourges Boulevard and A15 Lincoln Road
15	A47 Soke Parkway and Bretton Gate
16	A47 Soke Parkway, A1260 Nene Parkway, Bretton Way and Thorpe Wood
17	Bretton Way, Bretton Gate, Katharine Way and Rightwell East
18	Bretton Way and Flaxland
19	Bretton Way and Barnstock
20	Bretton Way, Mowbray Road, Oxclose and Mewburn
21	Bretton Way, Norburn and Wedgwood Way
27	A1179 Longthorpe Parkway, Thorpe Road and Thorpe Meadows
28	A1260 Nene Parkway and A1179 Longthorpe Parkway

MCC	Junction Arms
33	Gresley Way, Bretton Gate and Saville Way
34	Gresley Way and Ivatt Way
36A	A605 Oundle Road and slip road from A1260 Nene Parkway southbound
36B	A605 Oundle Road and slip road to A1260 Nene Parkway northbound
37	A1260 Nene Parkway, Malborne Way and Morley Way
38	A1139 Fletton Parkway, A1260 Nene Parkway and A1260 The Serpentine
39	A1139 Fletton Parkway, Malborne Way, Goldhay Way and Nature Way
40	A1139 Fletton Parkway, A1139 Orton Parkway and New Road
41	A1(M), A1139 Fletton Parkway and A605
42	A605 Oundle Road and slip roads to northbound A1
43	A605 Oundle Road and slip roads to southbound A1
44	A605 Oundle Road and Lynch Wood
45	A605 Oundle Road, A1139 Orton Parkway, Lynch Wood and Wistow Way
46	A1139 Orton Parkway, Goldhay Way, Brimbles Way and Newcombe Way
47	A605 Oundle Road, Brimbles Way and Wistow Way
97	A47, Marholm Road and Love's Hill
98	A47, Old Peterborough Road and Nene Way
99A	A47 and slip roads to A1 southbound
99B	A47, slip roads to A1 northbound and A6118 Old North Road

Figure 28-3: MCCs Procured by PCC in 2014 and 2015 within Scheme's Area of Influence



28.2.6 Discrepancies were identified between MCCs procured by PCC shown in Figure 28-3 and the Stage 1 MCCs shown in Figure 12-2, in that the latter showed significantly lower traffic levels. The Wansford roundabouts, Sutton Heath Road junction and Sutton Roundabout were therefore re-surveyed for PCF Stage 2.

28.2.7 The MCCs procured by PCC covered the trunk and principal routes through the model. To improve the level of data available on minor routes, including the B1443 and Stamford Road route shown in **Figure 28-4**, additional MCCs were performed at PCF Stage 2.

Figure 28-4: Additional MCCs procured by Amey for PCF Stage 2 in 2016

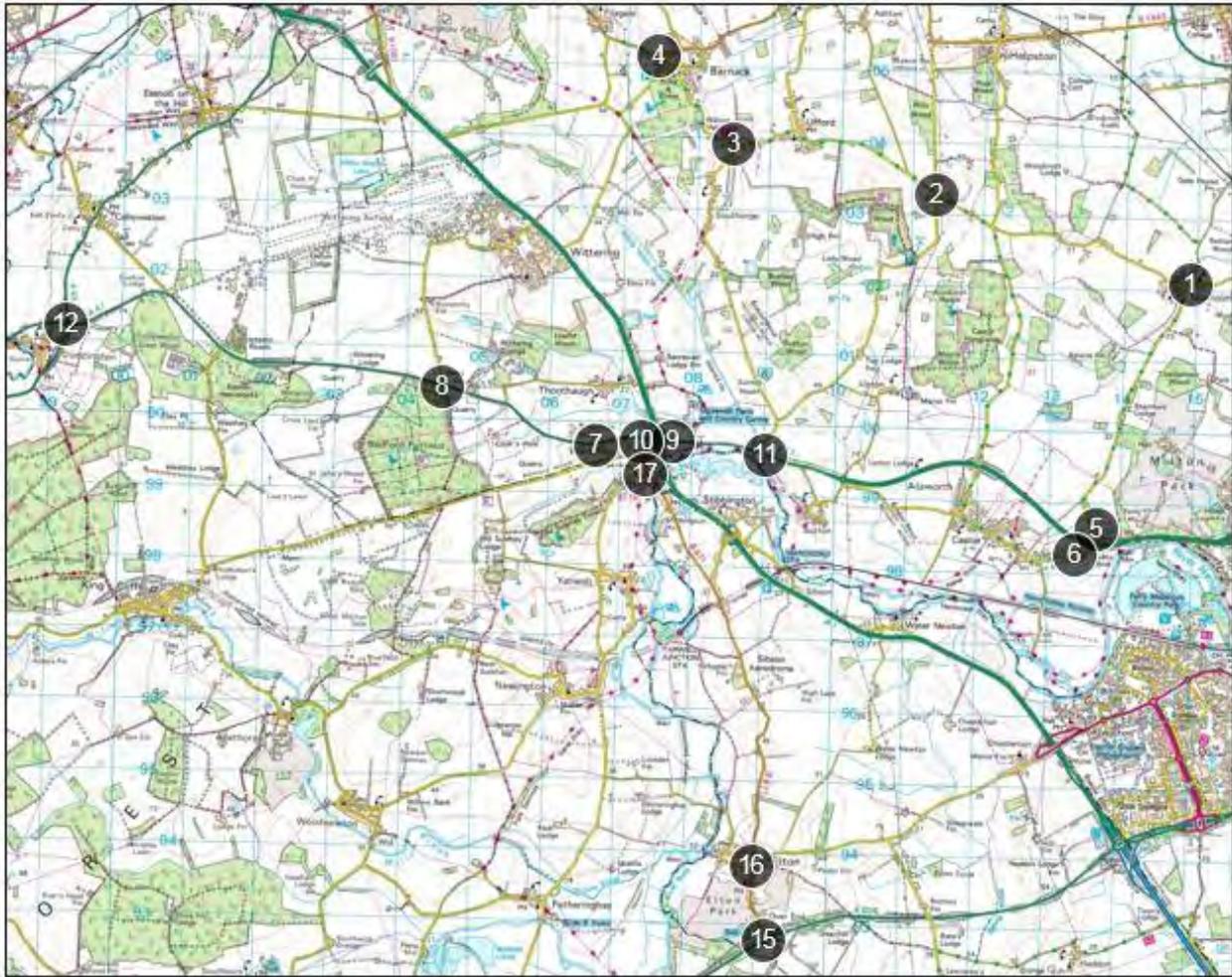


Table 28-2: Additional MCCs procured for PCF Stage 2

MCC	Location	Junction Arms
1	Marholm	Stamford Road, Walton Road, Castor Road and Woodcroft Road
2	South of Helpston	Stamford Road and Langley Bush Road
3	North of Southorpe	Walcot Road and Main Street
4	Barnack	B1443 Bainton Road and Stamford Road
5	East of Castor	Marholm Road and slip road to A47 eastbound
6	East of Castor	Love's Hill and slip road from A47 westbound
7	Wansford	A47 and Old Leicester Road
8	South of Wittering	A47 and Old Oundle Road
9	Wansford	A47, slip roads to A1 northbound and A6118 Old North Road
10	Wansford	A47 and slip roads to A1 southbound
11	South of Southorpe	A47 and Sutton Heath Road
12	Duddington	A47 and A43
15	South of Elton	A605 and B671 Overend
16	Elton	B671 Overend and Oundle Road
17	Wansford	A6118 Old North Road, Peterborough Road and Old Leicester Road

Time Periods

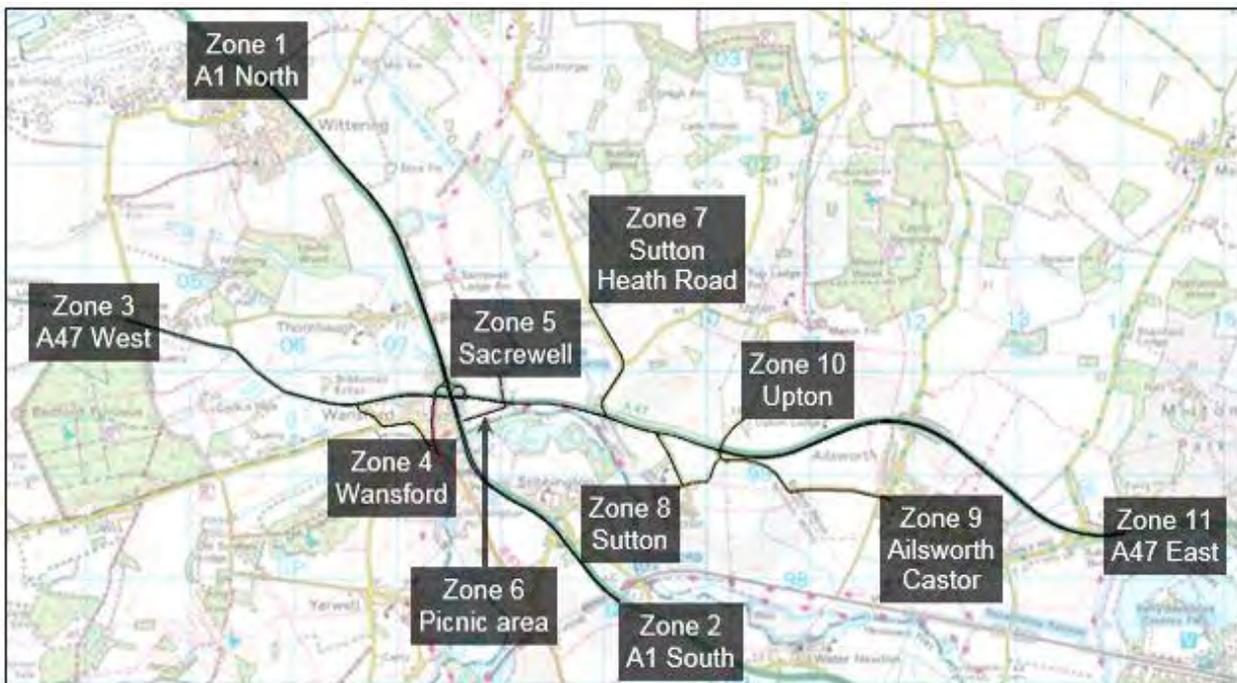
28.2.8 The time periods modelled in the PTM were adjusted to reflect the periods of greatest traffic flow on the A1 and A47 within the scheme's area of influence:

- AM peak hour: 07:30 to 08:30;
- Interpeak hour: 13:00 to 14:00;
- PM peak hour: 16:30 to 17:30.

28.3 Modelling Approach – S-Paramics

28.3.1 The S-Paramics model includes only the scheme extents and their immediate vicinity: the A47 from west of Wansford to east of Sutton and each of the roads its junctions (the A1, A6118, and accesses from other intermediate junctions) to a sufficient distance to accurately model the full length of queues. The link structure and locations of zone connectors in the model are shown in **Figure 28-5**:

Figure 28-5 Wansford to Sutton microsimulation model link structure



28.3.2 In S-Paramics each link was assigned a category representative of its width, speed limit and traffic behaviour. Each link and junction was aligned to match base mapping of the scheme extents with distance, curvature, stop line locations and relative heights considered. Lane selection behaviour was programmed to reflect road markings and local observations.

28.3.3 Junction capacities were modelled by adjusting their visibility and gap acceptance parameters to match observed conditions. The eastern roundabout at Wansford junction is currently signalised with operating hours and staging obtained from its traffic controller specification. A system has also been adopted that simulates the reverse priority behaviour observed at the junction with Sutton Heath Road.

Traffic Data

28.3.4 Traffic counts procured for the A47 between Wansford and Sutton in Stage 1 and Stage 2 were reused in the construction of the S-Paramics model.

Time Periods

28.3.5 The traffic demands in the S-Paramics model represent a 24-hour period on a typical weekday. For the purposes of segregating demands the model has been divided into the following time periods that match the standard time periods used in the TUBA economic modelling software:

- AM peak period: 07:00 to 10:00.
- Interpeak period: 10:00 to 16:00.
- PM peak period: 16:00 to 19:00.
- Off-peak period: 19:00 to 07:00.

Convergence

28.3.6 Ten runs of the full S-Paramics model were performed and the results from each averaged. This allows for any effects caused by variability in vehicle release and stochastic effects to be included while rendering reasonable averages for comparison.

Revised Modelling Approach

28.3.7 Following the PRD workshop, a revised modelling approach was agreed with Highways England Transport Planning Group (refer to Addendum 2 in ASR document reference A47-IMPS2-AMY-WS-ZZ-DO-J-0013).

28.3.8 The S-Paramics model offered a sufficient level of detail to test the effects of the scheme on the Wansford to Sutton corridor, including a detailed representation of the impact of the segregated left turn slip from the A1 southbound to the A47 westbound, a junction which is a source of significant congestion at present, as well as being able to differentiate between the scheme options in terms of link length and travel time, which was in turn used to inform the accident analysis in COBALT. The PTM, which was revalidated in February 2017 and upon which the SATURN modelling to this point had been based, was used to generate forecasts and traffic data which could be transferred to the S-Paramics model and generate an assessment sufficient for a PCF Stage 2 assessment of the scheme.

28.3.9 Therefore, it was agreed that microsimulation modelling, supported by the PTM, was sufficient for PCF Stage 2 analysis. S-Paramics outputted the journey distances, average travel times and vehicle demands required for an economic assessment in TUBA, and did so with more accuracy than SATURN as it differentiated travel times for different vehicle classes; for example, OGV1 and OGV2 vehicles were modelled explicitly with dynamics (e.g. acceleration, drag, inertia) appropriate for their bodies. Journey times were averaged from tens of thousands of individual vehicles and were therefore more representative of the stochastic differences between vehicles than predicted by SATURN.

28.4 Validation – SATURN

28.4.1 The validation was not completed due to the revised modelling approach as per Sections 28.3.7 to 28.3.9.

28.5 Validation – S-Paramics

Journey Times

28.5.1 The journey time path analysis has been constructed from six route sections, comprising the A47 and A1 roads throughout the model extents. Aggregation of the journey time data into longer routes compliant with WebTAG standards (at least 3 km in length) has been

performed, resulting in the formation of routes 7 and 8. The observed journey times are shown in **Figure 28-6** and the performance of the model against the WebTAG standards is in **Table 28-3**.

Figure 28-6: Observed journey times on A47 and A1

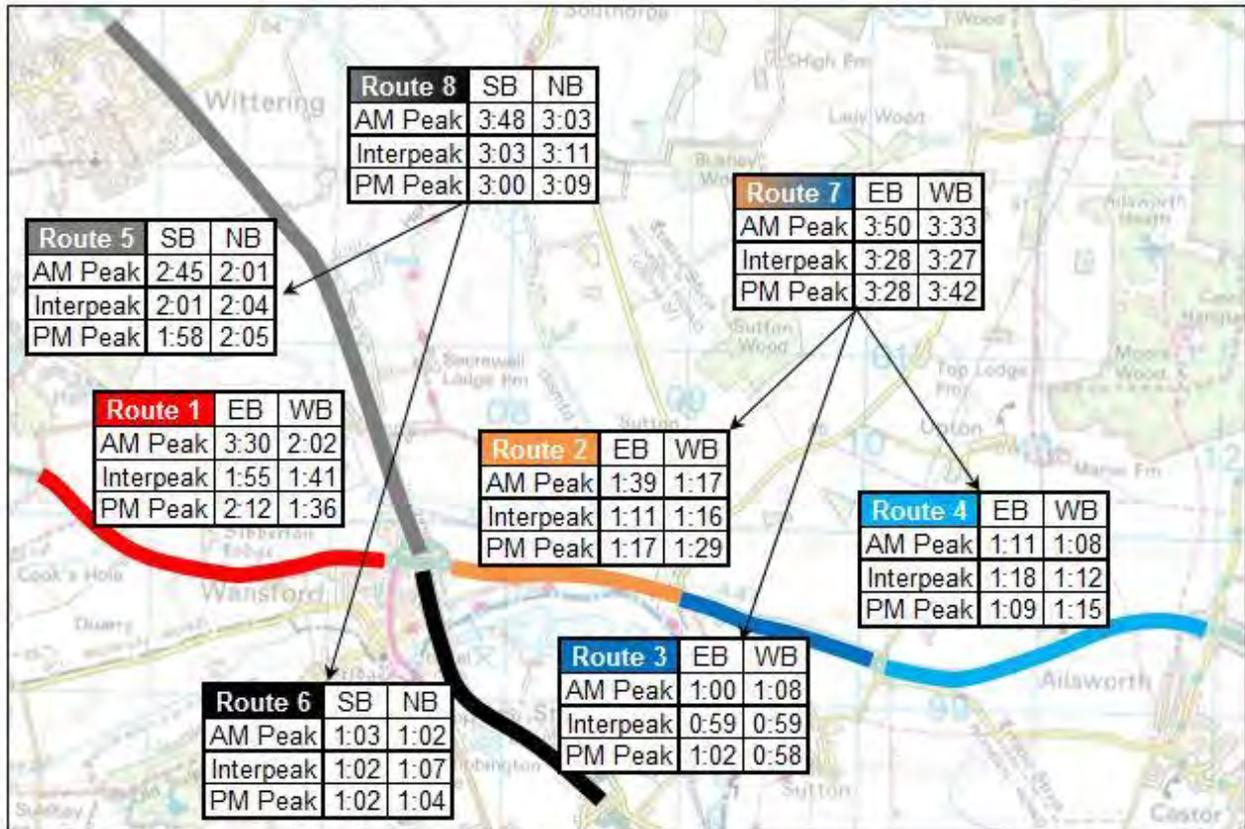


Table 28-3: Journey time validation results

Route	Length (km)	Direction	AM Peak				Interpeak				PM Peak			
			Observed	Modelled	Difference	Meets Criteria?	Observed	Modelled	Difference	Meets Criteria?	Observed	Modelled	Difference	Meets Criteria?
1	2.1	EB	3:30	3:21	-0:09	Yes	1:55	1:44	-0:11	Yes	2:12	2:32	+0:20	Yes
		WB	2:02	1:30	-0:32	Yes	1:41	1:31	-0:10	Yes	1:36	1:29	-0:07	Yes
2	1.4	EB	1:39	2:26	+0:47	Yes	1:11	0:57	-0:14	Yes	1:17	0:56	-0:21	Yes
		WB	1:17	1:09	-0:08	Yes	1:16	1:02	-0:14	Yes	1:29	1:15	-0:14	Yes
3	1.1	EB	1:00	0:55	-0:05	Yes	0:59	0:49	-0:10	Yes	1:02	0:48	-0:14	Yes
		WB	1:08	0:47	-0:21	Yes	0:59	0:47	-0:12	Yes	0:58	0:46	-0:12	Yes
4	1.9	EB	1:11	1:06	-0:05	Yes	1:18	1:08	-0:10	Yes	1:09	1:04	-0:05	Yes
		WB	1:08	1:13	+0:05	Yes	1:12	1:14	+0:02	Yes	1:15	1:30	+0:15	Yes
5	3.5	SB	2:45	2:59	+0:14	Yes	2:01	2:07	+0:06	Yes	1:58	2:13	+0:15	Yes
		NB	2:01	2:09	+0:08	Yes	2:04	2:16	+0:12	Yes	2:05	2:16	+0:11	Yes
6	1.9	SB	1:03	1:10	+0:07	Yes	1:02	1:12	+0:10	Yes	1:02	1:00	-0:02	Yes
		NB	1:02	1:04	+0:02	Yes	1:07	1:08	+0:01	Yes	1:04	1:07	+0:03	Yes

Route	Length (km)	Direction	AM Peak				Interpeak				PM Peak			
			Observed	Modelled	Difference	Meets Criteria?	Observed	Modelled	Difference	Meets Criteria?	Observed	Modelled	Difference	Meets Criteria?
7	4.4	EB	3:50	4:27	+0:37	Yes	3:28	3:04	-0:24	Yes	3:28	2:59	-0:29	Yes
		WB	3:33	3:09	-0:24	Yes	3:27	3:12	-0:15	Yes	3:42	3:38	-0:04	Yes
8	5.4	SB	3:48	4:09	+0:21	Yes	3:03	3:19	+0:16	Yes	3:00	3:13	+0:13	Yes
		NB	3:03	3:13	+0:10	Yes	3:11	3:26	+0:15	Yes	3:09	3:25	+0:16	Yes

Traffic Counts

28.5.2 The traffic counts were further validated against observed flows from the permanent ATC located on the A47 immediately west of Sutton Heath Road. The comparison of observed and modelled flows against the WebTAG criteria and the relative difference between them as measured using the GEH criteria is shown in **Table 28-4**.

Table 28-4: ATC validation results

	A47 eastbound							A47 westbound						
	Survey Data	Model Data	Difference	% Difference	Meets Criteria?	GEH	Meets Criteria?	Survey Data	Model Data	Difference	% Difference	Meets Criteria?	GEH	Meets Criteria?
07 to 08	1296	1130	-166	-12.8	Yes	4.8	Yes	781	689	-92	-11.8	Yes	3.4	Yes
08 to 09	1440	1476	36	2.5	Yes	0.9	Yes	757	784	27	3.6	Yes	1.0	Yes
09 to 10	1304	1363	59	4.5	Yes	1.6	Yes	644	667	23	3.6	Yes	0.9	Yes
10 to 11	989	972	-17	-1.7	Yes	0.5	Yes	553	615	62	11.2	Yes	2.6	Yes
11 to 12	789	775	-14	-1.8	Yes	0.5	Yes	649	708	59	9.1	Yes	2.3	Yes
12 to 13	597	642	45	7.5	Yes	1.8	Yes	650	735	85	13.1	Yes	3.2	Yes
13 to 14	730	747	17	2.3	Yes	0.6	Yes	748	708	-40	-5.3	Yes	1.5	Yes
14 to 15	717	728	11	1.5	Yes	0.4	Yes	788	761	-27	-3.4	Yes	1.0	Yes
15 to 16	806	804	-2	-0.2	Yes	0.1	Yes	996	888	-108	-10.8	Yes	3.5	Yes
16 to 17	1005	969	-36	-3.6	Yes	1.1	Yes	1110	1216	106	9.5	Yes	3.1	Yes
17 to 18	1004	1029	25	2.5	Yes	0.8	Yes	1158	1209	51	4.4	Yes	1.5	Yes
18 to 19	648	682	34	5.2	Yes	1.3	Yes	993	877	-116	-11.7	Yes	3.8	Yes
07 to	4040	3969	-71	-1.8	Yes	1.1	Yes	2182	2140	-42	-1.9	Yes	0.9	Yes

	A47 eastbound						A47 westbound							
	Survey Data	Model Data	Difference	% Difference	Meets Criteria?	GEH	Meets Criteria?	Survey Data	Model Data	Difference	% Difference	Meets Criteria?	GEH	Meets Criteria?
10														
10 to 16	4628	4668	40	0.9	Yes	0.6	Yes	4384	4415	31	0.7	Yes	0.5	Yes
16 to 19	2657	2680	23	0.9	Yes	0.4	Yes	3261	3302	41	1.3	Yes	0.7	Yes
Total	11325	11317	-8	-0.1	Yes	0.1	Yes	9827	9857	30	0.3	Yes	0.3	Yes

28.5.3 The model validated to a high standard, with all journey time routes achieving the 1 minute variance standard published in WebTAG and all traffic counts within the WebTAG and GEH criteria.

28.6 Forecasting Methodology

Forecasting Approach

28.6.1 Reference forecasts were produced using the forecasting suite developed for the PTM, which generates forecasts for any year covered by the PCC Local Plan (up to 2036) based upon committed and allocated levels of housing development and nationwide traffic growth forecasts.

28.6.2 Forecasts were generated for the 2021 (the scheme opening year) and 2036 (the furthest year that can be forecast by the model). These matrices were then assigned and simulated in the future year PTMs. Once run, the forecast year PTMs were cordoned to the microsimulation model extents and increases in trips for each origin-destination pair and user class were extracted for each time period and vehicle class, using a global factor for the overnight non-modelled period.

28.6.3 As described in paragraph 28.2.6, there were discrepancies between observed data and the PTM. Therefore, absolute numbers of additional trips were calculated rather than the percentage growth. This ensures that the magnitude of trip generation from new developments is accurately transmitted to the microsimulation model.

Alternative Scenarios

28.6.4 WebTAG Unit M4 “Forecasting and Uncertainty” mandates that in addition to the core scenario, two further scenarios should be tested to determine the sensitivity of scheme performance to variations in the national rate of growth, both above and below the core estimate. The high and low growth scenarios are developed by adding (in the high growth scenario) or subtracting (in the low growth scenario) a proportion of the base year demand from the core scenario. The proportion of demand change is determined using the formula:

$$u = p \times \sqrt{f - b}$$

- u is the uncertainty, the proportion of base year demand to be added to (in the high growth scenario) or subtracted from (in the low growth scenario) the core forecast demand;
- p is a factor representing the uncertainty in macroeconomic variables influencing travel demand, defined in WebTAG Unit M4 as 2.5% for national highway traffic;

- f is the forecast year being modelled (up to a maximum of 36 years after the base model);
- b is the model base year.

28.6.5 The derivation of u for the forecast models is therefore:

$$u_{2021} = 2.5\% \times \sqrt{2021 - 2016} = 5.59\%$$

$$u_{2036} = 2.5\% \times \sqrt{2036 - 2016} = 11.18\%$$

Variable Demand Modelling

- 28.6.6 The use of a microsimulation model meant it was not possible to perform a detailed Variable Demand Model (VDM) exercise. An “own-cost” type VDM, in which the demand for each route varies only as a function of its own user cost with no interaction between routes or assignment/convergence loops, is not recommended as per WebTAG Unit M2.
- 28.6.7 The appraisal in S-Paramics is limited to the modelled area only and does not consider whether traffic volumes on other routes will be affected, for example if traffic chooses to use the dualled A47 in preference to another parallel route after the scheme is constructed. It is likely such effects would have an economic impact, so a sensitivity test was performed in which the traffic in the Do-Something model network was increased to represent traffic rerouting to the A47 from parallel routes.
- 28.6.8 The level of rerouting was predicted using the same modelling suite, using a modified version of the PTM which represented the scheme design. The growth predicted by the PTM in both forecast years were then transferred to the S-Paramics sensitivity test models in the same manner described in paragraphs 28.6.2 and 28.6.3.

28.7 Modelling Outputs

Journey Time Improvements

- 28.7.1 A summary of journey time routes through the mode is shown in **Table 28-5**. Journey times have been measured in the forecast year (2036) for the AM and PM peak periods, for routes which use the full modelled extents via the following timing points:
- A1 North: at its junction with Wittering Ford Road, Wittering;
 - A1 South: at its junction with Old North Road, Water Newton;
 - A47 West: at its junction with Old Oundle Road, south of Wittering;
 - A47 East: immediately west of its junction with the A1260 at Thorpe Wood;
 - Wansford: on the A6118 Elton Road in the village, at its junction with the slip road from the A1;
 - Sacrewell: on the Sacrewell Farm access road 230 metres north of its junction with the A47;
 - Southorpe: On Sutton Heath Road 500 metres north of its junction with Langley Bush Road;
 - Sutton: On Nene Way in the village, immediately west of its junction with The Drift;
 - Ailsworth: On Peterborough Road in the village, at its junction with High Street;
 - Upton: On Church Walk in the centre of the village.

Table 28-5: Surveyed journey time routes for operational assessment

Journey Time Route		2036 AM peak journey times				2036 PM peak journey times			
Origin	Destination	Do-Min	Opt 1	Opt 2	Opt 3	Do-Min	Opt 1	Opt 2	Opt 3
A1 North	A1 South	06:47	04:04	04:05	04:04	04:57	03:41	03:42	03:41
	A47 East	14:34	06:43	06:45	06:43	08:12	06:29	06:32	06:28
	A47 West	11:14	05:36	05:37	05:37	06:50	05:34	05:34	05:33
	Ailsworth	14:20	06:34	06:36	06:37	07:48	06:26	06:30	06:26
	Sacrewell	09:22	03:55	03:58	03:55	04:36	03:54	03:54	03:48
	Wansford	09:49	04:14	04:15	04:14	05:30	04:12	04:14	04:11
A1 South	A1 North	04:32	03:51	03:51	03:51	04:02	04:03	04:02	04:02
	A47 East	12:52	06:56	06:58	06:58	06:58	06:42	06:42	06:42
	A47 West	06:42	04:31	04:31	04:31	04:31	04:31	04:32	04:32
A47 East	A1 North	11:46	07:35	07:36	07:36	09:36	08:00	08:00	08:05
	A1 South	11:29	06:31	06:31	06:32	08:16	06:28	06:29	06:34
	A47 West	11:19	07:10	07:11	07:12	09:04	07:29	07:28	07:34
	Sacrewell	08:03	05:31	05:33	05:35	05:39	05:51	05:48	05:48
	Southorpe	06:59	04:15	04:13	04:10	06:09	04:06	04:08	04:05
	Sutton	06:12	04:12	04:03	04:25	10:16	04:09	03:56	04:27
	Upton	05:38	06:44	06:42	06:41	05:16	06:45	06:49	06:44
Wansford	09:25	05:37	05:40	05:40	07:36	06:02	06:01	06:05	
A47 West	A1 North	21:52	12:01	11:28	11:49	10:37	11:38	11:46	11:32
	A1 South	21:51	12:24	12:00	12:23	10:22	11:27	11:28	11:24
	A47 East	26:03	14:50	14:28	14:48	12:53	13:42	13:46	13:41
	Southorpe	23:49	12:59	12:45	12:55	10:57	12:24	12:30	12:14
	Sutton	23:38	12:59	12:26	13:01	11:15	12:07	12:27	12:04
Ailsworth	A1 North	13:46	07:26	07:31	07:32	16:24	08:01	08:09	08:11
Sacrewell	A1 North	04:58	04:50	04:35	04:43	05:37	07:46	08:31	08:03
	A47 East	06:44	06:01	06:06	06:03	04:25	10:52	11:19	10:56
Southorpe	A47 East	12:23	04:28	04:55	04:27	04:22	04:06	04:12	04:03
	A47 West	14:13	06:00	06:30	05:50	05:55	05:46	06:01	05:51
Sutton	A47 East	04:34	04:03	03:52	04:13	04:12	03:54	03:45	04:07
	A47 West	09:32	05:24	05:16	05:31	06:17	05:51	05:49	06:03
Upton	A47 East	07:32	07:15	07:43	07:13	04:46	06:38	06:49	06:39
Wansford	A1 North	04:16	03:35	03:34	03:34	03:45	03:47	03:47	03:45
	A47 East	12:20	05:58	06:00	06:00	06:04	05:50	05:52	05:52

28.7.2 In the Do-Minimum model there is significant congestion in the AM peak period, at Wansford East roundabout. This would result in delays to all journeys which originate from the A47 west and those which turn off the A1 here (i.e. those that do not continue to the A1 south). In all three options, the queues at Wansford East are effectively eliminated.

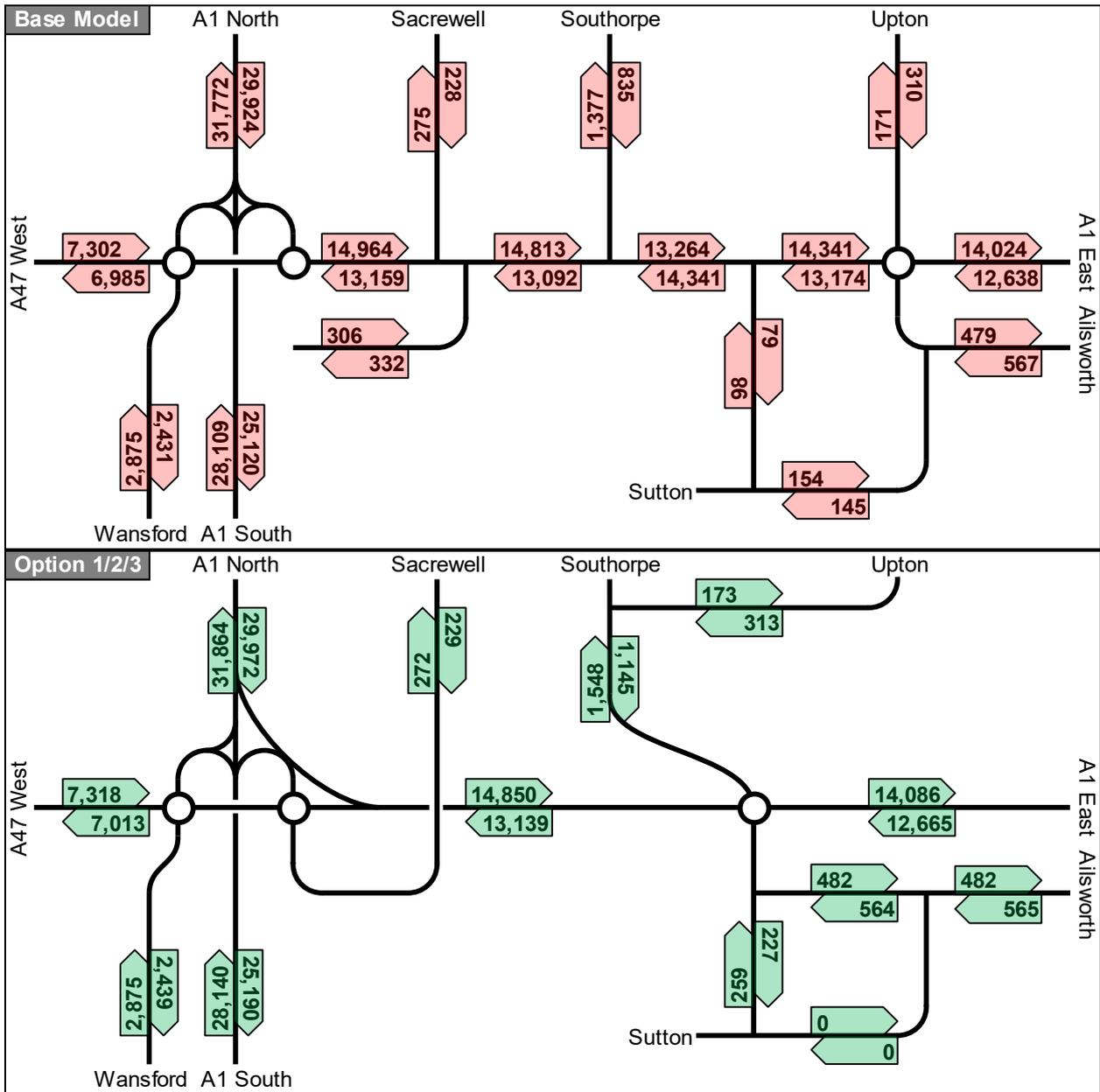
28.7.3 Traffic from the A1 north would benefit by up to 8 minutes in all options, with benefits effectively identical for all three options. Journeys from the A47 west, for which journey times are more variable (due to the queue from Wansford East stacking back through the western roundabout at the junction), would benefit by between 10 and 12 minutes depending on design option and destination; benefits would be greater for Option 2 than in Options 1 and 3 by around 30 seconds per movement.

- 28.7.4 Journeys which proceed westbound on the A47 would benefit from increased speeds and reduced junction delays at Wansford, leading to journey time benefits of up to 5 minutes for vehicles travelling on to the A1 southbound. No significant variation was seen between the design options for these movements.
- 28.7.5 The Do-Minimum model had significant delays at Sutton Heath Road junction for traffic travelling on the A47 east or emerging from the side road. As this priority junction is proposed to be replaced with a high-capacity roundabout at The Drift in the option designs, journeys originating from Southorpe would experience journey time reductions of up to 8½ minutes. For Option 2 the benefits would reduce by up to 40 seconds per vehicle relative to Options 1 and 3.
- 28.7.6 In the PM peak period, delays in the Do-Minimum model were generally lower than those in the AM peak. For journeys along the A47 in both directions, the provision of a dual carriageway in the Do-Something options, and the resultant higher vehicle speeds, would offer journey time benefits of between 1 and 2 minutes depending on origin and destination. Variances between options for these movements would be very small at less than 5 seconds.
- 28.7.7 The increase in A47 westbound capacity in the option designs would prevent the platooning of traffic behind heavy vehicles which was observed in the Do-Minimum model. As a result, there would be fewer gaps for traffic to proceed eastbound on the A47 at Wansford West roundabout and delays there would be increased in the Do-Something options. Disbenefits for journeys from the A47 west would be around 1 minute for most vehicles; journey times would be slightly longer for Option 2 by about 15 seconds compared to Option 3.
- 28.7.8 The improved A47 westbound flow would also impact traffic emerging from Sacrewell Farm, which would exit on to Wansford East roundabout via the proposed bridge in the Do-Something model. The journey times for these trips would be increased by up to 7 minutes.

Link Flows

- 28.7.9 The modelled link flows are shown in **Figure 28-7** for 2021 traffic levels and **Figure 28-8** at 2036 traffic levels as average annual weekday traffic (AAWT) volumes. There were no significant differences in link flows between Options 1, 2 and 3 as they did not differ in their routing behaviour.

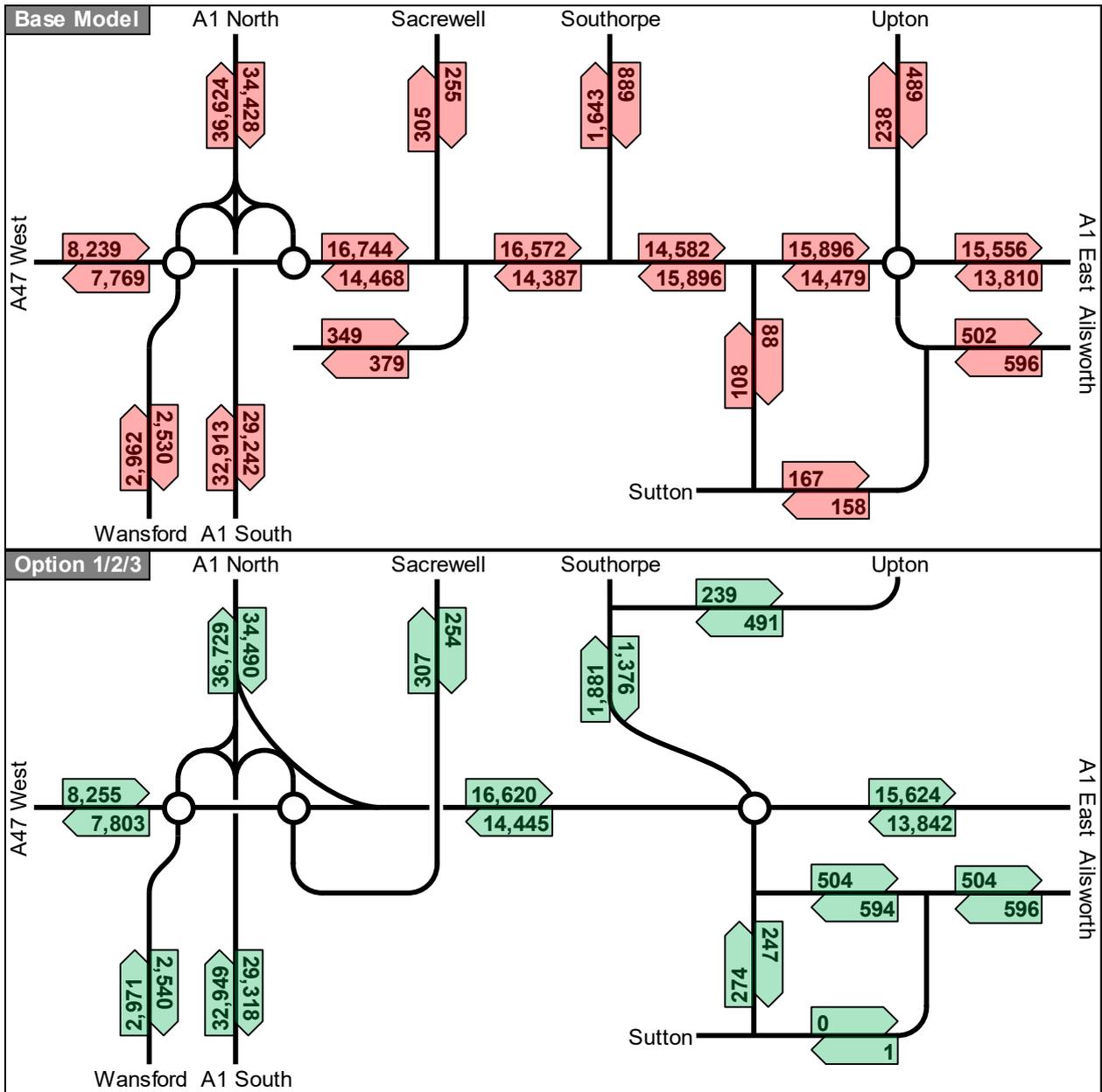
Figure 28-7: Junction-to-junction link flows at 2021 traffic levels



28.7.10 In all Do-Minimum and Do-Something models the same number of vehicles enter and exit the network at each zone, to within a variation of 2% due to stochastic effects, showing that all vehicles progress through the network.

28.7.11 In the Do-Something models the proposed new Sutton Roundabout has significantly more traffic than that in the Do-Minimum scenario due to extra traffic feeding in from Sutton Heath Road and The Drift; as a result, the link between the existing Wansford East roundabout and the proposed new Sutton roundabout is busier. The design also results in two routes between Ailsworth and the new roundabout at The Drift, with all traffic preferring to use The Drift and zero flow on Nene Way.

Figure 28-8: Junction-to-junction link flows at 2036 traffic levels



28.7.12 The behaviours seen at 2021 traffic levels are broadly repeated at 2036. As the proposed Old Peterborough Road to The Drift link becomes busier in the primary Do-Something models, one vehicle per day chooses to route from Ailsworth to Sutton via Nene Way. This is the only explicit route choice available in the model: as no dynamic feedback, has been programmed into the model, the vehicle chooses its route when entering the model, so queuing on the new link to The Drift when the vehicle entered the model may have resulted in this route change.

28.8 Impact of dualling between dumbbell roundabouts at the A1/A47 interchange

28.8.1 At Public Consultation questions were raised as to the inclusion of the western roundabout at the A1/A47 Junction within the scheme and suggestions were made to dual the section between the two dumbbell roundabouts. A sensitivity test was therefore performed for Option 2 to test this scenario.

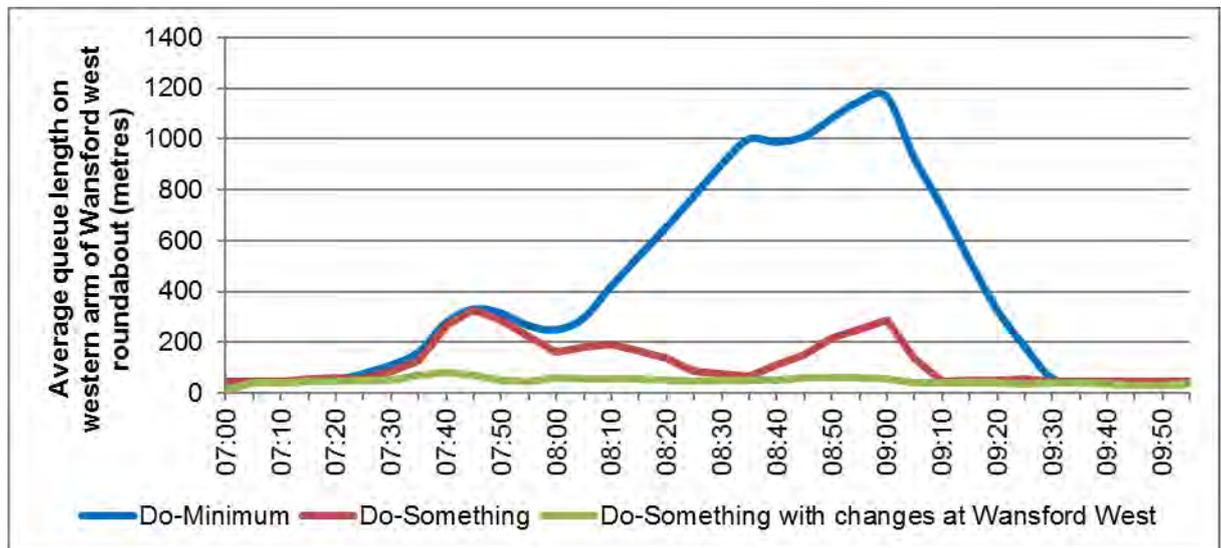
28.8.2 In the Do-Minimum scenario, there are very long queues in the scheme opening year (a maximum of 1200 metres at 2021 AM peak traffic levels) on the western arm of the western dumbbell roundabout at Wansford Junction, resulting in long delays for vehicles proceeding eastbound on the A47 towards Wansford and Peterborough. The existing Do-Something scenario (i.e dualling the A47 Wansford to Sutton but not dualling between the dumbbell roundabouts) shows maximum queue lengths reduced to 300 metres at 2021 AM peak traffic levels, resulting in significant journey time savings. However there remains significant queueing at peak periods on this arm of the roundabout, as only one lane proceeds through the roundabout towards the eastern dumbbell roundabout.

28.8.3 Dualling between the two dumbbell roundabouts would increase the effective capacity of this arm of the roundabout within the existing footprint of the carriageway. The following was assumed:

- The section of A47 between the dumbbell roundabouts was widened to a dual two-lane carriageway in its entirety. This was the configuration over the bridge before the dumbbell roundabouts were introduced in the late 1990s;
- Lane selection behaviour at the A47 western arm of the western roundabout was modified to allow two lanes to continue eastbound through the roundabout;
- Lane selection behaviour at the A47 eastern arm of the western roundabout was maintained for westbound cross bridge traffic; lane 1 was maintained for left turns to Wansford and ahead movements to the A47 westbound, with lane 2 reserved for right turns to the A1 northbound.

28.8.4 The queue lengths on the western arm of the roundabout were compared in this configuration against those in the existing Do-Minimum and Do-Something scenarios. Ten runs of the model were performed in each scenario, using the 2021 forecast traffic volumes in the AM peak period. The average queue lengths within those runs are shown in **Figure 28-9**.

Figure 28-9: Impact of dualling between dumbbell roundabouts at the A1/A47 interchange



28.8.5 The results show that the provision of two straight-ahead lanes from west to east at the roundabout, with consequent dualling of the A1 overbridge, would reduce queues from 300m to less than 100 metres average and not significantly longer than those experienced when there is no significant opposing traffic. Consequently, there would be additional benefits to traffic from the A47 western arm of the junction and to the scheme as a whole.

28.9 Conclusions

- 28.9.1 The S-Paramics modelling suggests that each of the three scheme design options would result in significant journey time improvements for most traffic. As congestion becomes greater at 2036 traffic levels there would be very significant benefits to mainline A1 southbound traffic as well as traffic routing via Wansford junction, with most vehicles experiencing journey time savings of 8 minutes or more in the AM peak and smaller but still significant savings at other times. There was little difference in journey times between the three options (up to 40s).
- 28.9.2 The journey time improvements also resulted in better journey time reliability, reduced driver frustration and improved road safety owing to the reduction in queueing vehicles on the A1 mainline which is observed at present and in the Do-Minimum models.
- 28.9.3 There would be additional benefits by dualling between the dumbbell roundabouts at the A1/A47 junctions with queues virtually eliminated.

29 Economic Assessment

29.1 Introduction

29.1.1 The economic assessment was performed using TUBA in the same manner as described in Chapter 18. An additional sensitivity test was performed in TUBA version 1.9.8, an interim release which incorporates changes to macroeconomic assumptions and applies values of time which are variable dependent on the full journey distance, a distinction not made in the previous version.

29.2 Methodology

Journey Time Benefits

29.2.1 Journey time benefits were calculated in the same manner as at PCF Stage 1. The five vehicle classes in the S-Paramics model were assigned to the six TUBA sub-modes by splitting LGV demands between personal and business trips to reflect their differing WebTAG values of time, using the default values from the WebTAG Data Book.

Options Estimate

29.2.2 Updated construction costs for each design option were estimated by HE's commercial team in June 2017. All sunk costs incurred in previous stages of the PCF have been excluded. The cost and expenditure profile for each option is shown in **Table 29-1** at 2010 prices and values.

Table 29-1: Estimated costs for Wansford to Sutton scheme at 2010 values and prices

Design option	Cost category	Total expenditure	Percentage of cost spent in				
			2017	2018	2019	2020	2021
Option 1	Preparation	£8,410,839	28.5%	27.3%	35.6%	8.5%	-
	Supervision	£1,595,205	-	-	-	54.6%	45.4%
	Works	£54,981,500	-	-	-	52.5%	47.5%
	Land	£3,761,292	-	-	-	100.0%	-
	Total	£68,748,836	3.5%	3.3%	4.4%	49.7%	39.1%
Option 2	Preparation	£8,348,323	33.4%	22.3%	38.2%	6.1%	-
	Supervision	£959,903	-	-	-	75.7%	24.3%
	Works	£51,314,098	-	-	-	68.2%	31.8%
	Land	£2,378,452	16.6%	-	-	83.4%	-
	Total	£63,000,776	5.1%	3.0%	5.1%	60.7%	26.3%
Option 3	Preparation	£8,108,507	33.6%	22.2%	38.1%	6.1%	-
	Supervision	£899,182	-	-	-	81.8%	18.2%
	Works	£46,726,802	-	-	-	74.2%	25.8%
	Land	£2,566,946	15.4%	-	-	84.6%	-
	Total	£58,301,437	33.6%	22.2%	38.1%	6.1%	-

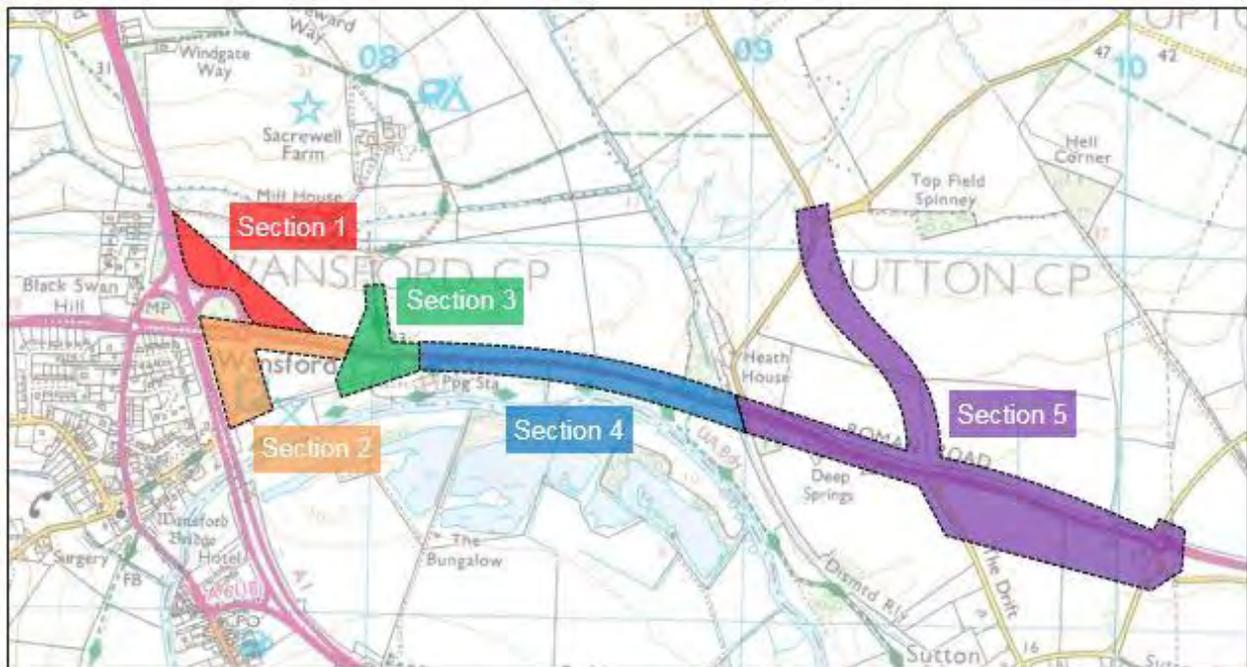
Annualisation factors

29.2.3 The S-Paramics models represent 24 hour periods in a typical weekday. These are annualised to yearly impacts using a factor of 253, the number of typical weekdays in an average year.

Construction impacts

29.2.4 Preliminary construction plans were developed for each of the three design options. The plans vary between design options to accommodate the differences in carriageway and junction layouts. Each is subdivided into five sections within the scheme extents as shown in **Figure 29-2**.

Figure 29-1: Wansford to Sutton construction plan work sites



29.2.5 TTM is required to manage traffic through areas where the existing carriageway and the works interact. Each TTM layout impacts on vehicle routing and/or junction capacity and therefore journey times. The impacts of slower journeys must be calculated as part of the economic assessment of the scheme. To assess such impacts TTM models were developed for the layouts shown in **Table 29-2** and tested against Do-Minimum models to determine their impacts.

Table 29-2: TTM models used in construction assessment

Model	TTM layout assessed	Duration
A	Reduce A47 to one lane (between Wansford Junction and Sutton Heath Road) and control traffic with shuttle working	Off peak
B	Reduce A47 to one lane (between Sutton Heath Road and Sutton Roundabout) and control traffic with shuttle working	Off peak
C	Reduce A1 to one lane and implement temporary 40mph speed limit; reduce length of slip lane to Wansford junction	Off peak
D	Reduce A47 eastern approach to Wansford Roundabout and southern quadrant of circulatory carriageway to one lane	Off peak
E	Reduce approaches to Wansford Roundabout and full circulatory carriageway to one lane	Off peak

Model	TTM layout assessed	Duration
F	Close The Drift with diversion via Nene Way	Full day
G	Reduce Nene Way to one lane and control traffic with shuttle working	Full day
H	Implement temporary 40mph speed limit between Wansford and Sutton	Full day
I	Close A1 southbound on- and off-slips at Wansford with diversions via previous junction; operate A47 traffic through roundabout on temporary alignment	Off peak
J	Close A47 from Wansford to Sutton Heath Road with diversion via A1, A1139 and A1260	Off peak
K	Close Sutton Heath Road with diversion via Langley Bush Road, Stamford Road and Castor Road	Full day

29.2.6 TTM models A to H were designed by modifying the 2021 S-Paramics Do-Minimum model with the appropriate restrictions and closures. The duration of the S-Paramics runs were set to match the TTM operating period, so each represents a single day or night of work. Models I, J and K have diversion routes which extend beyond the limits of the S-Paramics model so these were instead assessed in the 2021 PTM forecast model. An off-peak PTM model was synthesised from this purpose from ATC data.

29.2.7 A work programme was developed for each design option with dates and durations for works in each section as shown in Figure 29-1. These are tentative and subject to change following a construction contract tender and development of a detailed design, but are sufficient for a PCF Stage 2 assessment. The start and end dates for the operation of each TTM model and duration in typical weekdays (excluding bank holidays) is shown in **Table 29-3**.

Table 29-3: Active durations for each TTM model

TTM model	Option 1			Option 2			Option 3		
	Start	End	Days	Start	End	Days	Start	End	Days
A	14/10/21	20/10/21	30	14/10/21	20/10/21	40	14/10/21	20/10/21	30
	4/2/21	3/3/21		4/2/21	17/2/21		7/1/21	3/2/21	
				4/5/21	1/6/21				
	18/3/22	24/3/22		9/12/21	15/12/21		7/1/22	13/1/22	
B	14/10/21	20/10/21	25	14/10/21	20/10/21	25	14/10/21	20/10/21	25
	4/5/21	24/5/21		25/5/21	15/6/21		1/4/21	23/4/21	
	18/3/22	24/3/22		9/12/21	15/12/21		7/1/22	13/1/22	
C	18/2/21	3/3/21	10	18/2/21	3/3/21	10	18/2/21	3/3/21	10
D	14/10/21	20/10/21	5	14/10/21	20/10/21	5	14/10/21	20/10/21	5
E	11/3/21	17/3/21	5	11/3/21	17/3/21	5	11/3/21	17/3/21	5
F	4/11/20	24/5/21	138	4/11/20	15/6/21	153	4/11/20	25/4/21	118
G	30/6/21	6/7/21	5	21/7/21	27/7/21	5	2/6/21	8/6/21	5
H	7/10/21	10/3/22	108	28/10/21	1/12/21	25	9/9/21	22/12/21	75
I	3/6/21	9/6/21	5	3/6/21	9/6/21	5	3/6/21	9/6/21	5
J	24/5/22	24/5/22	1	3/3/22	3/3/22	1	3/5/22	3/5/22	1
K	25/5/21	6/10/21	95	16/6/21	27/10/21	95	26/4/21	8/9/21	95

Constraints

29.2.8 The impacts have been calculated through use of robust data from a fully WebTAG compliant S-Paramics model. However, several assumptions have been performed in the construction of economic analysis, and these must be considered in the context of the assessment:

- No benefits have been generated for traffic on weekends;
- Journey purpose splits and vehicle occupancies do not utilise local data and are instead based entirely on national averages from the WebTAG Data Book;
- Impacts have been calculated using a localised microsimulation model, rather than a strategic model; there are stochastic variations in the output data and the effect on traffic beyond the scheme extents such as that rerouting from parallel routes has been tested only in a sensitivity test proportionate for a PCF Stage 2 assessment;
- Traffic forecasts, sensitivity testing and TTM assessment used in part a strategic model, the PTM, which although revalidated in 2017 had a lower level of detail than the microsimulation model and, due to a lack of origin-destination revalidation, was not fully WebTAG compliant;
- No maintenance methodology has been created and the impacts of disruption to traffic during these periods has not been evaluated;
- Assumptions have been made in the absence of specific TTM layouts and durations, and the dates provided from which construction durations have been calculated are tentative.

29.3 Assessment Results

Impacts of Construction

29.3.1 The construction impacts for each TTM model in each design option are shown in **Table 29-4**. The TTM models used are described in **Table 29-2** and their durations in **Table 29-3**.

Table 29-4: Core scenario scheme disbenefits due to TTM during construction
All figures in £1000s at 2010 prices and values

Design option	Impact	TTM model											
		A	B	C	D	E	F	G	H	I	J	K	Total
Option 1	Commuter travel time impacts	-2	-2	1	0	0	-86	-2	-56	0	0	-289	-436
	Other user travel time impacts	-4	-4	1	0	0	-155	-5	-109	-1	0	-294	-571
	Business travel time impacts	-6	-7	-1	-1	-1	-297	-9	-202	-3	-1	-454	-982
	Indirect taxation revenues	-1	-1	-8	-1	-1	-18	-1	-15	0	0	30	-16
	Overall impacts	-13	-14	-7	-2	-2	-556	-17	-382	-4	-1	-1,007	-2,005
Option 2	Commuter travel time impacts	-3	-2	1	0	0	-95	-2	-13	0	0	-289	-403
	Other user travel time impacts	-5	-4	1	0	0	-172	-5	-25	-1	0	-294	-505
	Business travel time impacts	-7	-7	-1	-1	-1	-330	-9	-47	-3	-1	-454	-861
	Indirect taxation revenues	-2	-1	-8	-1	-1	-30	-1	-3	0	0	30	-17
	Overall impacts	-17	-14	-7	-2	-2	-617	-17	-88	-4	-1	-1,007	-1,776
Option 3	Commuter travel time impacts	-2	-2	1	0	0	-73	-2	-39	0	0	-289	-406
	Other user travel time impacts	-4	-4	1	0	0	-133	-5	-76	-1	0	-294	-516
	Business travel time impacts	-6	-7	-1	-1	-1	-254	-9	-140	-3	-1	-454	-877
	Indirect taxation revenues	-1	-1	-8	-1	-1	-15	-1	-10	0	0	30	-8
	Overall impacts	-13	-14	-7	-2	-2	-475	-17	-265	-4	-1	-1,007	-1,807

29.3.2 Most of the scheme disbenefits due to TTM during construction are as a result of work which would take place throughout the day (models F, G, H and K) with overnight disbenefits comparatively negligible given the low traffic flows. Much of the disbenefits arise due to longer journey times owing to the temporary 40mph speed limit. The most disruptive TTM phase would be the closure of Sutton Heath Road (model K) which generates disbenefits of over £10,000 per day and over £1 million over the construction period.

29.3.3 Overall, disbenefits are smallest in Option 2 at £1.77 million. Although the TTM requirements are greater than in Option 3 due to additional TTM in work section 4, the overall construction duration is shorter resulting in a small relative benefit. Option 1 has a longer construction period, consistent with the requirement to have more works on or near the existing carriageway, and therefore has greater disbenefits of just over £2 million.

Impact of Accidents

29.3.4 The economic impact of changes in accident rates as predicted by COBALT is shown in **Table 29-5** differentiated by accident location.

Table 29-5: Core scenario scheme benefits due to reduction in accidents

All figures in £1000s at 2010 prices and values

Design option	Link or junction	Do-Minimum		Do-Something		Accidents prevented	
		Accidents	Impact	Accidents	Impact	Accidents	Impact
Option 1	A1 Southbound	71.1	-4,310	23.0	-1,392	48.1	2,918
	A47 Eastbound	65.9	-5,501	29.4	-1,781	36.5	3,720
	A47 Westbound	49.4	-4,120	27.4	-1,664	22.0	2,456
	A1 to A47 slip			4.4	-268	-4.4	-268
	Wansford	53.5	-1,819	37.0	-1,260	16.5	559
	Sutton Heath Road	70.4	-3,977			70.4	3,977
	The Drift	46.9	-2,651	44.7	-1,519	2.2	1,133
	All accidents	357.1	-22,379	165.9	-7,883	191.3	14,496
Option 2	A1 Southbound	71.1	-4,310	23.0	-1,392	48.1	2,918
	A47 Eastbound	65.9	-5,501	30.7	-1,863	35.2	3,638
	A47 Westbound	49.4	-4,120	28.6	-1,739	20.8	2,381
	A1 to A47 slip			4.4	-268	-4.4	-268
	Wansford	53.5	-1,819	37.0	-1,259	16.5	560
	Sutton Heath Road	70.4	-3,977			70.4	3,977
	The Drift	46.9	-2,651	44.6	-1,517	2.3	1,134
	All accidents	357.1	-22,379	168.5	-8,041	188.7	14,338
Option 3	A1 Southbound	71.1	-4,310	23.0	-1,392	48.1	2,918
	A47 Eastbound	65.9	-5,501	29.3	-1,779	36.6	3,722
	A47 Westbound	49.4	-4,120	27.4	-1,663	22.0	2,457
	A1 to A47 slip			4.4	-265	-4.4	-265
	Wansford	53.5	-1,819	37.0	-1,260	16.5	559
	Sutton Heath Road	70.4	-3,977			70.4	3,977
	The Drift	46.9	-2,651	44.7	-1,520	2.2	1,131
	All accidents	357.1	-22,379	165.8	-7,879	191.3	14,500

29.3.5 Dualling the A47 generates approximately £6.1 million of benefits due to reductions in accident rates. The provision of the segregated left turn slip from the A1 to the A47 reduces flows on the A1 southbound generating another £2.4 million of benefits.

29.3.6 A further £5.7 million in benefits accrue due to junction improvements. There is a small improvement at Wansford due to less overall traffic using the roundabout with the segregated left turn in place; most benefits would come from the proposed replacement of the Sutton Heath Road and The Drift junctions with a safer roundabout.

29.3.7 The overall accident benefits varied from £14.3 to £14.5 million. Options 1 and 3 had similar link lengths and performed almost identically; in Option 2 the link from Wansford to Sutton is 70 metres longer as it crosses from north of the existing A47 to south. Given a consistent accident rate per kilometre, there was a small reduction in benefits of around £150,000.

29.4 Summary Tables

29.4.1 The Transport Economic Efficiency (TEE) tables for each option are shown in **Table 29-6**. User charges, private sector provider impacts, developer contributions and maintenance delays have not been assessed).

Table 29-6: Transport Economic Efficiency (TEE) Tables

All figures in £1000s at 2010 prices and values

Design option	User type	Benefit type	Benefits by journey type			
			Road personal	Road freight	Bus personal	Total
Option 1	Commuting	Journey time	41,019	0	0	41,019
		VOCs	538	0	29	567
	Other	Journey time	61,517	0	0	61,517
		VOCs	-549	0	89	-460
	Business	Journey time	78,818	57,790	0	136,608
		VOCs	2,389	7,948	13	10,350
	Total TEE benefits			183,732	65,738	131
Option 2	Commuting	Journey time	41,263	0	0	41,263
		VOCs	590	0	32	622
	Other	Journey time	60,437	0	0	60,437
		VOCs	-569	0	96	-473
	Business	Journey time	78,194	57,404	0	135,598
		VOCs	2,375	7,921	14	10,310
	Total TEE benefits			182,290	65,325	142
Option 3	Commuting	Journey time	41,266	0	0	41,266
		VOCs	623	0	31	654
	Other	Journey time	60,648	0	0	60,648
		VOCs	-468	0	94	-374
	Business	Journey time	78,322	57,449	0	135,771
		VOCs	2,413	7,949	13	10,375
	Total TEE benefits			182,804	65,398	138

29.4.2 The total TEE benefits for each design option are almost £250 million, of which approximately 75% is accrued by private personal vehicles and 25% by freight vehicles; the net contribution by bus traffic is negligible.

29.4.3 Option 1 offers the greatest overall benefits of £249.6 million, with greater journey time benefits for non-commuting consumers and business users than any of the alternative options. Option 3 performs second best at £248.3 million of benefits, and offers the most benefits to commuters overall. Option 2, with its longer link from Wansford to Sutton, has a small relative decrease in journey time benefits and overall offers £247.8 million of TEE.

29.4.4 An abridged Public Accounts (PA) table for each option is shown in **Table 29-7**. In the absence of revenues, operating costs, developer contributions, grants and subsidies, only the

cost to central government and the changes in indirect tax revenues are non-zero. The PA is reported as a cost table, so the signs are inverted from the other tables in this chapter; costs appear as positive numbers while benefits appear negative. To maintain consistency, costs have continued to be rendered in red.

Table 29-7: PA tables

All figures in £1000s at 2010 prices and values

Design option	Central government funding	Change in indirect tax revenues	
		Road	Bus
Option 1	68,749	-293	45
Option 2	63,001	-312	56
Option 3	58,301	-258	51

29.4.5 The cost-benefit analysis is summarised in the AMCB tables shown in Table 29-8. The AMCBs are constructed from the TEE and PA tables.

Table 29-8: Core scenario AMCB tables

All figures in £1000s at 2010 prices and values

Impact	Option 1	Option 2	Option 3
Construction delays	-2,005	-1,776	-1,807
Noise impacts	-422	-476	-532
Air quality impacts	-132	-128	-66
Accident analysis	14,496	14,338	14,500
Commuter travel time benefits	41,585	41,770	41,805
Other user travel time benefits	61,057	59,800	60,108
Business user travel time benefits	146,958	145,513	145,751
Indirect taxation revenues	248	257	208
Present Value of Benefits (PVB)	261,785	259,298	259,967
Present Value of Costs (PVC)	68,749	63,001	58,301
Net Present Value (NPV) = PVB - PVC	193,590	196,901	202,264
Benefit to Cost Ratio (BCR) = PVB ÷ PVC	3.81	4.12	4.46

29.4.6 Each of the three options offer a PVB of around £260 million, translating to NPVs of between £193.6 and £202.3 million and BCRs between 3.81 and 4.46. Business users alone perceive benefits of over £145 million. Option 1 has the highest PVB of £261.8 million but also the highest cost leading to the lowest overall BCR. Option 3 has a slightly lower PVB of £260.0 million but with the lowest cost returns the greatest BCR at 4.46.

29.4.7 This assessment represents a significant increase in scheme benefits and BCR compared to the PCF Stage 1 assessment.

- The increase in scheme benefits occurred due to:
 - More accurate modelling of the Do-Minimum scenario reflecting delays at Wansford East roundabout and its knock-on effect on the A1 southbound mainline.
 - The A47 junction with Sutton Heath Road was modelled with more accurate delays and reverse priority behaviour in the PCF Stage 2 model due to a change in the proposed junction strategy from PCF Stage 1.
- The cost of the scheme is also lower compared to PCF Stage 1.

29.4.8 The combination of increased benefits and reduced cost resulted in a significant increase in the BCR value compared to PCF Stage 1.

29.5 Non-Monetised Benefits

29.5.1 The WebTAG unit indicates there is no reliable method to monetise journey time variation on single carriageway routes outside urban areas, such as with this scheme, so a qualitative assessment was performed. Each qualitative assessment was assessed on a seven point, scale with impacts scored as either positive (beneficial) or negative (adverse) with a magnitude of slight, moderate or large. Neutral scores are assessed where the overall effects are balanced and/or negligible.

29.5.2 Option 1 would not allow for improvement of the NMU route between Wansford and Sutton as the existing carriageway would be re-used for motor traffic in the design. In Option 2 the detrunked carriageway would remain in situ for potential use as an NMU corridor; however, the new dual carriageway would sever the old route and given the difficulty in crossing it at-grade it is unlikely that it would form a desirable NMU route. In Option 3 the dual carriageway would not intersect the potential NMU route so the right-of-way between Wansford and Sutton would have the capacity to reduce journey times compared to the existing Nene Way long distance path and attract additional NMU use of the corridor.

29.5.3 The scheme would result in reductions in traveller stress; driver frustration would also reduce due to fewer queues and delays on both the A47 and the A1. The fear of potential accidents would be improved, as westbound and eastbound A47 traffic would be segregated eliminating the risks of speeds of over 100mph on impact through the removal of at-grade junction conflicts. The scheme would reduce the queue length on the A1 exit to the A47, which stacks on to the A1 mainline in the Do-Minimum models; the scheme therefore would reduce the fear of potential accidents on the A1 mainline. This is reflected in the forecast reduction in accidents from the COBALT analysis. The scheme would have one slight disbenefit in that A47 eastbound traffic would no longer be able to access the service station east of Sacrewell and must U-turn at The Drift roundabout to do so.

29.5.4 There were no significant security impacts associated with the scheme. Driver sightlines would improve allowing users to observe incidents from a greater distance, but the security impact of this benefit would be negligible. The reduction in vehicle idling and hence susceptibility to roadside crime would also have a negligible security benefit as there are no footways or pedestrian traffic adjacent to the roadside at the junctions where queues are presently observed. The overall impact is neutral.

29.5.5 There would be no impact on severance for Wansford to Sutton journeys in Options 1 or 2 as there would be no provision of a new pedestrian route due to the location of the new A47 dual carriageway and all users would continue to use the Nene Way long distance path. In Option 3 severance would be reduced as the detrunked A47 would become a new right-of-way that could be used to connect journeys along the A47 corridor.

Value for Money

29.5.6 A Value for Money (VfM) category is defined for each BCR as described in the DfT's "Value for Money Assessment: Advice Note for Local Transport Decision Makers". The VfM categories are shown in **Table 29-9**. Option 1 delivers high VfM at a BCR of 3.81, whereas Options 2 and 3 offer very high VfM with BCRs in excess of 4.0.

Table 29-9: Value for Money Categories

BCR range	Value for Money
Less than 1.0	Poor
1.0 to 1.5	Low

1.5 to 2.0	Medium
2.0 to 4.0	High
More than 4.0	Very High

30 Environmental Assessment PCF Stage 2

30.1 Introduction

- 30.1.1 The purpose of this chapter is to provide a summary of the environmental assessment undertaken during the Stage 2 PCF process. The PCF Stage 2 Environmental Assessment Report (EAR) is a standalone document which provides a detailed assessment of the environmental effects of the proposed option for the A47 Wansford to Sutton dualling scheme. The EAR also provides assurance that all legislative requirements to safeguard the existing environment are complied with, and to support this, an Environmental Impact Assessment (EIA) screening report and Habitats Regulations Assessment (HRA) have also been produced.
- 30.1.2 The option layouts for Options 1, 2 and 3 with indicative junction and side road layouts assessed are included in Appendix M.

30.2 Assessment Methodology

- 30.2.1 The Design Manual for Roads and Bridges (DMRB) Volume 11, Environmental Assessment was followed as far as possible; where relevant limitations to the environmental assessment are set out in each environmental topic section within Chapters 6 to 14 of the PCF Stage 2 EAR. The following section summarises the baseline information on all environmental topics and provides a summary of the potential impacts on receptors and features of each topic from the proposed options. The environmental assessment is considered in more detail in the PCF Stage 2 EAR.

30.3 Environmental Assessment of Proposed Options

30.4 Air Quality

Baseline conditions

- 30.4.1 There are no Air Quality Management Areas within the study area used for assessing air quality impacts. In order to characterise the existing air quality in the area a series of nitrogen dioxide diffusion tubes were placed at various representative locations around the Wansford area by Highways England. The tubes monitored the air quality between January 2016 and June 2016, however only 3 diffusion tubes were laid within the study area.
- 30.4.2 The diffusion tube results were annualised and a correction bias added and found the annual average NO₂ for these sites were all under the annual mean NO₂ objective of 40 µg/m³.
- 30.4.3 Sensitive receptors were identified through a review of maps during a desk study which were then confirmed/checked by a subsequent site visit. Sensitive receptors within 200m of each of the options were identified and are summarised in the **Table 30-1** below.

Table 30-1 Sensitive Receptors

Receptor ID	Receptor Address	X	Y
R1	3 Thackers Close, Wansford	507301	299982
R2	61 Old North Road, Wansford	507369	300044
R3	6 Black Swan Spinney, Wansford	507486	299706
R4	6 Swanhill, Wansford	507509	299620
R5	Deep Springs, Leicester Road, Wansford	509197	299451
R6	Old Station House, Sutton Heath Road, Peterborough	508952	299628
R7	Heath House, Sutton Heath Road, Sutton, Peterborough	508961	299723
R8	Snax 24 Ltd, Leicester Road, Wansford	508259	299667
SHB1	Sutton Heath & Bog SSSI Transect 1	508934	299640
SHB2	Sutton Heath & Bog SSSI Transect 2	508917	299640
SHB3	Sutton Heath & Bog SSSI Transect 3	508908	299736
SHB4	Sutton Heath & Bog SSSI Transect 4	508916	299785
SHB5	Sutton Heath & Bog SSSI Transect 5	508924	299835
SHB6	Sutton Heath & Bog SSSI Transect 6	508927	299857

30.4.4 A WebTAG assessment was undertaken by using seven residential receptors, one commercial receptor (R8) and 6 ecological receptors for Sutton Heath and Bog SSSI, chosen to be representative of the study area. Receptors were identified within 200 m of each 'affected' road link according to the WebTAG guidance in TAG Unit A3. Receptors were banded (0-50m, 50-100m, 100-150m and 150-200m) according to the link they were closest to in order to avoid double counting.

Impacts

Option 1

30.4.5 Option 1 model would mostly involve online widening of the existing A47 and would introduce three new receptors to the study area. The results representing predicted exposure at human receptors showed predictions of annual average NO₂ and PM₁₀ were under 50% the 40 µg/m³ objective in 2021 and 2036 for Option 1. The model results representing predicted exposure at human receptors showed changes in predicted concentrations ranged from minor beneficial to minor adverse for Option 1. Sutton Heath and Bog SSSI is an ecological receptor and would experience a negligible increase in NO_x. Temporary effects can be mitigated sufficiently.

Option 2

30.4.6 Option 2 would be constructed part offline to the north and part offline to the south of the existing A47. Like Option 1, three new receptors would be introduced to the study area. The model results representing predicted exposure at human receptors showed predictions of annual average NO₂ and PM₁₀ were under 50% of the 40 µg/m³ objectives in 2021 and 2036 for Option 2. The model results representing predicted exposure at human receptors showed changes in predicted concentrations ranged from moderate beneficial to minor adverse for Option 2. There would be negligible risk of effects on designated sites because increases in concentrations of NO_x have been shown to be largely negligible. For temporary effects, all identified risks can be mitigated sufficiently so that residual effects are not significant.

Option 3

30.4.7 Option 3 would be constructed offline to the north of the existing A47 and would introduce two new receptors to the study area. The model results representing predicted exposure at human receptors showed predictions of annual average NO₂ and PM₁₀ were under 56% of

the 40 µg/m³ objectives in 2017 for Option 3. The model results representing predicted exposure at human receptors showed changes in predicted concentrations ranged from moderate beneficial to major adverse for Option 3. However, where major adverse effects were predicted (22.5 µg/m³ of NO₂ at R6 Old Station House which would be demolished) the concentration was still only 57% of the AQS objective). There is a risk of adverse impacts to designated sites because the proposed carriageway would impact on Sutton Heath and Bog SSSI. For temporary effects, all identified risks can be mitigated sufficiently so that residual effects are not significant.

- 30.4.8 Construction activities are predicted to have a high risk of generating large quantities of dust in an area with high sensitivity for both human and ecological receptors. With construction dust management, mitigation and monitoring within the Construction Environmental Management Plan, the overall effect is expected to be not significant.

Option Ranking

- 30.4.9 Overall the effects on air quality were broadly similar between the three options. However, the major adverse effect from the removal of R6 Old Station House ranked Option 3 as the least preferred. Options 1 and 2 would have similar impacts, however Option 2 is the preferred option due to it having marginally lower predictions of PM₁₀.

30.5 Cultural Heritage

Baseline conditions

- 30.5.1 There are numerous archaeological sites, monuments and findspots located throughout the study area and the area is considered to be of high archaeological significance. Evidence for the earliest activity within the study area dates to the Mesolithic period and comprises a flint scatter found near the Village of Wansford. The majority of stray finds have been dated to the Neolithic to Bronze Age and have been found in relatively low numbers.
- 30.5.2 There is a scheduled monument north of the A47. This comprises a complex set of Bronze Age cropmarks which represent a probable barrow cemetery and a portion of a settlement enclosure. Geophysical survey of the scheduled monument has confirmed the presence of a bivallate ring ditch immediately north of the current A47 which would be impacted by any widening. LiDAR and aerial photography analysis has also confirmed the presence of a number of other ring ditches/cropmarks to the east of Sutton Heath Road.
- 30.5.3 There are six listed buildings which could be potentially impacted; Sacrewell Farmhouse, Sacrewell Mill, Mill House & Stables, Great North Road Bridge, Village Pound, 1 Nene Way and Manor House. A further four undesignated historic buildings and structures have been identified within the study area and include Old Station House and the railway bridge.
- 30.5.4 Sutton Conservation Area, is considered within the assessment as its boundary lies approximately 450m to the south of the existing A47. This conservation area comprises a rural open landscape, with a strong well wooded character and positive views.

Option 1

- 30.5.5 During construction, Option 1 would have adverse impacts on a number of archaeological remains, including a Bronze Age barrow and two prehistoric pit alignments. The bridge over the former Stamford and Wansford Railway may require demolition (to be determined). Following consideration by the design team it was confirmed that all widening could take place to the south of the current alignment thereby avoiding direct impacts on the scheduled monument.
- 30.5.6 During operation, there would be limited impacts on the historic environment. A re-aligned proposed link road to the A1 would bring the traffic closer to the Grade II listed Sacrewell Mill,

Mill House and Stables creating a greater visual intrusion than is currently experienced from the existing road network. This would result in a small adverse impact. The impacts upon the historic landscape are anticipated to be negligible.

Option 2

30.5.7 During construction, Option 2 would result in adverse impacts to multiple archaeological remains. These include; a ring ditch representing a Bronze Age barrow, prehistoric pit alignments, an undated rectangular enclosure and a number of undefined cropmarks to the east of Sutton Heath Road. An undesignated structure, a Royal Observer Corps bunker, would require removal.

30.5.8 During operation, the proposed realigned link road from the A1 would bring traffic closer to the Grade II listed Sacrewell Mill, Mill House and Stables. This would affect the setting of these designated heritage assets resulting in a small adverse impact. The realigned main carriageway would additionally move closer to the Grade II listed Manor House which would create greater visual intrusion. Impacts on the historic landscape are deemed to be minimal; the realigned carriageway would be more visible in the landscape to the north of the Sutton Conservation Area, yet this does not result in a significant change from existing conditions.

Option 3

30.5.9 During construction, the main carriageway realignment would intersect the southern end of the scheduled monument, resulting in the destruction of the southern bivallate ring ditch. Undesignated heritage assets located within the field to the east of Sutton Heath Road would also experience major adverse impacts. Other archaeological remains impacted include; a prehistoric pit alignment, cropmarks of a Roman building and a Roman iron working site. The realignment of the carriageway would further require the removal of the Royal Observer Corps bunker and the demolition of the Station House.

30.5.10 During operation, Option 3 is expected to bring limited impacts. Slight adverse impacts are expected for the Grade II listed Sacrewell Mill, Mill House and Stables, as the realigned proposed link road from the A1 would create a greater visual intrusion. Impacts on the historic landscape and historic buildings would be negligible.

Option Ranking

30.5.11 From a cultural heritage perspective, based on the assumption that the scheduled monument can be avoided, Option 1 is considered the preferred option, while Option 3 is considered the least favoured option. Option 3 would have a direct impact upon the scheduled monument.

30.6 Landscape and Visual

Baseline Conditions - Landscape

30.6.1 The study area is located within two National Character Areas; NCA 89 Northamptonshire Vales and NCA 92 Rockingham Forest. There are no national landscape designations or any designated Areas of Outstanding Natural Beauty (AONB).

30.6.2 Land cover consists predominantly of arable farmland, divided into relatively small fields interconnected by narrow rural lanes and defined by hedgerows and ditches throughout the landscape. The fields are interspersed with fragmented patches of woodland, clusters of farms and residential dwellings and small settlements. Significant landscape assets within the study area include the vegetated line of the dismantled railway and a range of features which lie beyond the study area including the Castor Hanglands National Nature Reserve, Ermine Street, (the Roman Road to the northeast) and the River Nene and associated wetlands to the south.

Impacts

30.6.3 During construction, all three options would result in the removal of vegetation, affecting the landscape structure. However, with replanting post construction, effects would be mitigated to a degree.

Option 1

30.6.4 The option would result in the loss of some vegetation along the main line and link roads although it is judged that mitigation would reduce impacts from significant to not significant. Impacts on landscape character would occur within a very small geographical area and would not influence landscape character of the wider area. As such there would not be significant impacts on landscape character due to the fact that the option would involve widening of the existing highway and the key characteristics of the landscape would remain intact.

Option 2

30.6.5 The Option would result in the loss of mature trees and woodland which are important landscape features that may only be replaced at alternative locations and would take a long time to establish. As such the LVIA impacts on landscape fabric would be significant. As with Option 1 impacts on landscape character were limited to a small geographical area and there was little to differentiate between them in the context of the national and local character areas assessed.

Option 3

30.6.6 Option 3 would result in the loss of trees, woodland and well established clipped hedges. These are important landscape features which cannot be replaced at their existing locations. Due to the loss of vegetation and effects on landscape pattern the option was judged to result in significant effects on landscape fabric. As with Option 1, impacts on landscape character were limited to a small geographical area and there was little to differentiate between them in the context of the national and local character areas assessed.

Baseline conditions – Visual

30.6.7 To the north of the existing A47 the land consists of a gently rolling plateau landscape with large fields bounded by clipped hedges. Woodland copses, larger areas of woodland and hedge trees are focal points. It is a sparsely populated area and large in scale with tree lined lanes and Public Rights of Way (PRoW) giving a sense of rural character and enclosure in some areas.

30.6.8 To the south of the existing A47 and west of the disused railway line that passes the junction with Sutton Heath Road, the field pattern is smaller and that land slopes down to the south and the river Nene. Woodland and mature trees are more prevalent forming an area of consistently high scenic quality that stretches from Wansford in the west of the study area to Sutton in the east. The southern part of Wansford and the villages of Stibbington and Sutton contain conservation areas.

30.6.9 Seven residential receptor groups are identified within the study area. In addition, four institutional/business receptors are identified along with eight recreational routes and six road receptors and viewpoints.

Impacts

30.6.10 For all options construction impacts would be temporary and associated with removal of vegetation and the presence of construction plant, machinery and the creation of site compounds, stockpiles and laydown area. Those visual receptors closest to the construction

corridor would experience the most significant effects, with some properties having large adverse effects, while others would be slight adverse.

Option 1

30.6.11 For most of the residential receptors, effects from this option will not be significant as it would involve widening online. There would be significant effects on residents of the Old Station House and Deep Springs due to the fact that the mainline would pass across the property boundary or in close proximity. The option would also result in significant impacts on a short section of the Hereward Way as a link road is proposed adjacent to the route. There would also be significant impacts on a very limited part of the Nene Way.

Option 2

30.6.12 Option 2 would result in significant impacts on residents of Deep Springs due to the fact the mainline would run immediately to the south of the property. There will be significant impacts on residents of two properties in Sutton due to visibility at the eastern part of the Option. The option will also result in significant impacts on a short section of the Hereward Way as a link road is proposed adjacent to the route. Impacts on the Nene Way would be greater than Options 1 and 3 due to the fact that the Option would pass offline closer to the route than the existing A47.

Option 3

30.6.13 This option would result in significant impacts on Heath House due to the removal of vegetation and the introduction of the main line into views eastward from the property. The option would result in significant impacts on the footpath network at Sacrewell Farm and Country Centre and on a short section of the Hereward Way and Nene Way.

Option Ranking

30.6.14 Option 1 is the preferred option as it has the least impact on landscape character and visual receptors as it would involve widening of the existing road. Option 2 is least preferred as it would go offline with the eastern offline section having greater impacts due to the fact that it will impact upon the River Nene valley and The Drift in addition to residential properties on the northern fringe of Sutton Village. Option 3 would be entirely offline within a landscape of larger scale and more modified by agricultural activity and would impact on a fewer number of properties.

30.7 Nature Conservation and Biodiversity

Baseline conditions

30.7.1 There are no Special Protection Areas (SPA), Special Areas of Conservation (SAC) or Wetlands of International Importance (Ramsar) located within 2km of the scheme. The River Nene however, which flows approximately 50m south of the A47 carriageway flows directly into the Nene Washes approximately 12.8km east of Wansford and is designated a SAC, SPA and Ramsar Site.

30.7.2 There are no National Nature Reserves located within 1km of the scheme boundaries, however there are five Sites of Special Scientific Interest (SSSI) within a 2km radius. These include; Sutton Heath & Bog, Wansford Pasture, Old Sulehay Forest, West Abbot's & Lound Woods and Castor Flood Meadows. Six County Wildlife Sites (CWS) and four Local Wildlife Sites (LWS) also lie within 2km of the scheme.

30.7.3 Online records and survey data indicate the presence of a number of species within the study area. These include; badger, bat, great crested newt, otter, water vole, white claw crayfish and a range of wintering birds.

- 30.7.4 Badger; The Phase 1 habitat survey for badger highlighted the presence of both active and inactive setts within the wider surroundings of the scheme. A detailed badger survey was undertaken in April 2017 where a total of five active badger setts were identified within the overall study area.
- 30.7.5 Bat; The phase 1 survey identified that the land directly surrounding the A47 (arable farmland) holds limited potential to host bat populations. The hedgerows, semi improved grassland and broad leaved plantation woodland located in the wider landscape, offer foraging and commuting potential. Building scoping assessments were undertaken in January 2017, where a total of six buildings were identified within 50m of the route options. Of these, one was identified as having high bat roost potential. Further to this, tree scoping identified 96 trees as having between low and high bat roost potential.
- 30.7.6 Invertebrates; The Phase 1 habitat survey identified Sutton Heath Bog as a potential habitat for Desmoulin's whorl snail.
- 30.7.7 Great crested newt; A total of 29 ponds within the study area were observed to ascertain presence and populations of great crested newt. Out of the 29 ponds assessed, 15 returned negative results for GCN.
- 30.7.8 Otter/ Water vole; Otter and water vole surveys were completed in April 2017. Several otter tracks and signs and potential holts were identified within 500m of the route options, some of which were located in close proximity to potential watercourse crossing points. No field signs of water vole were recorded.
- 30.7.9 White-clawed crayfish; The Phase 1 habitat survey identified a number of small watercourses located within the scheme boundary that hold low suitability for white-clawed crayfish. These watercourses were assessed in April 2017 and no crayfish were found during these surveys.
- 30.7.10 Wintering birds; Three wintering bird surveys were completed in January, February and March 2017. Forty-six protected species of wintering birds were identified during this time.

Impacts

- 30.7.11 Construction impacts would be similar from all options, with vegetation removal and disturbance to species. There is also potential for pollution of habitats although these would be controlled through adherence to best practice measures and pollution prevention.

Option 1

- 30.7.12 During operation, there would be adverse impacts for the A47/A1 Interchange Road Verges County Wildlife Site, which would result in the loss of a significant section of this CWS. Some existing hedgerows (two of which have been identified as native species) would be permanently lost or severed at various points across the option. Slight adverse impacts were determined for badger, bat, otter and wintering birds due to habitat disruption.

Option 2

- 30.7.13 During operation, significant adverse impacts were determined for the A47/A1 Interchange Road Verges CWS, Sutton Disused Railway CWS and Sutton Meadows North CWS due to land take and severance. Priority habitats would be directly impacted due to land take from Lowland calcareous grassland, traditional orchards and lowland meadows. Existing hedgerows would be permanently lost or severed at various points across the option. Slight adverse impacts were determined for badger, bat and otter due to habitat disruption.

Option 3

30.7.14 During operation, Option 3 would result in large adverse impacts on Sutton Heath & Bog SSSI. A proposed new link road would intersect the eastern boundary of this SSSI, while the realigned A47 would intersect the southern boundary of the SSSI. Two new culverts required for this option have the potential to change the hydrology of the SSSI. The A47/A1 Interchange Road Verges CWS would further experience an adverse impact due to the permanent loss of a small section of this CWS. Priority habitats would be impacted by Option 3 due to land take from wood-pasture and parkland, arable field margins and traditional orchards. Significant adverse impacts were determined for aquatic invertebrates (Desmoulin's whorl snail) and bat. Badger and otter species were also determined to experience slight adverse impacts.

Option Ranking

30.7.15 Options 1 is considered to be the preferred option. The alignment would not require a significant amount of land take from property or other habitats and would only impact the road verges CWS. This option is identified as the least preferred option and would have a potentially significant impact on Sutton Heath & Bog SSSI. Adverse impacts were further determined on aquatic ecology and bats under this option. The ranking is as follows;

- Option 1
- Option 2
- Option 3

30.8 Noise and Vibration

Baseline conditions

30.8.1 The A47 corridor between Leicester and Peterborough was identified as being predominantly single carriageway with areas of dual carriageway between Sutton and Peterborough. The section between Wansford and Sutton is single carriageway. The main source of noise within the study area is from the traffic on the A47 and the A1.

30.8.2 There are three Noise Important Areas (NIAs) within the study area, ID numbers 5303, 5304 and 5305. NIAs are 'noise hotspots', areas where the most people affected by traffic noise live.

Impacts

30.8.3 **Table 30-2** below shows the noise sensitive receptors in distance bands up to 600m from each of the options.

Table 30-2: Noise Sensitive Receptors

Layout	Band (metres)						Total
	0-50	50-100	100-150	150-200	200-300	300-600	
Existing	2	1	4	10	30	210	257
Option 1	3	4	11	26	40	244	328
Option 2	1	6	11	26	40	244	328
Option 3	2	8	18	28	43	210	309

Option 1

30.8.4 This option would affect 328 receptors. Noise modelling predicted that 11 receptors would experience significant adverse effects in the long-term as a result of Option 1.

Option 2

30.8.5 This option would affect 328 receptors. Noise modelling predicted that 14 receptors would experience significant adverse effects in the long-term because of Option 2.

Option 3

30.8.6 This option would affect 309 receptors. Noise modelling predicted that 15 receptors would experience significant adverse effects in the long-term because of Option 3.

Option Ranking

30.8.7 The results of the noise modelling predicted that Option 1 is the preferred option because it was predicted to cause significant effects at fewer numbers of receptors in comparison to the other two options. The ranking is as follows:

- Option 1
- Option 2
- Option 3

30.9 Road Drainage and Water Environment

Baseline Conditions

30.9.1 The River Nene is the principal surface watercourse located within the study area. According to the EA, the River Nene is located within the Anglian River Basin District and it has a moderate overall Water Framework Directive (WFD) status, despite being considered heavily modified. Water is abstracted and pumped from the River Nene to the Empingham Reservoir where it is stored and used as a source of water supply.

30.9.2 The Wittering Brook merges with the River Nene downstream of the Wansford Pumping Station. According to the EA, Wittering Brook also has a moderate overall WFD status. The site visit identified that there is a culvert and a weir within the study area which may affect the water level and flow of the Wittering Brook.

30.9.3 In addition to River Nene, the Wittering Brook and Mill Stream, there are approximately twenty-nine small lakes and ponds and ten drainage channels within the surrounding area.

30.9.4 According to the EA, there are three bedrock aquifers within the study area which are associated with the Blisworth Limestone Formation, Lower Lincolnshire Limestone, Upper Lincolnshire Limestone and the Rutland Formations. There are also superficial aquifers associated with areas of alluvium, river terrace deposits and head deposits. There are no groundwater abstraction licences in operation within the study area, however British Geological Survey indicate that there are approximately two water wells located within the study area; the first of which is located at Sacrewell Farm Country Centre and the second is located at Lower Lodge Farm. There are no Groundwater Source Protection Zones located within the study area. The western extents of the study area are classified by the EA as a Groundwater Nitrate Vulnerable Zone (NVZ).

30.9.5 The land surrounding the River Nene and the Wittering Brook is located within planning flood zones. This means these areas are likely to be affected by floods, with up to a 0.1 per cent (1

in 1000) chance of occurring each year and/or a 1 per cent (1 in 100) or greater chance of happening each year. There is also widespread surface water flooding along the land surrounding the River Nene and Wittering Brook (and their tributaries). The risk of surface water flooding ranges between high and low; however, the majority of the land is at medium risk of surface water flooding. The A47 route is considered to be at risk of groundwater flooding.

Impacts

- 30.9.6 During construction, all options have potential to affect the water environment through pollution and sediment runoff, however these will be controlled through best practice measures and adherence to pollution prevention.

Option 1

- 30.9.7 Option 1 would require the extension of existing culverts to accommodate the proposed slip-road between the A1 and the A47 and the dualling of the existing A47. These modifications would result in the greater absence of the natural stream bed and banks and the alteration of flows within watercourses.
- 30.9.8 There is also a potential for dualling of the A47 road and the creation of a local access road between the A47 and Sutton Heath Road / Langley Bush Road to impede groundwater flow due to the shallow nature of the groundwater within the area.
- 30.9.9 Option 1 has the potential to affect flooding risk, following the increased area of impermeable road surface and the modifications to the existing culvert structures.

Option 2

- 30.9.10 This option would have similar effects to Option 1; however, Option 2 would require the construction of a new culvert downstream of the existing A47 culvert and the potential replacement of the existing weir to accommodate the offline dualling of the A47. The introduction of the new A47 culvert has the potential to remove the natural stream bed and banks and the alteration of flows within watercourses (including the greater impediment and increased depth of upstream flows).
- 30.9.11 Option 2 would move a greater percentage of the route alignment into the planning flood zones associated with the River Nene and the Wittering Brook. This option has the potential to increase the risk of fluvial flooding both upstream and downstream of the culverts.

Option 3

- 30.9.12 This option will have similar effects to Option 2 as it would also require the construction of a new culvert downstream of the existing A47 culvert. This option would result in the presence of three culverts and a weir structure along the Wittering Brooke; thus Option 3 is expected to result in the greatest loss of the natural stream bed and banks and the greatest impact on flows within watercourses (including the greater impediment and increased depth of upstream flows).
- 30.9.13 However, Option 3 would move a portion of the route alignment out of the Planning Flood Zones and it is considered likely that the risks of flooding to the scheme would be reduced.

Options Ranking

- 30.9.14 Overall, Option 1 is considered the optimal route option, as the potential impacts on the road drainage and water environment are considered the least severe. Option 3 is preferred over Option 2 as it would result in lower flood risks to the scheme. The ranking is as follows:

- Option 1
- Option 3
- Option 2

30.10 People and Communities

Baseline Conditions

- 30.10.1 Land use within the study area is predominantly dominated by agriculture and specifically utilised for the cultivation of crops and cereals and the keeping of livestock or the cultivation of forage material. Residential properties are scattered throughout the study area with main concentrations located within the villages of Wansford and Sutton. A number of community facilities are additionally present within these villages.
- 30.10.2 There are also small areas of land located within the study area which are designated for development, with proposals including housing and agricultural developments. There are a number of community facilities within the study area.
- 30.10.3 There are three Public Rights of Way (PRoW) present within the study area which may be impacted by one or more of the proposed options. The PRoWs are used by a variety of non-motorised users (NMUs). The pedestrian access along the existing A47 and side roads is considered limited.

Impacts

Option 1

- 30.10.4 As a result of Option 1, NMUs using PRoWs would experience increases in ambient noise levels and potential reductions in air quality and views as they approach the works area. The construction activities would also result in temporary severance of the PRoWs. Given that Option 1 is online, the construction activities are also expected to result in greater disruptions to traffic flows on the existing A47 and thus high driver stress levels.
- 30.10.5 In terms of operational impacts, Option 1 would require approximately 244,612m² of land take. The land to be acquired includes agricultural, commercial, residential and community land and buildings.
- 30.10.6 Option 1 would introduce a link road between Wansford Roundabout to the existing truck layby and a proposed underbridge which would provide access to Sacrewell Farm. This option is anticipated to increase NMUs' exposure to traffic and noise and to increase the journey length by approximately 50m. On the other hand, the proposed underbridge is also expected to improve community severance. Option 1 is also expected to infringe and to marginally reduce the length of the Wansford 4 Section 1 Route due to online widening. In terms of vehicle drivers, Option 1 is expected to maintain low driver stress levels and existing views from the road at operation.

Option 2

- 30.10.7 The construction of Option 2 would have similar impacts on the PRoWs in terms of journey amenity, length and community severance as Option 1. However, Option 2 is expected to have less severe impacts on driver stress and views from the road compared to Option 1; as it is predominately offline.
- 30.10.8 In terms of operational impacts, Option 2 would require approximately 295,480m² of land take. Similarly, to Option 1, this option would require the acquisition of agricultural, commercial, residential and community land and buildings.

30.10.9 Option 2 is expected to result in similar impacts to Option 1 in terms of journey amenity, length and community severance as it would also introduce a link road between Wansford Roundabout to the existing truck layby and Sacrewell Farm and it is also expected to encroach upon the Wansford 4 Section 1 Route. In terms of vehicle drivers, Option 2 is expected to maintain low driver stress levels and existing views from the road.

Option 3

30.10.10 The construction of Option 3 would have similar impacts on the PRoWS in terms of journey amenity, length and community severance as Option 2.

30.10.11 In terms of operational impacts, Option 3 would require approximately 269,590m² of land take. Similarly, to Options 1 and 2, this option would require the acquisition of agricultural, commercial, residential and community land and buildings.

30.10.12 Option 3 is expected to result in similar impacts to Options 2 and 3 in terms of journey amenity, length and community severance as it would also introduce a link road between Wansford Roundabout to the existing truck layby and Sacrewell Farm; however, it is not expected to encroach upon the Wansford 4 Section 1 Route. In terms of vehicle drivers, Option 3 is expected to maintain low driver stress levels and existing views from the road.

Option ranking

30.10.13 Overall, option 3 is considered the most preferred option as it expected to result in the least adverse impacts on overall land use. From the perspective of pedestrians, cyclists and equestrians, Option 3 is marginally preferred over options 1 and 2 as in addition to improving community severance (similarly to Options 1 and 2), it would also shift the road alignment north of NMU routes – reducing NMUs' exposure to traffic and noise and leave the existing A47 in place as a facility for NMU usage.

30.10.14 Option 2 is considered second most preferred option. Option 1 is online and the construction activities are expected to result in major traffic delays and adverse impacts on driver views. Option 1 is also expected to have the most adverse impacts on land use (particularly residential and commercial properties).

30.11 Geology and Soils

Baseline conditions

30.11.1 The anticipated solid geology immediately underlying the site includes Rutland, Lincolnshire Limestone, Grantham and Whitby Mudstone Formations. Superficial deposits comprise alluvium, river terrace deposits and head deposits. Natural England's Agricultural Land Classification Map indicates that the floodplain areas associated with the River Nene and Wittering Brook (within the southern extents study area) are mostly classified as very good agricultural land with a few minor areas of poor agricultural land located immediately adjacent to the watercourses. The land located within the northern, eastern and western extents of the study area are generally classified as good-moderate land for agricultural purposes with minor areas of poor-very poor agricultural located near Thornhaugh and Upton.

30.11.2 The current agricultural, woodland and naturalised areas surrounding the options have a high potential for being able to store carbon.

30.11.3 Approximately 15 potentially contaminated sites have been identified within 300m of the scheme extents. These include sand/gravel pits, disused railways, commercial fuel station and historic pollution events.

Impacts

30.11.4 All options have potential to result in pollution of underlying soils during construction, however these can be managed through best practice measures and adherence to pollution prevention. Adverse impacts on bedrock are expected for all options due to the excavation work required. The removal of woodland and vegetation would create adverse impacts on biomass production and climate change.

Option 1

30.11.5 This option would require the excavation of 11,485.56m³ of superficial geology and soil materials which are designated as very good and good agricultural land and the importing of 47,496.50m³ of engineering fill to obtain a satisfactory engineering platform. The scheme is expected to permanently change the composition of superficial geology and soil materials within the footprint of the proposed scheme.

30.11.6 Option 1 has the potential to mobilise pollution associated with the existing road infrastructure / underlying made ground, the disused railway and embankments, the petrol station and the historic pollution event during the construction phase.

30.11.7 The removal of woodland and vegetation would create adverse impacts on biomass production and climate change.

Option 2

30.11.8 Similarly, to Option 1, Option 2 would require the excavation of 10,287.92m³ of superficial deposits and soils which are designated as very good and good to moderate agricultural land by Natural England (cut volume) and the importing of 76,533.22m³ of engineering fill. The scheme is expected to change the soil composition within the footprint of the proposed scheme.

30.11.9 Option 2 would shift the road alignment offline and away from a number of the contaminated land risks associated with the existing road infrastructure.

30.11.10 The removal of woodland and vegetation would create adverse impacts on biomass production and climate change.

Option 3

30.11.11 Similarly, to Options 1 and 2, Option 3 would require the excavation of 22,494m³ of superficial deposits and soils which are designated as very good and good to moderate agricultural land by Natural England (cut volume) and the importing of 94,583m³ engineering fill. The scheme is expected to change the soil composition within the footprint of the proposed scheme.

30.11.12 Option 3 would shift the road alignment offline and away from a number of the contaminated land sources associated with the existing road infrastructure.

30.11.13 The removal of woodland and vegetation would create adverse impacts on biomass production and climate change.

Option ranking

30.11.14 Overall, Option 1 is considered the optimal route option, as it would have the least severe impact on the soil composition. Option 2 is preferred over Option 3 as it would have a less severe impact on the soil materials within the study area. All three options are considered to have similar impacts in terms of contaminated land. The option ranking is as follows:

- Option 1
- Option 2
- Option 3

30.12 Materials and Waste Management

Baseline conditions

30.12.1 The existing carriageway along the section proposed for improvement is single carriageway with associated drainage. There are a number of utilities present in the road verges including; communications cables and a water mains. A number of waste facilities are present in the wider area and a number of landfill sites in and around Peterborough.

Impacts

30.12.2 All options would result in the use of virgin or recycled materials and generate waste. Where possible existing materials would be reused and the amount of virgin materials used would be minimised.

Option ranking

30.12.3 Option 1 is considered the optimal route option, as there is a potential to re-use existing materials and to reduce the procurement of finite construction materials. Option 2 is preferred over Option 3 as it is anticipated to generate less waste. Earthwork estimations indicate that Option 2 would result in smaller cut volumes. The option ranking is as follows:

- Option 1
- Option 2
- Option 3

30.13 Conclusions

30.13.1 The options were ranked using colour coding, with the most preferred option ranked green, the least preferred red, and the second preferred option yellow. **Table 30-3** below summarises the environmental ranking of the options.

Table 30-3: Environmental Ranking of Options

Environmental topic	Option 1	Option 2	Option 3
Air quality	Yellow	Green	Red
Cultural heritage	Green	Yellow	Red
Landscape and visual	Green	Red	Yellow
Nature conservation and biodiversity	Green	Yellow	Red
Noise and vibration	Green	Yellow	Red
Road drainage and the water environment	Green	Red	Yellow
People and communities	Red	Yellow	Green
Geology and soils	Green	Yellow	Red

Environmental topic	Option 1	Option 2	Option 3
Materials			

30.13.2 The above table shows that Option 1 is the environmentally preferred option, with Option 2 second preferred and Option 3 least preferred.

30.13.3 Further detailed assessment will be undertaken during the PCF Stage 3 to identify specific mitigation and monitoring requirements where these may be required.

30.14 Next Steps and Potential Mitigation

30.14.1 During PCF Stage 3 further detailed environmental surveys and assessment will be undertaken. A full environmental assessment and a formal Environmental Statement will be prepared as part of the submission of the scheme for DCO.

30.14.2 The PCF Stage 2 EAR contains some initial potential mitigation statements prepared for each of the three options and each of the topic areas. A summary of these is included in the sections below. It should be noted that these mitigation measures will need to be developed, reviewed and updated once the preferred route has been developed but give an idea of the type of environmental mitigation measures which are likely to be considered during PCF Stage 3.

Mitigation - Air Quality

30.14.3 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.

30.14.4 In accordance with the IAQM Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Mitigation - Cultural Heritage

30.14.5 It is likely that archaeological mitigation measures can be put in place through a Written Scheme of Investigation (WSI) to reduce the impact on the historic environment. Mitigation measures may include, but are not limited to, further geophysical surveys, evaluation excavation and landscape screening.

Mitigation – Landscape and Visual Impacts

30.14.6 It is likely that the following mitigation measures will be undertaken during the construction phase: minimising of working corridor to limit vegetation removal and soil disturbances, tree surveys to identify key specimens or groups of trees to retain and protect, generation of a soil resource plan in accordance with good practice guidance such as the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, careful siting and management of construction compounds, traffic and plant.

30.14.7 The primary means of mitigation of operational impacts is in the design of the road including its horizontal and vertical alignment and the layout and design of junctions and link roads.

Other secondary mitigation measures include the siting and design of roadside infrastructure, on and offsite planting and mounding and earth shaping.

Mitigation – Nature and Conservation

30.14.8 Options to avoid/reduce/mitigate/compensate for any potential adverse effects on designated sites, and protected/notable habitats and species should be undertaken as the scheme evolves. Standard mitigation measures are also to be considered which include pollution prevention control measures, water flow management strategies, standard control measures to control dust from construction activities, preconstruction surveys and production of an EcoCEMP.

30.14.9 Additional mitigation measures to also consider during the scheme design, construction and operation, include: retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and HE BAP; off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary); enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design; Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and on-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.

30.14.10 Net-gains in biodiversity could potentially be achieved, which would meet objectives in the Highways England Biodiversity Plan ahead of the 2040 target. These gains may be achieved through the creation of new habitats, wildlife corridors and by improving existing habitats and habitat interconnectivity.

30.14.11 Further baseline surveys are required at PCF Stage 3 to fully inform mitigation proposals. Consultation will also be required with ecological stakeholders on the mitigation proposed.

Mitigation – Noise and Vibration

30.14.12 Mitigation measures that could be considered to reduce the operational impact of traffic noise on local receptors, if required, include:

- Maximising the distance between new/realigned sections of road and nearby receptors;
- Minimising changes in traffic on existing roads due to the scheme;
- Earth bunds/noise barriers to screen nearby receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of new/realigned sections of road into the surrounding area. This can also provide visual mitigation;
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
- Noise insulation of individual properties to protect the internal noise environment.

30.14.13 Construction works should be carried out in accordance with BS 5228-1 and -2 2009 plus amendments 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

Mitigation – Road Drainage and Water Environment

30.14.14 Mitigation measures that could be considered during the construction phase include:

- Compliance with Environmental Agency Policy and Practice for the Protection of Groundwater (1998) and Environment Agency Pollution Prevention Guidance notes (in particular PPG5) until such times that new guidance becomes available;
- Production of a Pollution Prevention and Spill Response Procedure; and
- Implementation of site clearance strategies, including phased removal of surface vegetation, provision of a grass buffer strip around the construction site and along watercourses, re-vegetation of exposed soils; and protection/maintenance of storm water drain inlets.

30.14.15 Mitigation measures that could be considered during the operational phase include:

- An assessment of pollution impacts from routine runoff to surface waters, assessment of pollution impacts from routine runoff on groundwaters and assessment of pollution impacts from spillages to quantitatively assess potential impacts to the water environment;
- Upgrading the drainage design and consideration of sustainable drainage principles and the advice of the EA and Internal Drainage Board (may require additional land take); and
- Careful consideration of the culvert designs to minimise impacts on the channel morphology, flood risks and aquatic ecology.

Mitigation – People and Communities

30.14.16 Mitigation measures should include the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with Highways England and other appropriate stakeholders. The appointed Contractor will adhere to current best practice techniques during the construction phase.

30.14.17 Appropriate landscape planting would be implemented to minimise visual impacts during the operation of the scheme. Alternative means of access would also be provided where existing access points are disrupted by the proposed options. Similarly, it is assumed that hedgerows, field boundaries, water supplies and existing field drainage infrastructure would be re-instated where impacts are sustained as a result of the option construction. Additionally, it is assumed that where possible PRowS would be re-connected and where new junctions or roundabouts are part of the design these will incorporate suitable provision of NMU infrastructure.

Mitigation – Geology Soils and Materials

30.14.18 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.

30.14.19 Where contamination is identified, or expected, appropriate sampling, analysis and risk assessment should be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors. Where necessary, a phase 1 and phase II contaminated land assessment should be undertaken. The contaminated land assessment should be undertaken in accordance with CIRIA guidance, CIRIA 107 remedial treatment for contaminated land, 1995 and DEFRA's Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012. Guidance in materials use and resourcing can be found within the DfT's Sustainable Highways: A Short Guide, June 2008.

30.14.20 Maximising the reuse of materials on site through the use of a MMP or SRP will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.

30.14.21 Construction works should be in compliance with the guidance provided in the BS 3882:2015 'British Standard Specification for Topsoil', 2015 – sourcing suitable topsoil, handling topsoil in appropriate manner (weather, machinery), avoiding stockpiling where possible. The excavated soils should be reused on site to minimise the amount of material to be imported where possible. Additional guidance can be found within DEFRA's 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites', 2009.

31 Additional Assessment of Public Consultation

31.1 Introduction

31.1.1 As discussed in Section 24, the total number of respondents to the consultation was 170, which included responses from stakeholders and members of the public. Therefore, the findings set out in the Report on Consultation and in Section 24 should be treated with caution and not be interpreted as representative of the views of the wider population of Wansford to Sutton and the surrounding area.

31.1.2 Section 24.2.5 to 24.2.9 explains the way in which the responses received from the consultation were coded for analysis.

31.1.3 The consultation comments were filtered to identify where comments were specific to “route” comments. This was undertaken by filtering comments which had been coded as follows:

- General theme comments also coded as:
 - Design / route
 - Design / route – lorry park
 - Design / route – Sutton Heath Road Junction
- Option 1 theme comments also coded as:
 - Design / route
 - Design / route – Sutton Heath Road Junction
- Option 2 theme comments also coded as:
 - Design / route
 - Design / route – Sutton Heath Road Junction
 - Design / route – too far south
- Option 3 theme comments also coded as
 - Design / route

31.2 Filtered Route Comments

31.2.1 The “route” comments identified by the filtering as explained in 31.1.3 are presented in the Tables in **Appendix Q**.

31.3 Review of Comments

31.3.1 The comments have been reviewed and a response has been added. The response seeks to either explain how the comment has been considered or addressed within the PCF Stage 2 work undertaken or indicates that the comment will be considered or addressed within following PCF Stages of the scheme.

31.3.2 As is noted in the tables in Appendix Q, the majority of the filtered comments refer to issues which will be addressed and used by the design teams to help shape the preliminary design as explained in the recommendations in the Report on Public Consultation:

“Going forward following Preferred Route Announcement, the responses and the information contained and appended to the responses, will be used by the design teams to help shape and develop the preliminary design of the preferred route into more detailed proposals This will include consideration of comments and suggestions when developing proposals for junction, side road and non-motorised user strategies. They will also be used to inform analysis, assessment and potential mitigation proposals and considerations for accessibility, environmental, buildability, landscape, severance and interconnectivity, planning and engineering.”

31.3.3 The following headed sections discuss where the comments identified an alternative proposal or Potential Solution and give a brief description of how these have been considered.

The road between the two roundabouts at A1/A47 Interchange needs to be dualled in both directions

31.3.4 A sensitivity check was carried out to test the operational performance of the model where the section between the two dumb bell roundabouts was dualled in both directions (see Section 28.8). This showed a further benefit to eastbound traffic west of the A47. The impact of this will be considered in more detail in PCF Stage 3 – preliminary design.

A potential solution would be to close the northbound access to the A47 from Wansford permitting a free flow of Westbound traffic along the A47 with modifications to Kings Cliffe Road and Old Leicester Road.

31.3.5 Local roads are the responsibility of the local authority and any closures or proposed changes would need to be discussed with PCC and are outside the scope of this scheme.

32 Other Relevant Factors considered in PCF Stage 2

32.1 Summary of Engagement with Public Bodies in PCF Stage 2

32.1.1 A summary of completed stakeholder engagement in PCF Stage 2 is detailed below:

Peterborough City Council and Cambridgeshire County Council

- 04 July 2017 - Technical Officers Meeting to discuss progress and developments to the design.

Other Stakeholders

- 11th April 2017 – Meeting with HCA to get an update following PCC's recent review of the Peterborough Local Plan
- 28 July 2017 – Meeting with Sustrans to give an update on the scheme.

Environmental Bodies

32.1.2 A meeting took place with Historic England on 10th May 2017 specifically to discuss impact on the scheduled monument.

32.1.3 No further meetings were held with the national or local environmental statutory bodies (Natural England, Environment Agency,) during PCF Stage 2 at the request of Highways England.

32.1.4 Further engagement with the environmental bodies is required early in PCF Stage 3.

32.2 Assessment of Planning Requirements, National and Local Policy

32.2.1 The construction on this stretch of carriageway will meet the criteria for a Nationally Significant Infrastructure Project and will therefore be subject to the DCO process due to:

- The amount of land take required; and
- Environmental Impact Assessment which showed significant impact on the County Wildlife site, the River Nene and a number of historic environment records.

National Policy Statement for National Networks (NPSNN)

32.2.2 As detailed in 32.2.1 above and earlier in this document (Chapter 2), during PCF Stages 1 and 2, it was assumed that improvements to Wansford to Sutton Scheme would meet the criteria for a NSIP and would be subject to the DCO process. In this case, the planning application will be judged primarily against the NPSNN, according to the decision-making framework set out in the Planning Act 2008.

32.2.3 The NPSNN was reviewed and the relevant topics and impact on the options were summarized at a high level in the PCF Stage 2 product DCO Application - Planning Statement & National Policy Statement Accordance document (A47-IMPS2-AMY-WS-ZZ-J0058 DCO Report).

32.2.4 In this case, the planning application will be judged primarily against the NPSNN, according to the decision-making framework set out in the Planning Act 2008.

32.2.5 This confirmed the assumption that the Scheme should be considered a NSIP and therefore follow a DCO planning route determined by the Planning Act 2008 at this time.

Roads Investment Strategy (RIS)

32.2.6 The RIS described in Chapter 2 of this report is still applicable to this Scheme.

Highways England Strategic Business Plan (SBP) (2015-2020)

32.2.7 The SBP described in Chapter 2 is still current and relevant to this Scheme and has not been updated.

Highways England Delivery Plan (2015-2020)

32.2.8 The Delivery Plan described in Chapter 2 is still current but is subject to an annual review/update. The latest update, published in August 2017, details current progress on schemes and performance against Highways England KPI's.

32.2.9 The objectives of the RIS including the KPI's from the SBP and the original Delivery Plan were used during the sifting of options described in Chapter 10.

32.2.10 The KPI's remain but the PI's within each KPI has been updated which will need further consideration during PCF Stage 3.

32.2.11 A supplementary Annex was published by Highways England in October 2017 which provides further update on scheme delivery and performance against KPI's.

32.2.12 The A47 Wansford to Sutton Scheme is still listed in the latest update but now has the start of works as 2020/21 in the 'Updated Scheme Schedule 2015-20'. This represents a delay to the Scheme not previously identified and is as a result of concerns regarding phasing of the works along the A47 as a whole. The start on site date will be confirmed by Highways England in future stages.

32.2.13 Specifically, the update to the Delivery Plan describes the reason for delay as 'the route based review seeks to optimise the delivery programme of seven projects along the A47 linking Peterborough and Norwich. All schemes within this study have been rescheduled to avoid potential impact of simultaneous roadworks and minimise delivery risk. The schedules for the two schemes around Peterborough enable a joint traffic management strategy to be developed for improved delivery efficiency.'

Local Plans

32.2.14 There have been further developments in the Local Plans described in Chapter 2 highlighted below:

Greater Cambridge Greater Peterborough Local Enterprise Partnership (GCGP LEP) Strategic Economic Plan 2014

32.2.15 The GCGP LEP Strategic Economic Plan originally published in 2014 is still current but has been updated to include 'Growth Deals':

- In July 2016, the LEP submitted a bid for an additional £70.5 million under Growth Deal Round Three to support a range of projects in the local area, including new skills facilities and infrastructure improvements, and will see the creation of 10,000 new jobs and building of 2,700 new homes.

- On 2nd February 2017, Government announced that the GCGP area had secured £37.6 million of Growth Deal Funding via the Third Round to help create jobs, support businesses and encourage growth.

32.2.16 It also recognises the combined authority (see section 2.3.9 and 32.2.20) and that the Mayor is a member of the LEP. It states that 'GCGP will have senior representation within the Mayor's cabinet'.

32.2.17 GCGP are currently developing 'investment pipelines' to support the new combined authority, but no further details are available at the time of writing.

Peterborough Local Plan Further Draft December 2016

32.2.18 An initial review of the Local Plan discussed in Chapter 2 has been completed by PCC. Updates to the proposals in Sections 2.3.7 to 2.3.10 are listed below:

- The number of dwellings at Great Haddon increased from 5300 to 5910
- The eastern landholding (identified as Land north of Castor and Ailsworth in the Peterborough Local Plan) that belongs to HCA (discussed in section 2.3.9) has been allocated for 2500 dwellings in the plan period to 2036.

32.2.19 All the above updates are still potential development and not yet committed.

Cambridgeshire and Peterborough East Anglia Devolution Proposal 2016

32.2.20 The Cambridgeshire and Peterborough East Anglia Devolution Proposal 2016 described in Section 2.3.13 has been set up and a Mayor was elected on 4 May 2017. The Mayor will chair the new Combined Authority and will be a focal point of leadership for central government, business and other partners.

32.2.21 This means that more important decisions are decided by a local combined authority rather than being imposed by Government as well as new funding. This current deal would include decisions on things like housing, transport and major infrastructure projects.

32.2.22 By having a Combined Authority and a Mayor in place, Cambridgeshire and Peterborough will receive:

- £170 million to deliver new homes over a five year period
- £20 million a year funding over 30 years to boost growth in the region
- responsibility for chairing a review of 16+ skills provision in the area
- authority to co-design a new National Work and Health programme with Central Government aimed at those with a health condition or disability and the very long-term unemployed.

32.2.23 Policies are currently in development but at the time of writing, there are no specific areas that have been published in regards to the Wansford to Sutton Scheme.

32.3 Assessment of Options against Planning Factors

32.3.1 At the time of writing none of the options currently being developed have a negative impact on any of the committed plans described in Chapter 2, Chapter 7 and in this Chapter and all comply with the policies described in these chapters.

32.3.2 The proposed developments described in Section 32.2.17 are not yet committed, however they will need to be considered in further PCF Stages as the scheme progresses.

33 Appraisal Summary Table

33.1.1 The completed AST can be found in **Appendix R**.

33.1.2 The purpose of the AST is to provide the project team with a concise, across-the-board overview of the impacts of a scheme option, taking account of all the economic, social, environmental and financial impacts of a proposed solution as set out in the Treasury Green Book. This enables an assessment to be made as to the overall value for money an option provides. Further information on the Distributional Impact Assessment can be found in the Distributional Impact Appraisal Report, document reference A47 IMPS2-AMY-WS-ZZ-DO-J-0063 which supports the AST.

34 Programme

34.1.1 A high-level programme for scheme delivery has been prepared in accordance with Highways England's PCF requirements. The current programme has been developed making allowance for the DCO process to be followed. Highways England to complete estimated delivery dates for PCF Stages 3 to 7.

Table 33-1: Summary of Key Milestones

PCF Stage	Delivery Item	Estimated project delivery date	Estimated project duration
PCF Stage 0	Strategy, Shaping and Prioritisation	Complete	Complete
PCF Stage 1	Option Identification	Complete	Complete
PCF Stage 2	Option Selection	Complete	Complete
PCF Stage 3	Preliminary Design	TBC	TBC
PCF Stage 4	Statutory Procedures and Powers	TBC	TBC
PCF Stage 5	Construction Preparation	TBC	TBC
PCF Stage 6	Construction, Commissioning and Handover	TBC	TBC
PCF Stage 7	Close Out	TBC	TBC

35 Validation of Preferred Route

35.1.1 This section highlights any differences in assessments between PCF Stage 1, interim assessment prior to PRD, final assessment following PRD and whether it has any impact on the preferred route decision.

35.2 Environmental

35.2.1 Comparing the assessments in PCF Stage 1, Pre-PRD summary (Table 27-3) and Final summary (Table 30-3), the assessments were the same for:

- Landscape and Visual;
- Road Drainage and Water;
- Geology and Soils; and
- Materials.

35.2.2 There were some differences between assessments for Air Quality; Cultural Heritage; Noise and Vibration; and People and Communities. These are highlighted in the following paragraphs.

Air Quality

35.2.3 The Air Quality was assessed as neutral for Options 1 and 2 and slight adverse for Option 3 at PCF Stage 1 and pre-PRD. In the final assessment, there wasn't much difference between the options but Option 3 was least preferred due to demolition of The Old Station House.

Cultural Heritage

35.2.4 Option 3 was the least preferred option in all stages due to impact on the scheduled monument which is a designated site and demolition of The Old Station House, a building of historic interest. In PCF Stage 1 and prior to PRD, Option 2 was the preferred option and Option 1 second preferred as at the time it was assumed that online widening of Option 1 would impact on the scheduled monument. In the final assessment, Option 1 was the preferred route and Option 2 second preferred as further consultation with the Engineering Design team concluded that online widening could be possible without further impact on the scheduled monument.

35.2.5 This does not impact on the PRD as Option 1 was ruled out due to higher cost and potential delays due to construction/traffic management and lack of suitable diversionary routes.

Nature Conservation and Biodiversity

35.2.6 In all stages, Option 1 was the preferred option. In PCF Stage 1, Option 3 was second preferred and Option 2 least preferred. Prior to PRD and following final assessment Option 2 became the second preferred and Option 3 least preferred. This was due to surveys revealing two buildings with confirmed bat roosts (full status to be confirmed); one of which is directly in line of Option 3 and the other will experience significant disturbance. It was also discovered that the SSSI has a confirmed population of Desmoulin's whorl snails for which any impact on hydrology would have a significant effect. This had no impact on the PRD; in fact it highlights the issues with Option 3 and makes the case for Option 2 stronger.

Noise and Vibration

35.2.7 Options were slight adverse or neutral at PCF Stages 1 and pre-PRD. In the final assessment once noise modelling had been completed, Option 3 was the least preferred as it impacted on the most number of receptors.

People and Communities

35.2.8 In PCF Stage 1, Option 3 was most preferred and Option 1 least preferred, however prior to PRD the assessment showed Option 1 to be the most preferred and Option 3 to be the least preferred. This was incorrect as the assessment was incomplete at the time and was mainly based on impact on PRoWs. In the final assessment, Option 3 was the most preferred and Option 1 the least preferred. This had no impact on the PRD.

Overall Environment Assessment

35.2.9 Overall environment ranking of the options was the same prior to PRD and following final assessment and made no difference to the PRD. Option 1 was the environmentally preferred option, with Option 2 second preferred and Option 3 least preferred.

35.3 Economics

35.3.1 The BCR ranking of the options were the same prior to PRD and following full economic assessment with BCR for Option 3 the highest and Option 1 the lowest. Option 1 would deliver high VfM with a BCR of 3.82, whereas Options 2 and 3 would deliver very high VfM with BCRs in excess of 4. Option 2 had a BCR of 4.13 and Option 3 had a BCR of 4.47.

35.4 Overall Validation

35.4.1 The work completed after the PRD namely the traffic modelling (including construction delay modelling), economic assessment, environment assessment and summary of all appraisals during the stage (as detailed in the AST), did not show any issues that contradicted the decision to progress the re-aligned Option 2 as the Preferred Route.

36 Conclusion and Recommendations

36.1 Introduction

36.1.1 This sections concludes the work carried out in PCF Stage 2 and describes the PRA route.

36.2 Conclusions

36.2.1 This study has confirmed the transport problem. The likely increase in traffic flow due to committed and potential future developments in and around the Peterborough area will lead to increased congestion.

36.2.2 In seeking to resolve the transport problem, a number of potential options have been developed that have been considered in this report.

36.2.3 The options have been evaluated and assessed further to include:

- More detailed environmental surveys and assessment
- Traffic and Economic assessment
- Responses from Public Information Event

36.2.4 The result of the non-statutory public consultations was overall positive, with local people expressing their support for the scheme.

36.2.5 Indications based on economics assessment in PCF Stage 2 were that Option 1 would likely deliver high VfM (BCR between 3 and 4), whereas Options 2 and 3 would likely deliver very high VfM with BCRs in excess of 4.0.

36.2.6 A preferred route has been announced taking into consideration the environmental sensitivities in the area and key concerns raised at public consultation. The preferred route is an amendment to the original proposed Option 2.

36.3 Recommended PRA Route

36.3.1 The preferred route was announced by Highways England on 14th August 2017. The PRA leaflet states:

“Having reviewed the feedback following the consultation, and completed a number of other assessments, HE is proceeding with an amended version of Option 2 presented at consultation.

Option 2 solves the main traffic and safety problems along the route. It has significant advantages in terms of environmental impact when compared to Option 3 and will have less impact during construction when compared to Option 1.

Key concerns raised in the consultation have influenced an amendment to the original proposal.

The new dual carriageway will be moved as close as possible to the southern edge of the existing A47 at the eastern end of the scheme. This would:

- Increase the distance from the new road to both the River Nene and the village of Sutton.
- Reduce the amount of land take required.

- Allow for the easiest connection of existing side roads to the new A47.
- Allow for most of the existing A47 to remain in place for local traffic and non-motorised groups such as pedestrians, cyclists and equestrians”.

36.4 PCF Stage 3

36.4.1 As stated previously, the PCF Stage 3 Consultants were engaged early and are progressing a number of areas. Some of the key areas that need to be addressed include:

- Affordability and Value Management - further value management interventions are recommended as the Scheme progresses to ensure the Scheme remains affordable.
- Further engagement with statutory stakeholders in particular those concerned with the sensitive environmental areas nearby, to ensure minimal impacts and necessary permits/licenses are in place for any works.
- An appropriate level of flood risk assessment.
- Topographical survey data to be obtained to enable a greater understanding of the topography of the area and link in with the construction process.
- Ground Investigation data to be obtained to assess the local ground conditions and to inform potential geotechnical solutions.
- More detailed investigations and recommendations regarding NMU provisions, including an NMU audit and a RSA as appropriate.
- Buildability of the option and understanding the arrangements in regards to Traffic Management required during construction to minimise disruption.

37 List of Appendices

Appendix A – Existing Key Features of Road Section

Appendix B – Collision Data

Appendix C – Geology Maps

Appendix D – Utilities Plan

Appendix E – Existing Area 6 Diversion Route

Appendix F – Constraints Plan

Appendix G – Detailed Options 1 to 9

Appendix H – EAST Assessment Methodology and Results

Appendix I – Environmental and Engineering Ranking Tables

Appendix J – Detailed Options 10, 1a, 1b

Appendix K – Options 1, 8, 10 with Indicative Side Roads and Junctions

Appendix L – AST for Option 10

Appendix M – Options 1, 2, 3 with Indicative Side Roads and Junctions

Appendix N – Exceptions and Limitations Document

Appendix O – PRD Minutes

Appendix P – Preferred Route Alignment

Appendix Q – Response to Filtered Public Comments

Appendix R – ASTs for Options 1, 2, 3