Norfolk County Council

NORWICH WESTERN LINK

Option Selection Report

70041922-WSP-OSR
JULY 2019

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Norfolk County Council

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Option Selection Report

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GLOSSARY

Acronym	Meaning
AADT	Annual Average Daily Traffic
AMCB	Analysis of Monetised Costs and Benefits Table
AONB	Area of Outstanding Natural Beauty

Acronym	Meaning
AQMA	Air Quality Management Area
ARN	Affected Road Network
ATC	Automatic Traffic Count
BCR	Benefit to Cost Ratio
BGS	British Geological Survey
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CO_2	Carbon Dioxide
CPO	Compulsory Purchase Order
CWS	County Wildlife Site
DBA	Desk Based Assessment
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DIADEM	Dynamic Integrated Assignment and Demand Model
DMRB	Design Manual for Roads and Bridges
D2AP	Dual 2 lane All purpose
EA	Environment Agency
EAST	Early Assessment and Sifting Tool
EFT	Emission Factor Toolkit
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
ES	Environmental Statement
FBC	Full Business Case
FEZ	Food Enterprise Zone
GDP	Gross Domestic Product
GEH	Geoffrey E. Havers
GNDP	Greater Norwich Development Partnership
HER	Historic Environment Record
HEDBA	Historic Environment Desk-Based Assessment
HGV	Heavy Goods Vehicle
HPI	Habitats of Principal Importance
HRA	Habitats Regulations Assessment
HSE	Health and Safety Executive
IDB	Internal Drainage Board
IMD	Indices of Multiple Deprivation
KSI	Killed or Seriously Injured

Acronym	Meaning
LDO	Local Development Order
LEZ	Low Emission Zone
LGV	Light Goods Vehicle
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LLG	Local Liaison Group
LMVR	Local Model Validation Report
LNR	Local Nature Reserve
LPA	Local Planning Authority
LSOA	Lower Super Output Area
LTP	Local Transport Plan
MAGIC	Multi Agency Geographic Information for the Countryside
MCC	Manual Classified Count
MRN	Major Road Network
MWG	Member Working Group
NATS	Norwich Area Transport Strategy
NCA	National Character Area
NCC	Norfolk County Council
NCN1	National Cycle Network Route 1
NDR	Northern Distributor Road *(now named A1270 Broadland Northway)*
NNDR	Norwich Northern Distributor Road
NE	Natural England
NIA	Noise Important Area
NIS	Norfolk Insight Statistics
NMU	Non-Motorised User
NNUH	Norfolk and Norwich University Hospital
NO_2	Nitrogen Dioxide
NPPF	National Planning Policy Framework
NRTF	National Road Traffic Forecasts
NTEM	National Trip End Model
NWL	Norwich Western Link
NWQ	Norwich Western Quadrant
OAN	Objectively Assessed Need
OAR	Option Assessment Report
OSR	Option Selection Report
OBC	Outline Business Case

Acronym	Meaning
OGV	Ordinary Goods Vehicle
ONS	Office for National Statistics
PCU	Passenger Car Unit
PEA	Preliminary Ecological Appraisal
PIA	Personal Injury Accident
PRA	Preferred Route Announcement
PRoW	Public Rights of Way
PVB	Present Value of Benefits
PVC	Present Value of Costs
RIS	Road Investment Strategy
RNR	Roadside Nature Reserve
SAC	Special Area of Conservation
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SERTM	South East Regional Transport Model
SHMA	Strategic Housing Market Assessment
SOBC	Strategic Outline Business Case
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
TBM	Tunnel Boring Machine
TEMPro	Trip End Model Presentation Program
TEN-T	Trans-European Transport Network
TUBA	Transport User Benefit Appraisal
UEA	University of East Anglia
VfM	Value for Money
WebTAG	Transport Appraisal Guidance
WebTRIS	Highways England Traffic Information System
WFD	Water Framework Directive

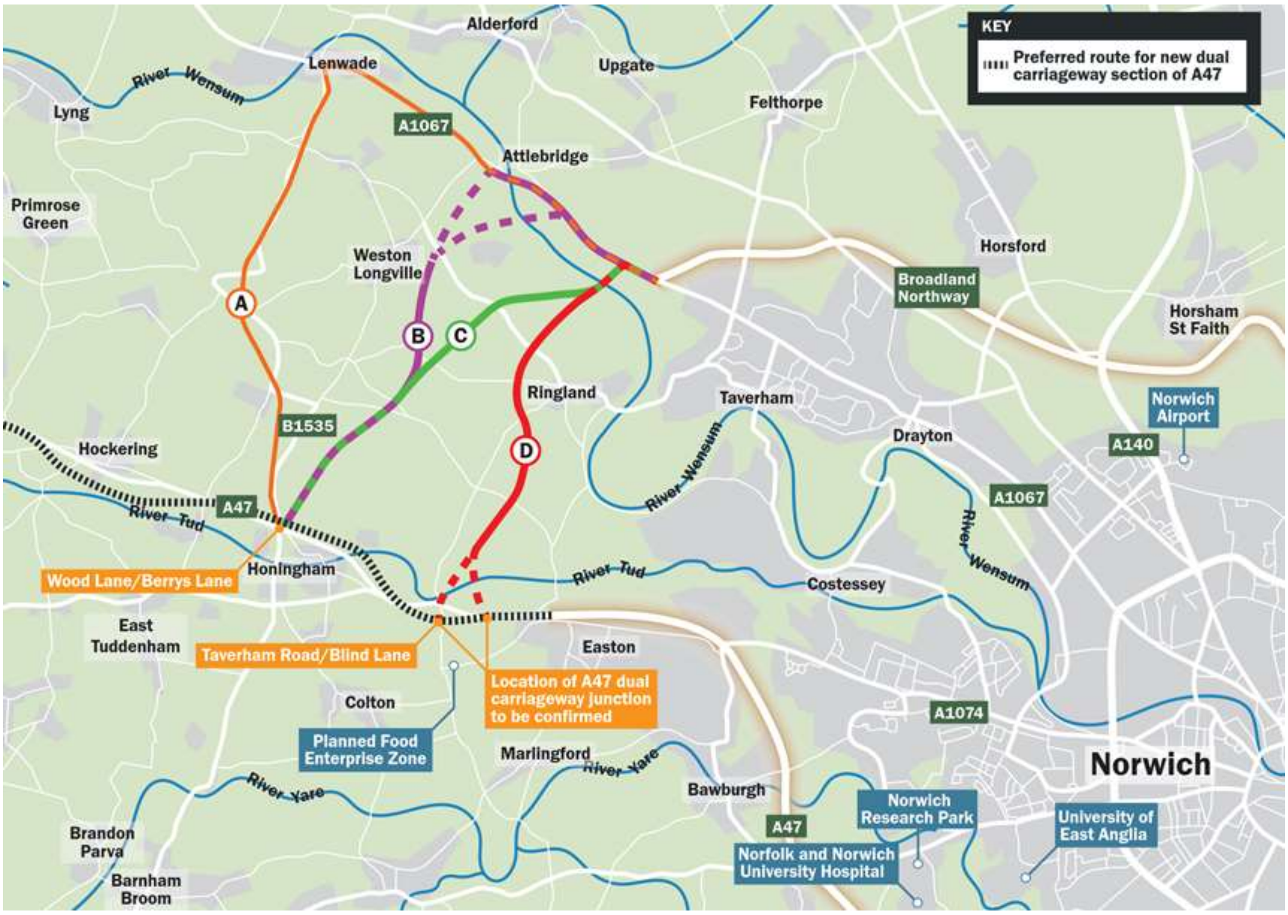
EXECUTIVE SUMMARY

Scheme Background

The Norwich Northern Distributor Route (NDR) A1270 opened partially in 2017 and was completed in April 2018. Since this time, there has been sustained calls for the NDR to be continued to connect from its western end to the A47 trunk road, to ease traffic problems in the local area and enhance strategic connectivity. This pressure has increased with proposals by Highway England to improve the A47 between Easton and North Tuddenham to a dual carriageway. With this consideration, Norfolk County Council committed to revisit the feasibility of a NWL, and undertook a study to develop a shortlist of options.

Proposed Route Options

The option appraisal process for the proposed NWL considered a total of 82 highway and non-highway options. The WebTAG based shortlisting process resulted in shortlisting options that performed better than a do-nothing scenario and scored well against scheme objectives, feasibility, cost and environmental criteria. Four route options were identified as best performing named routes A, B, C and D. Further investigation of the 4 route options resulted in development of variants of Options B and D, subsequently referred to as Option B West and Option B East; and Option D West and Option D East. The route options as shown below were also subject to a public consultation which ran from November 2018 to January 2019. The results of the consultation have been considered within this report alongside a range of engineering, environmental and economic assessment results.



Purpose of Report

The purpose of this report is to draw together the information relating to the route options for the NWL to enable a decision to be made on a preferred route, considering a wide range of engineering and environmental criteria as well as feedback from public consultation.

Scope of the Report

The report has been prepared as a Stage 2 Scheme Assessment Report, following guidance in Design Manual for Roads and Bridges (DMRB) TD 37/97 Scheme Assessment Reporting, to asses:

- existing conditions of the road network and surrounding land;
- engineering layouts of the route options;
- impacts of each route on different environment aspects;
- traffic and economic implications of each route; and
- results of the 2018/19 public consultation.

CONCLUSIONS

Engineering

The main engineering issues identified are related to provision of new roads within constrained corridors, with the six NWL route options having varied layouts and profiles.

In general, the options that link the NWL to the A1067 closer to the A1270 are dual carriageways to cater for the greater volume of traffic attracted to the routes, with structures provided to enable local road crossings. It therefore follows that these options would also involve more land take, earthworks and generally have higher scheme costs.

Considerable access disruption and traffic management is anticipated for route options that require online construction, and the Wensum River crossing construction is expected to be challenging considering environmental sensitivities and site topography.

Overall, none of the engineering issues identified are significant enough to completely discount any of the options under consideration and while each option may have some engineering merit, Option C overall ranks ahead of other Options when assessed with a combination of criteria, that include, design fit with topography, layout constraints, utility and traffic management/disruption during construction. Each option was ranked against the topics below in order to understand relative ranking.

- Horizontal alignment, land use and constraints - how far each route avoids impact.
- Junctions and links – requirement and challenge of these.
- Topography and profile – challenge of terrain / requirement for large embankment and cuttings
- Structures / bridges – complexity and number required
- Drainage – drainage strategy requirements
- Public utilities interaction – impacts on utilities with consideration of complexity and challenge of these
- Junctions with A47 dualling scheme – ease of accommodation within current known Highways England proposals
- Departures from standards – how physical constraints may affect design acceptability
- Buildability – complexity of construction including online / offline works

Engineering	Route A	Route B (west)	Route B (east)	Route C	Route D (west)	Route D (east)
Horizontal Alignment, Land Use and Constraints	6	5	4	1	3	2
Junctions and Links	6	3	2	1	4	4
Topography and Profile	1	3	4	2	6	5
Structures	1	4	2	3	6	5
Drainage	1	1	1	1	1	1
Public Utilities	4	3	2	1	6	5
A47 Tie-in	1	2	2	2	5	6
Departures from Standard	1	6	5	1	1	1
Buildability	4	3	2	1	6	5
Overall	**3**	**4**	**2**	**1**	**6**	**5**

All NWL shortlisted options are currently considered as being acceptable for connection to the proposed A47 North Tuddenham to Easton dualling scheme, however due to the physical constraints of the River Tud and steep topography, Options D (East and West) has been assessed as more challenging in comparison to the other options. This is shown in the table above under 'A47 Tie-in'.

Traffic and Economics

An updated traffic model based on the existing Norwich Area Transport Strategy (NATS) SATURN highway model, was used to assess each route option, and test a future year Reference Forecast scenario comprising the proposed NWL and including the major developments most likely to be developed for forecast years of: 2025 (opening year); 2040 (design year); and 2050 (horizon year).

Updated forecast year 2025, 2040 and 2050 networks have been produced with the core growth demand matrices. These are the 'Do Nothing' scenarios for 2025, 2040 and 2050 that are without NWL infrastructure. Predicted traffic flow, journey time, and accident changes were analysed, and generally, all routes generated the most journey time savings for local roads nearest to them, with Option C attracting the most NWL traffic, and Option A attracting the least NWL traffic.

An appraisal of the economic elements associated with the scheme was also undertaken in accordance with WebTAG Unit A1.1 Cost-Benefit Analysis (May 2018) using the DfT's standard appraisal software: Transport User Benefit Appraisal (TUBA) using TAG Data Book v1.10 (May 2018), and considering Time Savings, Vehicle Operating Costs, Scheme Costs, and Indirect tax revenue.

Based on the additional monetised impacts, the scheme has adjusted Benefit Cost Ratio (BCR) that results in adjusted Value for Money (VfM) categories in the range of Low to High. Option A returns the lowest BCR placing it in the Low VfM range, Option D West reports Medium VfM and Options B East and West, C, and D East have High VfM.

Environment

The environmental impacts of the six NWL route options have been assessed in line with WebTAG guidance, where appropriate, as well as best practice, and included identification of baseline conditions, environmental effects; mitigation; and consultation, for environmental topics of Noise; Air Quality; Greenhouse gases; Landscape; Historic Environment; Biodiversity; and Water Environment.

The assessments of NWL environmental impacts are based upon a series of WebTAG assessments that have been carried out in accordance with TAG Unit A3 'Transport Analysis Guidance – Environmental Impact Appraisal' (December 2015).

Noise

The noise effects of each option was determined using a 3 dimensional model i.e. including the height of the road; including when on embankments or bridges in accordance with the DMRB (Design Manual for Roads and Bridges). Prevailing wind directions were considered as part of the analysis.

The noise generated is based on the traffic modelling undertaken for the scheme as described elsewhere in this report. The work considers change in existing noise levels. Mitigation in terms of acoustic fencing and bunding has not been include in the analysis therefore the results in the OSR present a worst case scenario. Where sufficiently beneficial, mitigation works would be included in the scheme to reduce the magnitude of the noise effects. Both adverse and beneficial affects have been taken into account.

Option A was determine to be the best option from a noise perspective as it adversely affects in terms of moderate and major impacts the fewest number of properties. A significant factor in this is that its aligment follows or is close to the existing road network. However Option A also benefits the fewest number of properties and has a much wider low level impact, while carrying significantly less traffic than the other options. Option B (East) and Option C predominatly along a new road link, offer the most desirable balance in terms of noise impacts and benefits.

Air Quality

The air quality impacts of NWL scheme have been appraised following TAG Unit A3 Environmental Impact Appraisal Guidance: Chapter 3.3 'Air Quality Impacts' (31 May 2019). The appraisal considers the scheme impacts in terms of changes in ambient annual mean concentrations of nitrogen dioxide (NO_2) and fine particulates ($PM_{2.5}$) at locations with relevant human exposure (residential premises,schools and hospitals).

The appraisal is based on the result of traffic modelling undertaken for the scheme. The study area does not lie in an Air Quality Management Area (AQMA). The closest AQMA is east of the study area, within Norwich city centre area, known as Central Norwich AQMA. A quantitative appraisal of each of the six route options, and of the roads and wider highway network that would be affected by them, has been undertaken to identify any routes that may experience an increase or decrease in air pollution during operation of the scheme.

In the short-term (opening year), there are apparent benefits with all options - except Route Option A - in terms of greater numbers of properties experiencing improvements in air quality than worsening. The greatest benefit in the opening year is with Route Option B West. Beyond the opening year, with the clear exception of Route Option A, the year-on-year increases in vehicle kilometres mean that option benefits are eroded. Over the 60-year period, Route Option A has most benefit with an NPV of £3,602,929, Route Option B West has some benefit with an NPV of £728,499 whilst the other options have dis-benefits. The greatest long-term dis-benefits are indicated for Route Option D where both the West and East variants have an NPV of -£3,029,388.

Greenhouse Gases

The appraisal has been undertaken following TAG Unit A3.4 'Greenhouse Gases' (31 May 2019) methodology. CO2 emissions have been calculated for the opening and forecast years. The monetary valuation method requires emission to be forecast for a 60-year appraisal period.

The results of the assessment are summarised in which shows the change in CO2 equivalent (CO2e) emissions, in tonnes, attributable to the scheme being in place and demonstrates the Net Present Value (NPV) of the CO2e emissions associated with the implementation of the proposed scheme over a 60-year period.

The most beneficial of the options in terms of greenhouse gases is Option A where there is a net reduction in CO2e emissions over the 60-year appraisal period associated with reductions in vehicle kilometres travelled on the road network. The other options have net dis-benefits due to increases in vehicle kilometres travelled. The greatest dis-benefit is with Option D West and East variants. Dis-benefits in CO2e emissions are not uncommon for schemes that create additional road space to relieve congestion in other areas. However, over the 60-year appraisal period the changes in CO2e emissions are relatively very small in the context of regional emissions for road transport and do not account for electrification of the vehicle fleet beyond 2030.

Landscape

Consideration has been given to the potential effects on landscape character and visual receptors resulting from each of the six proposed scheme options. The assessment of landscape character and visual amenity are two distinct but related areas.

Landscape Character Assessment is the process whereby the different elements that form the landscape are recorded and assessed. DMRB Interim Advice Note (IAN) 135/10 describes the process as "the assessment of a combination of physical (e.g. landform, vegetation, buildings), aesthetic/perceptual (e.g. scale, appearance, tranquillity) and cultural/social (e.g. human interaction, land use, heritage) aspects which together make up the character of the area.

Visual amenity assessment assesses the impact to receptors from locations inhabited and frequented by people.

Options that avoid a crossing of the River Wensum on a viaduct (Options A and B West) would be less impactful on the perception of landscape character, in particular the horizontal alignment of Option A broadly reflects the alignment of existing local roads within the landscape and would require less significant changes to the landform associated with its vertical alignment. Of those options that include a crossing of the River Wensum on a viaduct Options D West and East alignments would result in moderate adverse effects, however within the context of the landscape they are likely to provide opportunities for mitigation to tie into existing woodland within the landscape. In contrast Option C crosses the open landscape, with a reduced capacity to incorporate existing woodland blocks into the mitigation design.

Historic environment

Within the study area there are a number of statutorily designated and non-statutorily designated heritage assets. The assessment has been informed by the proximity of these assets and through an identification of their value. To reflect to rural location of the route options a 500m buffer for the identification of heritage assets has been applied.

This assessment uses information derived from the National Heritage List for England, the Norfolk Historic Environment Record and a Heritage Constraints Report for the Norwich Western Link which was produced by WSP in November 2018. WebTAG sheets have been produced for each option in accordance to DMRB guidance.

In terms of options with the least and highest impact in respect of adverse effects on known buried heritage assets, and potential for possible, previously unrecorded remains; Route Option C has the least impact, and Route Option D has the highest impact.

In terms of options with the least and highest impact in respect of adverse effects on designated heritage assets; Route Option C has the least impact, and Route Options A and Option B West has the highest impact.

Biodiversity

Consideration has been given to the biodiversity features that may be affected by Route Options A to D with consideration given to, statutory and non-statutory wildlife sites, habitats of conservation importance protected species and other ecological features.

Assessment has been undertaken in accordance with TAG Unit A.3. A Preliminary Ecological Appraisal (PEA) has also been produced covering the study area, which comprised habitat mapping (largely using freely available mapping) and a desk study.

In addition to the WebTAG a matrix was used to further asses and compare the impacts of the route options. The below table provides a comparison of the potential impacts of each route on the key ecological features identified at this stage. This comparison is based on information from online resources, baseline data available to date and professional judgement. The evaluation considers potential impacts in the absence of mitigation but with consideration for design mitigation i.e. a viaduct is proposed to cross the River Wensum on route B west, C and D.

Impact[1]	Routes					
Ecological Feature	**A**	**B (Western variant)**	**B (Eastern variant)**	**C**	**D Both variants**	**Route with biggest impact**
River Wensum SAC						B (Western variant)
Barbastelle bats						A and B
Site of Special Scientific Interest						B (Western variant)
Ancient woodland – direct and indirect –within 200m						D
Habitat of Principle Importance						C and D
Woodland						C and D
County Wildlife Sites						D
Watercourses (excluding R.Wensum)						D
Habitat fragmentation						D
Pond loss						A
Reduction in HPI quality						D
Number of hedgerows dissected						B (Western variant)

[1] In order of significance in relation to legislation and policy.

Key	Likely Impacts
Red	Major
Orange	Moderate
Blue	Minor
Grey	Not applicable

Based on the conclusion from the above WebTAG assessment, it is concluded that Option A, B West and East will have a very large adverse impact on ecological features. Option C and Option D both variants will have a large adverse impact.

For options B (East), C and D it is anticipated that potential impacts on the River Wensum can be mitigated to ensure there is no adverse impact on the SAC, this will include;

- Providing significant vertical and horizontal clearance from the river channel;
- Reducing the impact of shading by the bridge deck in order to retain sufficient light to beneath;
- Minimise construction impact near to the river and within the flood plain;
- Durable and low maintenance design to minimise maintenance activities, in accordance with BD 57/01 and BA 57/01 – Design for Durability

Further mitigation specifically related to water is identified below.

<u>Water environment</u>

Consideration has been given to the water environment features that may be affected by Route Options A to D with consideration given to water quality, aquatic and riparian biodiversity, recreation, hydromorphology and flood risk.

This assessment has been undertaken in accordance with TAG Unit A.3 and comprises a qualitative assessment. A desk study of the hydrological and hydrogeological features associated with the proposed options has been undertaken.

The overall summary assessment score for Route Options A and B West is minor adverse. For Route Option B East, C and D the overall summary assessment score is moderate adverse.

It is anticipated that potential impacts on the River Wensum can be mitigated to ensure there is no adverse impact on the SAC. Mitigation measures for the management of identified impacts of all the route options are likely to comprise;

- Suitable treatment train for highway runoff to minimise impact to surface water and groundwater quality;
- Compensatory flood storage for loss of floodplain and provision of appropriately sized culverts to manage flood flow conveyance;
- Restriction of highway discharge rates to watercourses to mimic Greenfield runoff rates and volumes;
- Minimising footprint of abutment/piers required for new bridge with no structures within channel and locating structures away from channel edge;

- Maximising the span between piers / distance from the banks of the River Wensum and River Tud;
- Adoption of a suitable CEMP to manage pollution risks during construction

Geology and soils

An assessment has been carried out on the basis of the following information:

- Geological maps and memoirs for the area;
- Available historic geotechnical logs and reports;
- Search of relevant maps, records and other data (Envirocheck search)

Existing ground investigation information indicate that the proposed scheme Options are underlain by the following sequence of geologies (starting from the top);

- Made Ground
- Alluvium
- Colluvium
- River Terrace Gravel
- Crag Deposits
- Glaciofluvial sands and gravels (Sheringham Cliff Formation)
- Till Members (Sheringham Cliff Formation)
- Lowestoft Formation
- Cretaceous Upper Chalk

It is planned to carry out a detailed ground investigation survey after the preferred route is selected. This will assist in determining possible site-specific ground conditions and potential presence of contaminants along the preferred route corridor.

The above WebTAG assessments have been used to inform the route selection process and indicate that all six route options provide varying degrees of environmental impacts. The following environmental effects summary table based on the above assessments indicates that Option A will have the least overall environmental impact, whilst Route Option D West and East will have the most overall impact.

The below matrix summarises the potential environmental effects of each option across the above categories.

Environment Impacts	Route Options				
	Option A	**Option B West**	**Option B East**	**Option C**	**Option D (west and east)**
Noise	Considered to be the best option as it adversely affects (in terms of moderate and major impacts) the fewest properties.	Considered to be the worst option as it adversely affects (in terms of moderate and major impacts) the highest number of properties.	Considered the third best option in terms of moderate and major adverse impacts on properties.	Considered the second-best option in terms of moderate and major adverse impacts on properties.	Considered the second worst option in terms of moderate and major adverse impacts on properties.
Air Quality	Slight beneficial local air quality impact; affects fewest numbers of properties	Negative local air quality impact	Negative local air quality impact	Negative local air quality impact	Worst negative local air quality impact; affects largest numbers of properties
Greenhouse Gases	Net present value $(CO_2)_e$ of £8,622,855; lowest emissions of greenhouse gases	Net present value $(CO_2)_e$ of - £1,358,528; second lowest emissions of greenhouse gases	Net present value $(CO_2)_e$ of - £4,900,284; second highest emissions of greenhouse gases	Net present value $(CO_2)_e$ of - £4,149,699; third highest emissions of greenhouse gases	Net present value $(CO_2)_e$ of - £10,575,555; highest emissions of greenhouse gases
Landscape	Slight Adverse	Slight Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Historic Environment	Large Adverse	Large Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse

Biodiversity	Very Large Adverse	Very Large Adverse	Very Large Adverse	Large Adverse	Large Adverse
Water Environment	Minor Adverse	Minor Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Geology and Soils	This Option has the least exposure to the construction of embankments /piled structures over Alluvium layer.	This Option has a limited exposure to construction of embankments and piled structure over Alluvium layer.	This Option has a considerable exposure to construction of embankments and piled structure over Alluvium layer.	This Option has a considerable exposure to construction of embankments and piled structure over Alluvium layer.	This Option has the greatest exposure to construction of embankments and piled structure over Alluvium layer.

Public Consultation

Feedback has been collected during the two rounds of public consultation from members of the public and a range of stakeholders. In relation to the general principle of the NWL, the majority of stakeholders were supportive of the proposals, as long as adequate environmental mitigation and supporting traffic management measures were put in place to enable the solution to be sustainable. In relation to specific options, the majority of stakeholders, support Options D or C.

The feedback also included notable responses from the Environment Agency (EA) and Natural England (NE). Both EA and NE require a solution which does not impact on the integrity of the River Wensum SAC and SSSI. The EA also highlighted that the River Tud is classed as a Priority Habitat as a chalk river in the WWF-UK 2014 report 'The State of England's Chalk Streams'.

In both cases EA and NE consistently indicate a preference to minimise the number of river crossings, although noting that Option A is expected to have the least impact on flood risk and does not require a new crossing. Both the EA and NE also confirm that a new viaduct is considered an acceptable solution subject to appropriate design and construction methodology, should a new road crossing be required.

Feedback from members of the public indicated that Option D was considered to be the most logical solution by the consultation respondents while Option C was considered the 2nd most logical, with questionnaire feedback showing that more than 50% of respondents found these two options to be fairly or very effective at providing a western link and meeting scheme objectives.

Option D is generally considered to be the most logical option due to the shortness of the route and orbital connectivity with major roads such as the A47 and A11. However, it is evident from a review of the textual and key stakeholder responses that there were also those who could see that this was likely to be a costlier option, which would potentially have a more pronounced effect on the environment.

With the proposed A47 dualling scheme in place, Option C is likely to offer similar journey time savings to Option D and Option C would therefore offer similar benefits in a more cost effective and less intrusive way. The preference for Option C or D was also supported by several local stakeholders.

Overall Preferred Route Option Recommendation

On balance, considering all factors, it is therefore recommended that Option C is taken forward as the Preferred Route as this offers a solution which offers good value for money, is publicly acceptable and less environmentally intrusive, easier to build, cheaper to install and lower risk to deliver through the statutory process.

It is also recommended that any option taken forward needs to be accompanied by a package of supporting non-motorised user interventions to encourage active and sustainable travel for shorter distance trips, for example creating new cycle and equestrian routes on minor rural roads that will receive a traffic reduction linking existing and growing communities and helping to alleviate congestion.

Once a preferred route has been established, a Walking, Cycling & Horse Riding Assessment and Review will be undertaken in accordance with DMRB HD 42/17, in order to inform the development of a complementary package of non-motorised user interventions. This guidance is prepared in line with Highways England's Strategic Business Plan and Roads Investment Strategy, as well as the Infrastructure Act 2015.

A sustainable transport strategy would then be produced for input to the Outline Business Case (OBC) which seeks to maximise opportunities for transferring shorter distance band trips to non-motorised modes of travel such as walking and cycling where possible.

The existing coverage of the commercial bus service network across Norfolk is predominantly focussed on key radial routes into central Norwich, where there are higher concentrations of potential passengers and direct route opportunities between homes and workplaces to make services more viable. However, some services currently experience delays at peak times due to congestion on these routes and in some instances, there is a lack of bus priority at key junctions. This can lead to bus journey time reliability issues which make buses less efficient and unable to compete with private car travel.

The need for commercial viability of services is noted as the key driver for bus routing, with operators attracted to routes which have higher density development alongside to maximise patronage and viability. Since the NWL is not coupled directly with development, it is unlikely that the NWL route itself would support new bus service routes directly.

Following the NWL Preferred Route Announcement (PRA), meetings will be held with bus operators to understand opportunities in more detail, exploring whether the provision of a new link through the study area would create new commercial opportunities for additional bus services as a result of traffic relief to alternative routes.

1. INTRODUCTION

1.1. PURPOSE OF THE REPORT

1.1.1. This Norwich Western Link (NWL) Stage 2 Option Selection Report (OSR) reports on the appraisal of the NWL route options, and outcomes of the scheme consultation and recommends a preferred route. The report has been prepared as a Stage 2 Scheme Assessment Report, following guidance in Design Manual for Roads and Bridges (DMRB) TD 37/97 Scheme Assessment Reporting.

1.2. REPORT STRUCTURE

The Remainder of this report is structured as follows:

- Chapter 2 - Existing Conditions
- Chapter 3 - Description of Scheme Options
- Chapter 4 - Engineering Assessment
- Chapter 5 - Environmental Assessment
- Chapter 6 - Traffic and Economic Assessment
- Chapter 7 – Public Consultation
- Chapter 8 – Conclusions / Recommendations

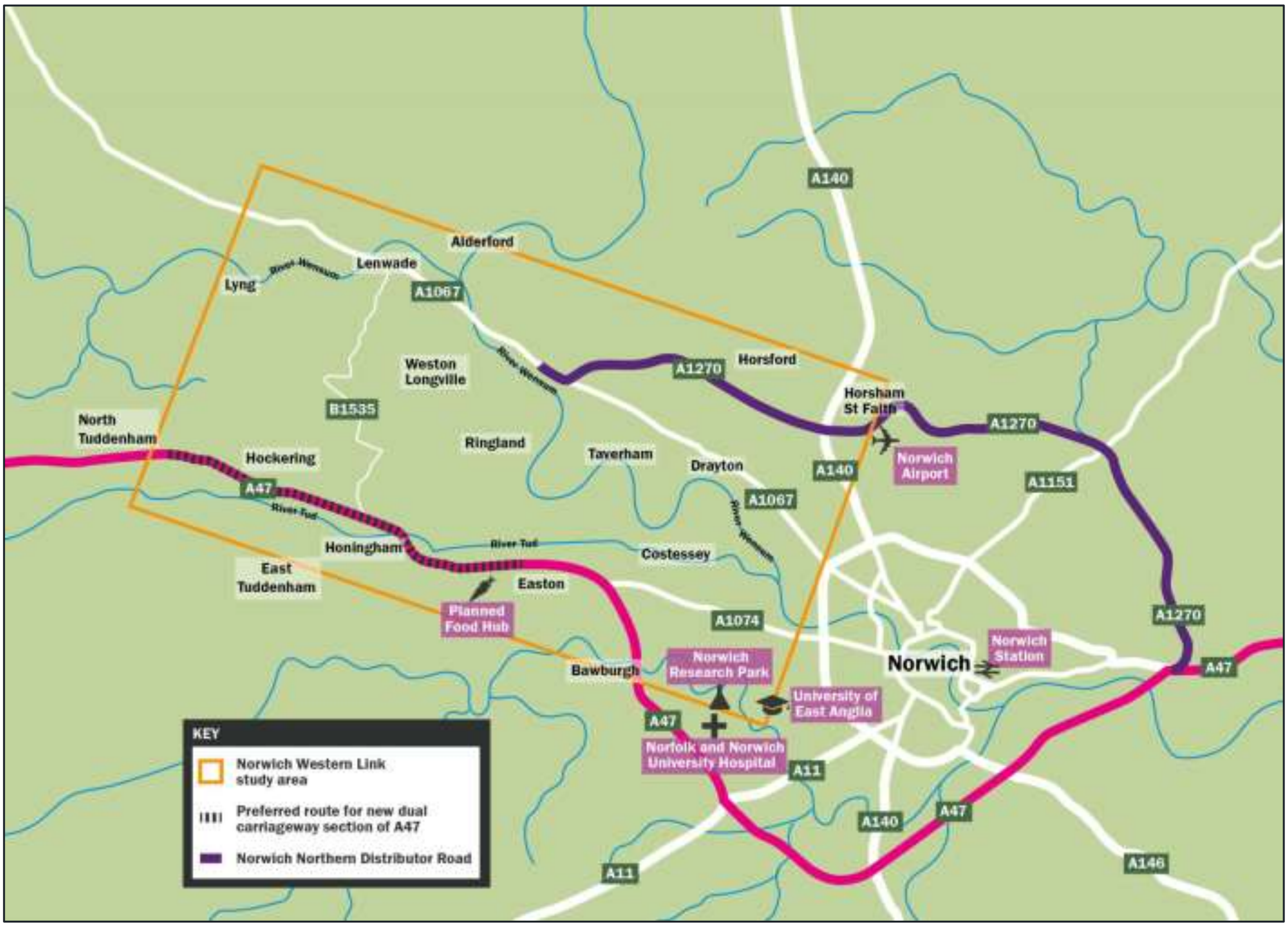
1.3. SCHEME LOCATION

1.3.1. Norwich performs a regional role in delivering growth and as a major employment, shopping and service centre, as well as performing as a focal point for transportation. Following the completion of the NDR, which was subsequently designated as an A-Road in the route hierarchy (A1270) and named Broadland Northway, there have been calls to complete the 'missing link' between the A47 and A1067.

1.3.2. The focus of this study is the north-west area of Norwich, known as the Norwich Western Quadrant (NWQ), as illustrated in **Figure 1.1.** The broad study area includes the key radial routes of the A47 trunk road, the A1074 (Dereham Road), and the A1067 (Drayton High Road / Fakenham Road).

1.3.3. The study area encompasses the western fringe of Norwich and settlements, including; Bawburgh, Marlingford, Honingham, Hellesdon, Drayton, Taverham, Costessey, New Costessey, Ringland, Hockering, Weston Green, Weston Longville, North Tuddenham, Primrose Green, Lenwade, Alderford, Morton, Upgate, Felthorpe, Thorpe Marriot, Horsford, Elsing and Lyng.

Figure 1.1 - Study Area



Source: About the Norwich Western Link, Location Map (Norfolk County Council)

1.4. SCHEME BACKGROUND

1.4.1. Public consultation on the revised Norwich Area Transport Strategy (NATS) in 2003 showed strong support for transport improvements to the north and west area of Norwich. In particular, there was support for the NDR extending from the A47 in the west skirting around the northern fringe of Norwich to re-join the A47 at Postwick, in the east.

1.4.2. A revised NATS was agreed in 2004, which included the provision of a NDR, with the aim to reduce the impacts of high volumes of traffic and congestion in Norwich. Throughout 2004 and 2005, further consultation was undertaken on a variety of route options for the NDR, including several different options for the western section, between the A47 and the A1067, through the River Wensum Valley.

1.4.3. On 19 September 2005, Norfolk County Council's cabinet agreed an adopted route for the NDR, excluding a link between the A47 and the A1067. Early plans to link the A47 (west) to the A47 (east) via the A1067 were not progressed due to environmental concerns regarding the River Wensum and its status as a Special Area of Conservation (SAC), and protection due to its international importance in biodiversity conservation.

1.4.4. Since the adoption of the NDR preferred route, there has been sustained local pressure for provision of a Norwich Western Link (NWL) to connect the A47 to the A1067, to ease traffic problems in the local area and enhance strategic connectivity. Following an announcement from the Department for Transport (DfT) and subsequently Highways England[2] (in 2014) of their intention to investigate options for the upgrade the A47 between Easton and North Tuddenham to dual carriageway, Norfolk County Council committed to revisit the feasibility and need for a NWL, whilst also considering wider public transport and non-motorised user (NMU) impacts, and the role of complementary measures to reduce traffic on existing routes.

1.4.5. A pre-feasibility study[3] was completed in June 2016 which reviewed previous work, including a scoping study[4] from 2014 which investigated potential NWL route options. The output of the 2016 study included, amongst other aspects, a series of actions to support the next stage of development for a NWL, and these were presented at Norfolk County Council's Environmental, Development and Transport Committee in July 2016.

1.4.6. The 2016 study concluded that further work needed to be undertaken to develop a business case and set out a compelling case for the scheme. This included demonstrating that the scheme forms part of a coherent wider strategy, and as such, the report recommended that a local transport strategy be developed to identify local problems, define objectives for the wider area and identify possible measures within the western quadrant of Norwich.

1.4.7. A further study[5], undertaken in October 2017, looked at the potential mitigation of environmental impacts of crossing the River Wensum through a number of crossing options – a bridge (dual carriageway / single carriageway) and a tunnel (dual carriageway / single carriageway). The study resulted in a viaduct option being taken forward as the preferred crossing option on all new link road schemes which cross the River Wensum.

1.4.8. Norfolk County Council undertook a non-statutory public consultation, which ran between Tuesday 8 May 2018 and Tuesday 3 July 2018. The purpose of this consultation was to understand people's experience of living in, and travelling through, the area to the west of Norwich.

1.4.9. The results demonstrated that respondents perceive the roads in the area to be unsuitable for the current levels and type of traffic, with rat-running and slow journey times issues mentioned with a clear preference for developing a new road between the A1270 and A47.

1.4.10. Between July 2018 to November 2018 an optioneering and appraisal process was carried out to assess options which would potentially address the issues identified by Norfolk County Council (NCC), various stakeholders, with traffic forecasting undertaken by consultants WSP.

1.4.11. This study, using the DfTs Early Assessment Sifting Tool (EAST), identified a long list of 82 potential options which were developed across a broad range of modes and policies and resulted in a short list of 4 new highway link options, an existing highway link upgrade option and 10 non- highways options carried through to be considered as part of potential packages of measures together with the Highways option.

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[2] Road Investment Strategy (Department for Transport, December 2014)

[3] Norwich Western Link Project Technical Report (Mott MacDonald, June 2016)

[4] A47-A1067 Western Link Road Scoping Study (Mott MacDonald, September 2014)

[5] Norwich Western Link Technical Report (WSP, October 2017)

1.4.12. A second round of public consultation commenced on 26 November 2018, with a series of public events held in late 2018 prior to the Christmas break and after the holidays until 18th of January 2019. This provided consultation on the shortlisted options which were produced during the initial options assessment.

1.5. CURRENT STAGE OF THE PROJECT

1.5.1. The stage 2 assessment has been carried out on shortlisted options carried forward from the initial consultation, and developed from a number of new options that included highways options, new links and link upgrades; and non- highway options including active travel, information, public transport, demand management and freight.

SCHEME OBJECTIVES

1.5.2. A range of objectives have been developed to align with the current strategic objectives presented in national, regional, and local policy and associated guidance. It is considered that the objectives reflect the issues and opportunities identified within the previous project reports, in addition to the wider objectives of the New Anglia Local Enterprise Partnership, supporting the principal aim to deliver a modern and efficient transport system. The objectives are in two tiers, namely high-level objectives and specific objectives.

1.5.3. A set of high level objectives and scheme specific objectives were developed in order the scheme would tackle the local issues while also fitting in with wider Government objectives.

HIGH LEVEL OBJECTIVES

1.5.4. The high-level objectives for the NWL have been established with particular consideration of the key themes emerging from the review of national and sub-national policy and strategy. After consultation with the Member Working Group (MWG) and Local Liaison Group (LLG) the following high level objectives were carried forward:

- H1 Support sustainable growth
- H2 Improve the quality of life for local communities
- H3 Support economic growth
- H4 Promote an improved environment
- H5 Improve strategic connectivity with the national road network

SPECIFIC OBJECTIVES

1.5.5. The specific objectives for the NWL were developed to both support the high-level objectives and respond to the local challenges identified and need for intervention, and again after consultation with MWG and LLG the following scheme specific objectives were carried forward:

- S1 Reduce congestion and delay, and improve journey time reliability, on routes through the study area
- S2 Improve network resilience and efficiency of the strategic and local transport network
- S3 Reduce the number of Heavy Goods Vehicles using minor roads
- S4 Make the transport network safer for all users (including NMUs)
- S5 Encourage modal shift to more sustainable modes of transport
- S6 Provide traffic relief (and reduce noise & emissions) within residential areas
- S7 Enable improved accessibility to existing and new housing and employment sites
- S8 Improve emergency response times

- S9 Improve access to green space
- S10 Not affect the ecological integrity of the River Wensum SAC
- S11 Contribute to the improved health and well-being of local residents
- S12 Improve connectivity and accessibility to Norwich Airport, Norwich Research Park and Norfolk & Norwich University Hospital (NNUH)
- S13 Minimise any detrimental impact on valued landscapes, the built environment and heritage assets, including through high quality design

1.5.6. The current assessment process involved assessment of route engineering, environmental and traffic and economics and the performance of the options against the objectives. A sifting process had earlier been carried out included an EAST assessment that reduced an initial 82 options down to 3 new highway link options, an existing highway link upgrade and 10 non-highway options.

1.5.7. The highway options carried forward were named A, B, C, and D based on their location from west to east. The options have been listed below:

- Route Option A, runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road, at its junction with Porters Lane and the B1535, to the south.
- Route Option B, runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road, between Morton on the Hill and Attlebridge.
- Route Option C, runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road to the west of its junction with the A1270.
- Route Option D runs from the A47 at its junction with Taverham Road to the A1067 Fakenham Road to the west of its junction with the A1270. The route passes to within approximately 47m of houses on Taverham Road.

1.5.8. Further consideration of options, B and D produced a western and eastern variant for each option, increasing the number of road options to 6. For Option B further consideration related to the northern end of this route, and provision for how it could join the A1067. One would be via a new junction near Attlebridge which would include widening the existing River Wensum bridge at Attlebridge, Option B West. The other would see a new viaduct crossing of the Wensum created, joining the A1067 further to the east and is named Option B East.

1.5.9. A slight variation of Option D was also proposed in relation to how option D could join the A47 and Highways England proposed A47 dualling scheme and potential junction designs. Resulting in western and eastern variants.

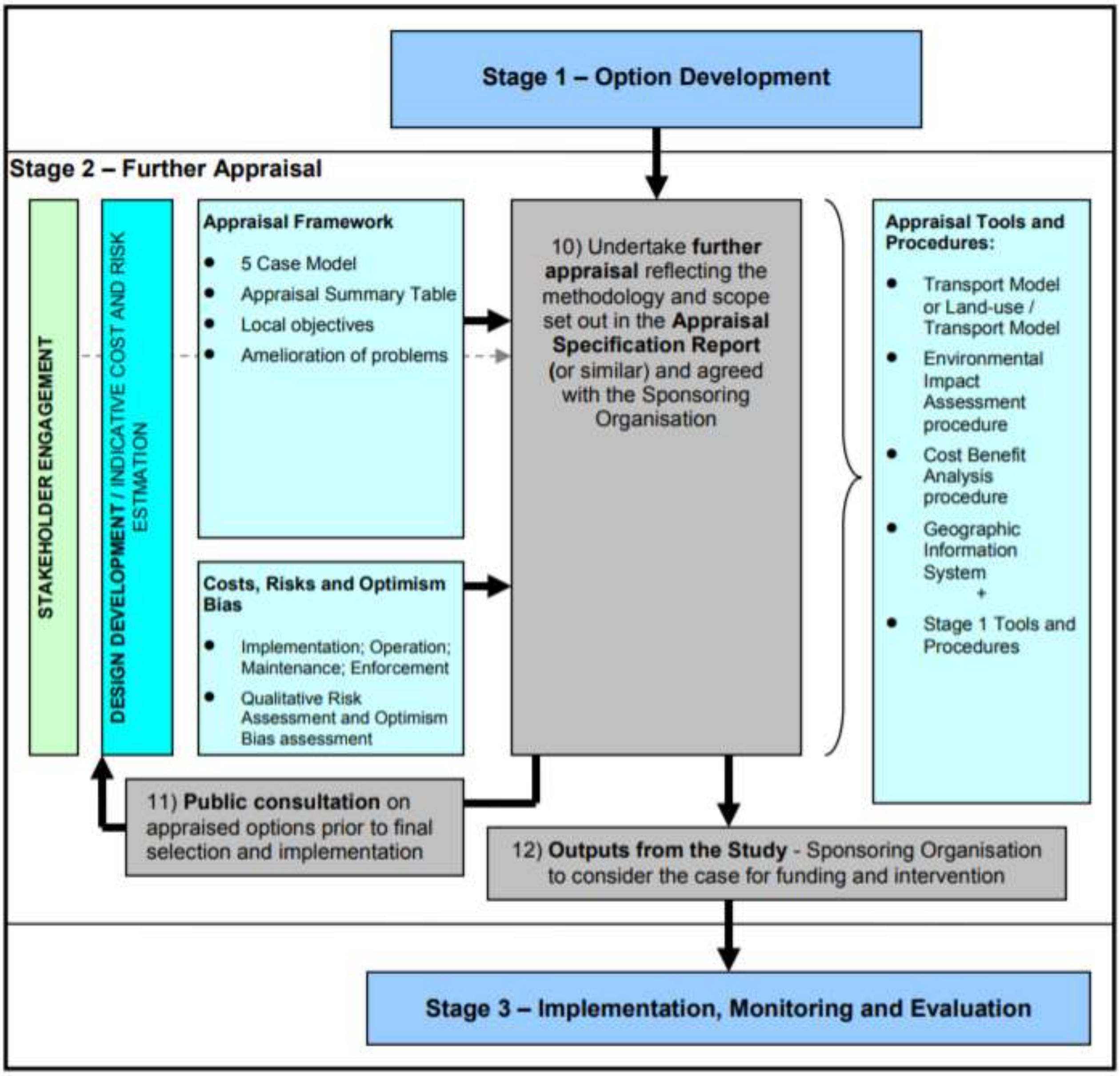
1.5.10. Preliminary horizontal and vertical alignments were designed, using level information from the Ordnance Survey while probable junction locations and layouts were also defined. This information was used for checking and refining original cost estimates and forming the basis for the environmental assessment.

1.5.11. The impact that each option would have on traffic patterns in the Norwich Area was assessed using the traffic model developed from traffic survey data collected in 2015. The Option Assessment Report published in November 2018 was used as the basis for the options consultation process.

1.5.12. This report aims to provide a more a detailed analysis for the NWL options from the engineering and design perspective and will identify the merits and challenges of each route corridor, seeking ways to maximise the benefits and mitigate any adverse impacts. This will ultimately lead to the identification of a preferred route for the NWL.

1.5.13. This OSR documents the approach to the Stage 2 of the Transport Appraisal Process shown in **Figure 1.2**.

Figure 1.2 - Stage 2 of Transport Appraisal Process



1.5.14. This OSR is produced to summarise the assessment of the shortlisted options and to determine the preferred option.

2. EXISTING CONDITIONS

2.1. CONDITION OF EXISTING ROADS AND HIGHWAY STRUCTURES

HIGHWAY NETWORK

2.1.1. The study area is bounded to the south by the A47 which forms part of the Strategic Road Network (SRN) and provides a link from Lowestoft and Great Yarmouth in the east, via Norwich towards King's Lynn, Peterborough and the A1. Just outside of the study area to the south-east, the A47 connects with the A11 which also forms part of the SRN and provides connections from Norwich to Cambridge and London (via the M11). Despite only accounting for 2% of the road network as a whole, the SRN is the most heavily used part, carrying one-third of all traffic and two-thirds of all freight[6]. To the north of the study area is the A1067 which provides a key radial route from Norwich to surrounding residential communities and out to the market town of Fakenham.

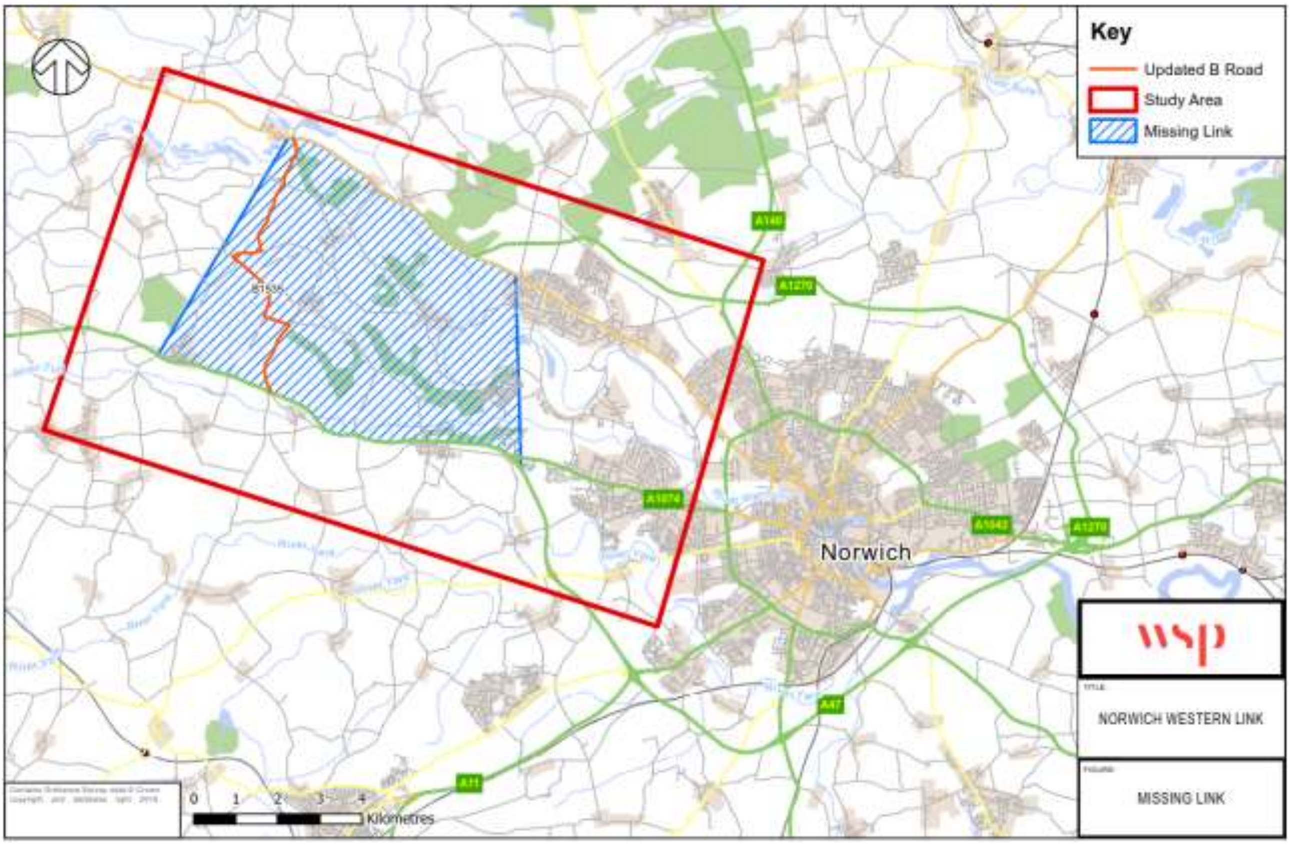
2.1.2. Within the study area there is a key 'gap' between the A47 and A1067, with a limited number of routes connecting the two. The existing links are rural single carriageway roads and pass through residential areas including Costessey, Taverham, Ringland and Weston Longville.

2.1.3. Recently, improvements have been delivered along Sandy Lane, Walnut Tree Lane, Wood Lane, Stone Road and Lyng Road to provide an enhanced link between the A47 and north Norwich for Heavy Goods Vehicle (HGV) movements, primarily to reduce long-standing HGV traffic problems in Hockering. Since the improvements, this route has now been designated as a B-Road (B1535) in the route hierarchy. However, the alignment of the B1535 is constrained by existing property boundaries and consequently includes a number of tight bends.

2.1.4. **Figure 2.1** shows the study area, indicating the B1535 and the key 'gap' between the A47 and A1067 in relation to the newly completed A1270 and the existing A47.

[6] Transport Statistics (Department for Transport)

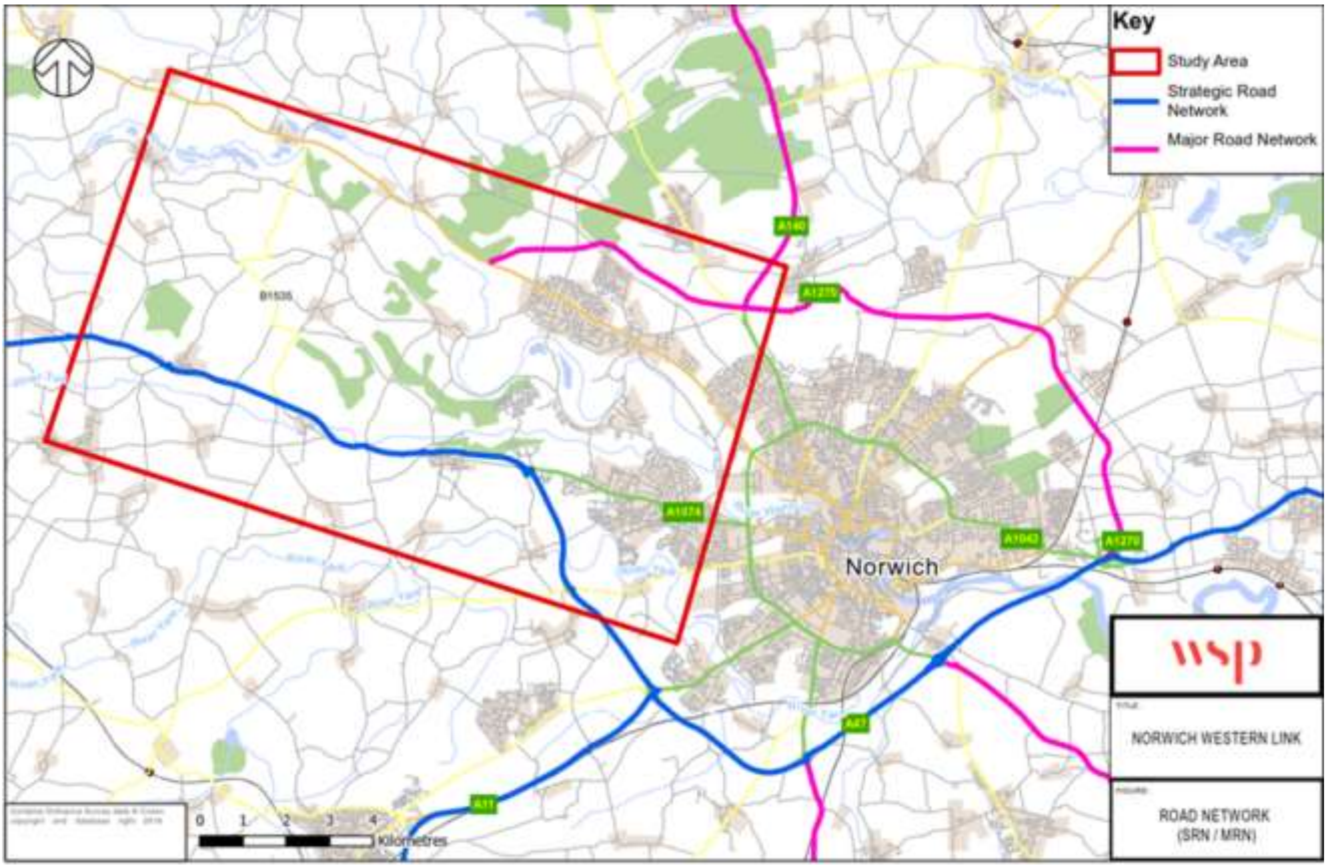
Figure 2.1 - Key 'gap' between the A47 and A1067



2.1.5. The final section of the A1270, from the A1151 Wroxham Road to the A47 at Postwick, opened on Tuesday 17 April 2018. The A1270 significantly increases network capacity, providing an improved route for trips whilst relieving traffic pressures and congestion on existing routes. However, the lack of a western link reduces the orbital connectivity, and existing traffic issues within the NWQ remain.

2.1.6. The A140 and A1270 are MRN routes, connecting to the A47 at the Postwick Hub, as shown in **Figure 2.2**. A NWL would fill in the missing link between the A47 and A1067 in the west, extending the A1270 to meet the A47 on the west of Norwich. This route would increase orbital connectivity and provide a suitable east-west alternative for vehicles to circumnavigate Norwich to the north, and would be appropriate to form part of the MRN due to its connectivity with the A140 via the A1270, and A47 in the east.

Figure 2.2 - MRN routes



Source: Proposals for the creation of a Major Road Network, Map (Department for Transport)

STRUCTURES

2.1.7. Within the study area there are numerous existing structures. **Figure 2.3** indicates the locations of the structures and classifies them into dual carriageway, single carriageway, single lane carriageway, footway / cycleway structures and existing track bridges.

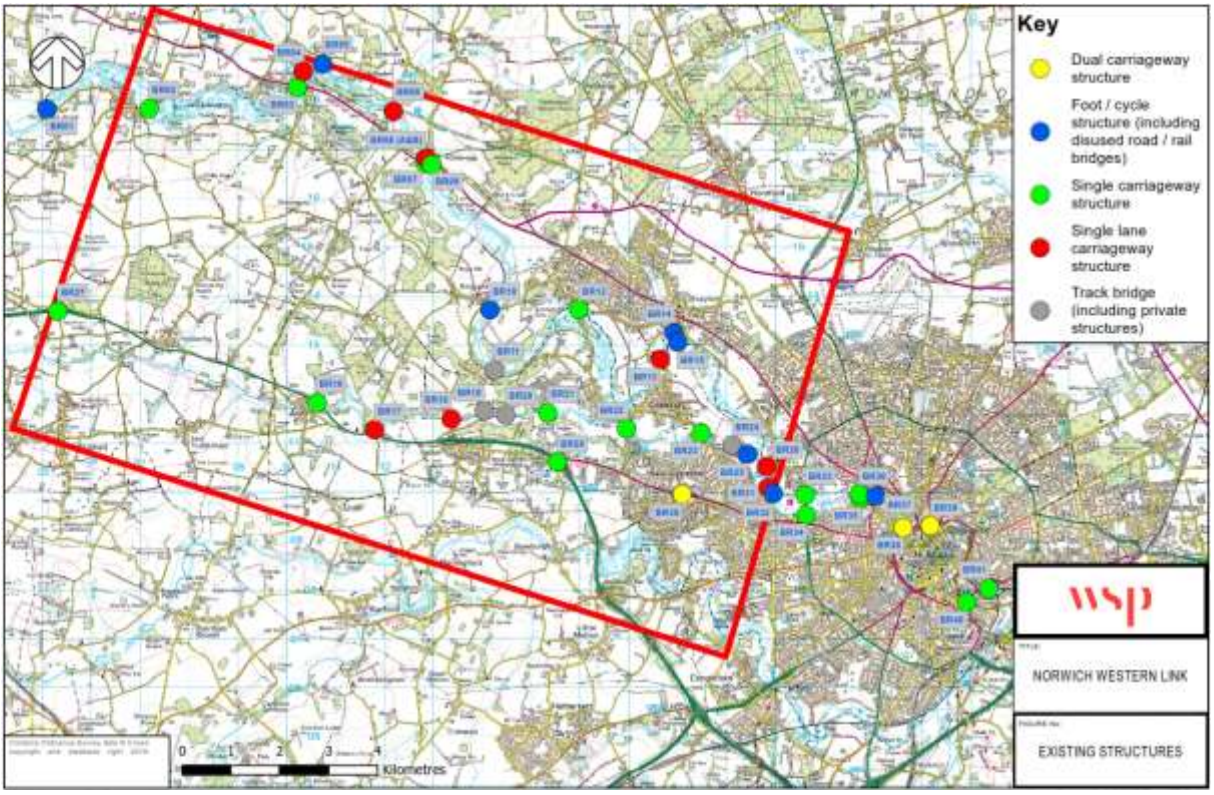
2.1.8. In the central region on the study area, between Hockering, Longwater interchange, Taverham and Attlebridge, there are a limited number of existing structures. Where there are structures, these are for single carriageways and footway / cycleway connections. There are two single carriageway structures at Queen's Hill and Taverham. The only dual carriageway structure is currently in New Costessey serving the A1074. This demonstrates that, currently, there is limited existing infrastructure in place that could support a new route in the event that a dual carriageway standard road is required.

2.1.9. There are three structures along the section of the A1067 near Attlebridge that are potentially impacted by some of the proposed NWL options. **Table 2.1** gives some initial considerations as to the potential impact on existing structures as well as on the wider environment, and notes existing deck widths and capacities.

Table 2.1 - Existing Conditions of Affected A1067 Mainline Structures

Structure Reference	Structure Name	Norfolk County Council Structure ID	Structural Condition[7]	Current deck width[8] and capacity	Estimated minimum total width of widening required[9] (m)
29	Attlebridge No. 2	TG11115	Good	12.6m, Full HA and 30 Units of HB	6.0
30	Attlebridge No. 1	TG11114	Good	12.5m, Full HA and 45 units of HB	6.0
31	Attlebridge Diversion Culvert	TG11113	Good	14.3m, Full HA and 45 units of HB	4.0

Figure 2.3 - Existing structure locations



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[7] *Conditions are quoted from Norfolk County Council inspection report*

[8] *Deck width given are between trafficked faces of the vehicle restraint systems over the structure.*

[9] *Assuming highway cross-section D2UAP*

![wsp logo]

OTHER PROPOSED HIGHWAY SCHEMES

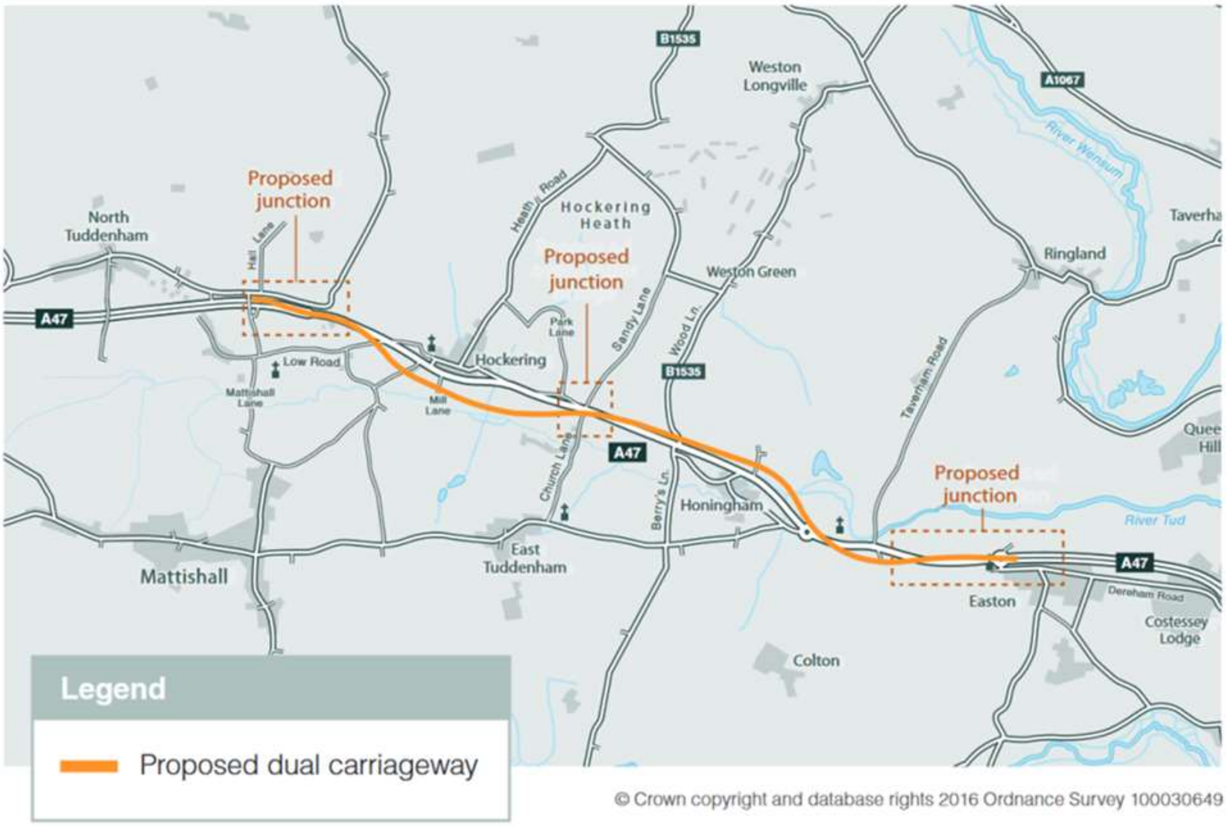
2.1.10. The North Tuddenham to Easton section of the A47 located to the west of Norwich is a 7.9km single carriageway section of the A47 and forms part of the main arterial highway route connecting Norwich to the west of Norwich.

2.1.11. This section of the A47 acts as a bottleneck, resulting in congestion and leading to longer and unreliable journey times while also suffering from a poor safety record.

2.1.12. The proposed A47 North Tuddenham and Easton dualling scheme is expected to relieve the currently congested single carriageway section of the A47.

2.1.13. **Figure 2.4** illustrates the preferred A47 route.

Figure 2.4 - A47 North Tuddenham to Easton scheme



2.1.14. The dualling of the A47 will influence traffic behaviour across the NWQ and beyond, and whilst the impact of the dualling will need to be considered alongside the potential for a NWL the improvement does present a possible opportunity to ensure that a NWL could effectively tie in to the dualled A47 at an existing or upgraded junction.

2.1.15. Highways England are progressing plans for the A47 North Tuddenham to Easton dualling scheme after consultation with the public in August 2017. Currently Highways England are considering the potential junction options on the route which will determine the junction option for the final preferred NWL option.

ACCIDENTS

2.1.16. Highway schemes are generally assessed with both travel time savings and accident benefits. While accident benefits normally come from a change of junction or link type or a change in flow which impacts exiting conditions such as speed and merge or diverge rates, the scheme accidents benefits have not been directly assessed currently because the proposed scheme does not include sufficient detail at this stage. In order to assess the impact of the scheme in relation to accidents a qualitative exercise has been carried out at this stage. It is envisioned that a quantitative assessment will be carried out using Cobalt at a later stage.

2.1.17. The implementation of transport schemes may have an impact on the risk of accidents occurring, and on the number and severity of casualties.

2.1.18. An assessment of the impact that the proposed NWL scheme would have accidents has been undertaken.

2.1.19. Within the study area, there have been a number of recorded road traffic accidents, primarily along the main arterial routes to or from Norwich city centre. It should be noted that these records only represent injury accidents recorded by the police and do not take into account 'damage only' accidents.

2.1.20. In the five years from 2013 to 2017, there were 621 recorded collisions in the study area, involving 830 casualties. **Table 2.2** provides a summary of all accidents in the study area for the study period.

Table 2.2 – All Accidents (NWQ Study Area)

Injury Severity	Collisions	Casualties
Slight	515	702
Serious	99	121
Fatal	7	7
Total	621	830

2.1.21. Of the 830 casualties, 64 (8%) were pedestrians and 115 (14%) were cyclists while 106 casualties (13%) arose from accidents involving motorcycles.

2.1.22. Clusters (based on five-year accident plot 2013-2017) have been identified at the following locations:

- A47 Longwater junction
- Dereham Road (A1074), junction with Longwater Lane
- Dereham Road (A1074), roundabout junction with Wendene
- Dereham Road (A1074), junction with Norwich Road
- Drayton High Road (A1067) junction with Boundary Road
- A140 in the vicinity of the airport Middletons Lane

2.1.23. Currently the majority of traffic in the study area can be found on three roads, the A47, and its continuation the A1074 from Longwater Junction heading east into Norwich and the A1067 located to the north of the study area. As strategic routes within the study area these roads provide core linkage between the west and east and access to the main north to south routes. A summary of the number of accidents recorded on these roads is provided below.

- A1067 from Cadge Road to Longwater Junction - 46
- Longwater Junction - 19
- Longwater to Taverham Road -15
- Hospital Lane to NDR -38
- NDR to Attlebridge - 18
- Attlebridge to B1535 and Porters Lane - 11

2.1.24. The proposed link road will run between the A47 in the south and the A1067 in the north and is expected to have the most significant impacts on roads and routes which currently serve this area. Analysis has shown that between 2013 and 2017 a total of 61 accidents were recorded in this area, resulting in 82 slight injuries and 17 serious injuries. It was noted that in terms of non-motorised users a total of 14 injuries were sustained by pedestrians (5) or cyclists (9) which equates to 14% of all injuries, 29% above the national average.

2.1.25. A review of the main 5 routes linking the A47 and A1067 in the study area was undertaken to allow an understanding of the potential direct impact on accidents.

- Route 1 – Lyng Road, Heath Road, The Common
- Route 2 – Sandy Lane Weston Grange Road, Rectory Road, Weston Hall Road
- Route 3 - Wood Lane, Paddys Lane, Honingham Road, Church St, Marl Hill
- Route 4 - Taverham Road, Honingham Lane, The Street, Ringland Road, Beech Avenue
- Route 5 – Longwater Lane, West End, The Street, Costessy Lane

2.1.26. On these five routes during the five-year (2013) to 2017 study period a total of 32 accidents occurred resulting in 36 slight injuries and 11 serious injuries with 13% of injured individuals categorized as non-motorised users, approximately 16% above the national average.

WIDER TRANSPORT CONTEXT

National Rail network

2.1.27. Norwich Railway Station is located approximately 8km south-east of the study area, and to the south-east of the city centre. Norwich is generally well placed on the rail network, with Norwich Railway Station located on the Great Eastern Mainline and several secondary railway lines such as the Breckland Line, Bittern Line and Wherry Line. The station is served by two rail operators (Abellio Greater Anglia and East Midlands Trains) providing access to destinations within the Norfolk area as well as further afield. **Table 2.3** indicates the typical weekday train timetable for Norwich.

Table 2.3 - Typical weekday train timetable for Norwich Railway Station

Service	Operator	Peak Frequency
Norwich – Ipswich – London Liverpool Street	Abellio Greater Anglia	2 per hour
Norwich – Great Yarmouth – Lowestoft	Abellio Greater Anglia	3 per hour

Norwich – Cromer – Sheringham	Abellio Greater Anglia	1 per hour
Norwich – Ely – Cambridge	Abellio Greater Anglia	2 per hour
Norwich – Nottingham – Manchester – Liverpool Lime Street	East Midlands Trains	1 per hour

2.1.28. The rail network emerges from Norwich in a northerly, easterly and southerly direction, with no connecting stations present within the NWQ, or to key employment locations on the west side of Norwich. Norwich Railway Station can be accessed by bus services from Costessey (Queen's Hills) and Taverham, however, access to the station from more rural towns or villages within the NWQ, located away from the bus routes, is more challenging.

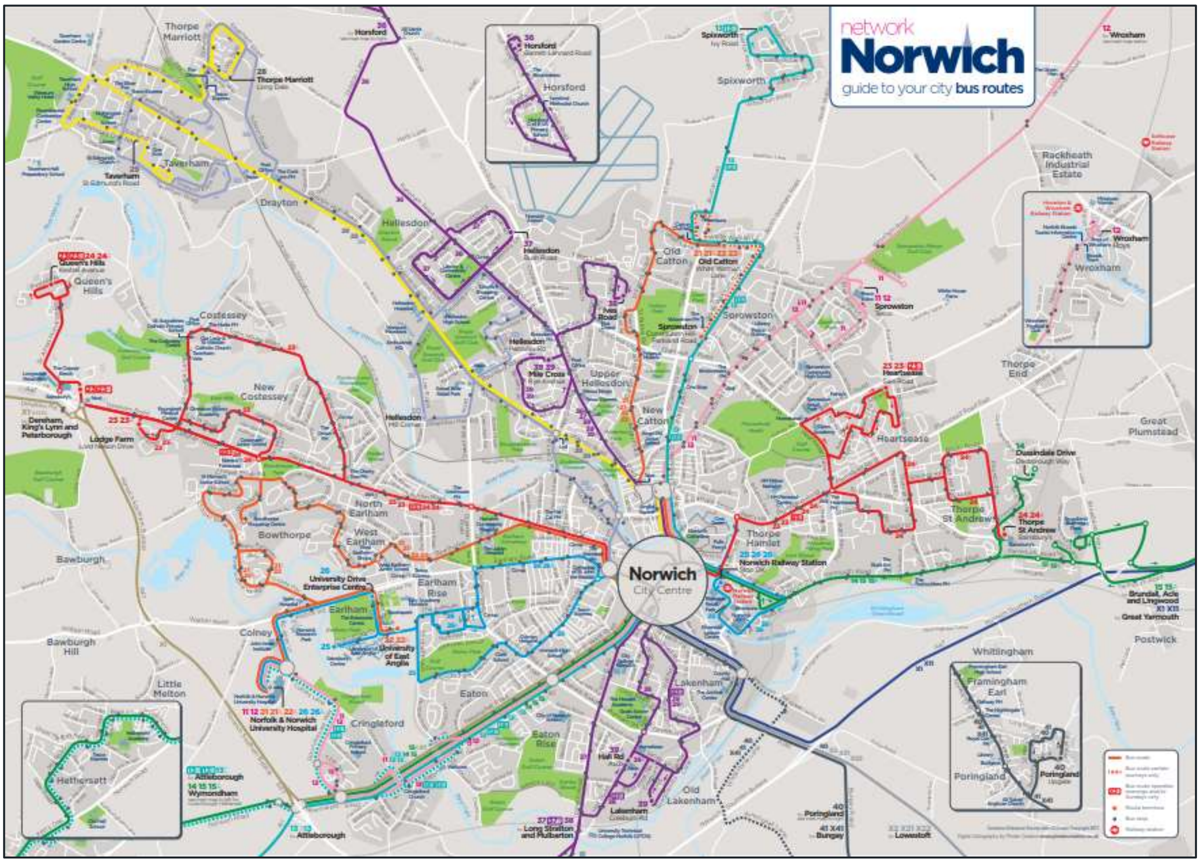
2.1.29. Two disused railway lines, running between Norwich and Aylsham (passing through the study area), now form the Marriott's Way – a 42km footpath, bridleway and cycle route, which attracts over 100,000 cyclists, walkers and horse riders every year[10]. Currently, there is no option to travel through the study area via rail, and significant new rail infrastructure would be required at high cost to improve the connectivity between the NWQ, Norwich city centre and key employment locations by rail.

Bus & Coach network

2.1.30. The bus network in the study area is largely radial, providing routes to / from Norwich city centre along key corridors. The eastern part of the study area is well connected with Norwich city centre, particularly during the day, due to there being a shorter distance to the city centre. First Bus provides several services connecting Queen's Hills, Easton, Hellesdon, and Ringland with services within and around Norwich city centre as shown in **Figure 2.5**. Bus services also operate within the study area connecting residential areas to major employment sites, however there is generally a lack of traditional bus services within the key 'gap', covering areas including, Weston Longville, Weston Green and Ringland. A NWL has the potential to provide for new bus links servicing disconnected villages within the NWQ.

[10] The Marriott's Way Heritage Trail (http://www.marriottsway.info/)

Figure 2.5 - Bus service routes



Source: Norwich City-Wide Network Map (First Bus)

2.1.31. There are bus stops in the NWQ located within walking distance from residential areas, however due to inadequate or limited pedestrian facilities (more detail provided in Walking Accessibility) between villages and bus services, access by foot from many residential areas is less viable.

2.1.32. **Table 2.4** shows that there are a number of bus services connecting the NWQ to the north and east of Norfolk, Norwich city centre and locations to the north and east of Norwich. However, the services connecting settlements within the study area with Holt, Cromer, King's Lynn and Swaffham are limited and infrequent, particularly during weekends.

Table 2.4 - Typical weekday bus timetable for NWQ

Service	Route	Operator	Frequency
4, 5	Norwich to Swanton Morley	KonectBus	1 per hour
8 Fast	Norwich to Toftwood	KonectBus	2 per hour
Yellow (28 & 29)	Norwich to Thorpe Marriott	First Bus	1-4 per hour
Purple (36, 37, 38 & 39)	Long Stratton to Horsford (via Norwich City Centre)	First Bus	Up to 4 per hour

Service	Route	Operator	Frequency
Red (23 & 24)	Norwich City Centre & Rail Station to Thorpe St Andrew	First Bus	Up to 4 per hour
510	Costessey Park & Ride to Norfolk and Norwich University Hospital	KonectBus	Up to 2 per hour
X1	Norwich to King's Lynn	First Bus	2 per hour
X29	Norwich to King's Lynn	First Bus	1 per hour

Park & Ride

2.1.33. Currently, there are six Park & Ride sites located around Norwich, providing a total of almost 5,000 parking spaces on the urban fringe. Of the six sites, five serve the city centre, as shown in **Figure 2.6**.

Figure 2.6 - Park & Ride routes and locations

Source: Network Map (Park & Ride Norwich)

2.1.34. The Costessey Park & Ride is located closest to the NWQ study area, next to the Royal Norfolk Showground; however, this only serves Norfolk and Norwich University Hospital (NNUH) and the University of East Anglia (UEA). As a result, residents of western Norwich or users arriving from the west, would need to use Thickthorn Park & Ride or the Airport Park & Ride sites to access the city centre. The latter results in journeys across the study area.

2.1.35. Further transport intervention in the NWQ could benefit existing and potential users of the Park & Ride sites, by improving strategic connectivity to the existing sites, catering for desire lines through the study area and making sustainable travel to central Norwich more convenient and efficient.

Walking accessibility

2.1.36. Walking infrastructure in the study area is variable. Within more built up areas, the provision is generally adequate, with footways in place adjacent to the roads. However, away from residential areas, there is limited provision, especially between villages where there is very limited or no facility. Whilst walking could provide a sustainable alternative means for short length journeys, the infrastructure available to do so is extremely limited, and much of the study area is largely inaccessible due to the distances involved and associated journey times.

2.1.37. The A47 corridor and Longwater interchange are major barriers to pedestrian access, as no / limited infrastructure is available for users wishing to access local community facilities, such as Saint Peter's Church (Easton) or Saint Andrew Honingham Church, or access shops and services on William Frost Way. The A1067 also creates a barrier to pedestrian access and there are limited opportunities for safe crossing to access shops and services along the corridor.

2.1.38. There are numerous Public Rights of Way (PRoW) within the study area, including footpaths and bridleways in Bowthorpe, Costessey, Drayton and Ringland. Pedestrian crossing points are generally on main roads and at key locations and junctions.

Cycling accessibility

2.1.39. Cycling facilities are limited within the study area, with only local (on-road) routes to the south-east and the National Cycle Network Route 1 (NCN1) through the northern extents. This section of the NCN1, also known as The Marriott's Way, is a 42km footpath, bridleway and cycle route, following the alignment of two disused railway lines. The route passes through Norwich city centre, Costessey, through Drayton crossing the A1067 and the A1270, and goes westward towards Lenwade. From there the route goes north towards Reepham and beyond.

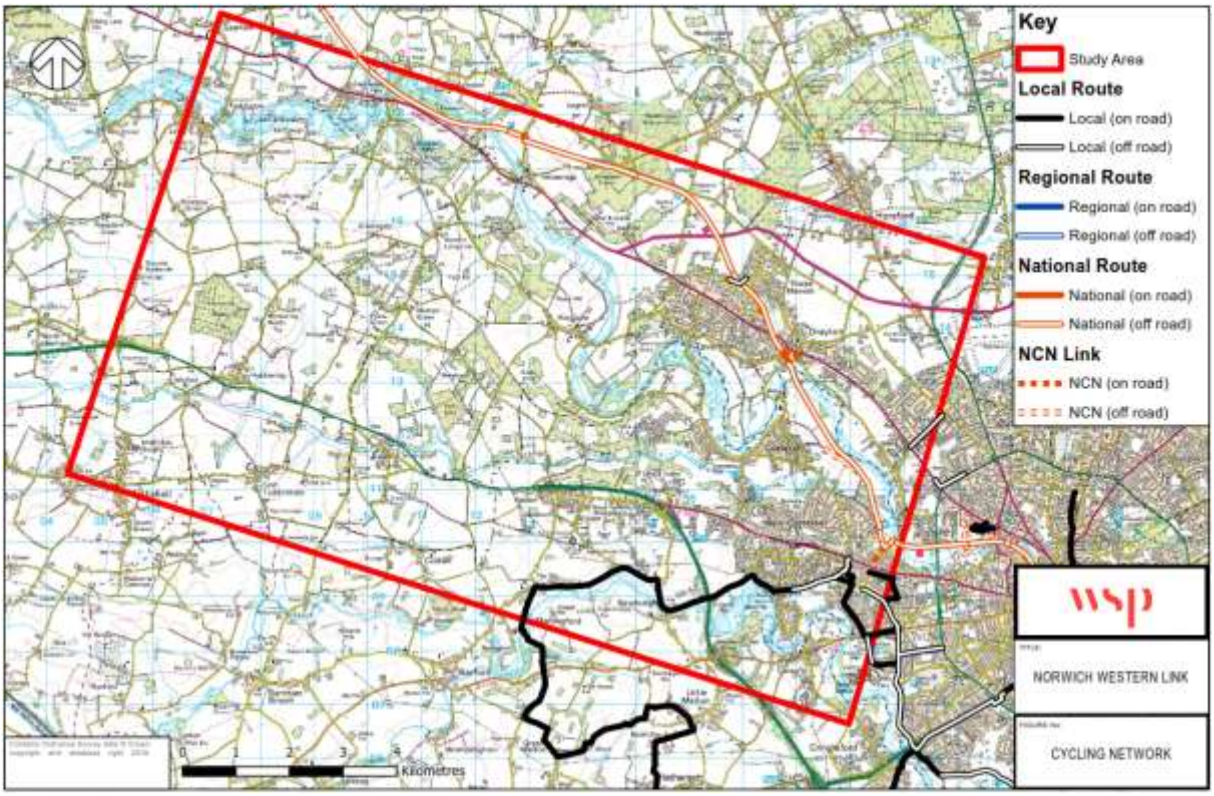
2.1.40. **Figure 2.7** shows the NCN1 and the other local cycle routes present within the study area, demonstrating the lack of connectivity and available infrastructure and routes throughout the NWQ. Whilst cycling could provide a sustainable alternative means for short to medium length journeys, the infrastructure available to do so is extremely limited.

2.1.41. Elsewhere, the Norwich cycle network is made up of seven colour-coded routes, known as 'Pedalways', which cross the city in all directions, and converge at St Andrews Plain in the city centre. Since 2013, Norwich has been awarded two significant Cycle City Ambition grants from the DfT and, with additional contributions from local partners, the cycle network will see £14.1 million of investment by 2019. The Pedalways in Norwich are as follows:

Green	between Bowthorpe and Broadland Business Park
Red	between Drayton and Whitlingham (NCN1)
Yellow	between Lakenham and Aviation Academy
Pink	between NNUH and Heartsease
Blue	between Wymondham and Sprowston
Orange	Inner circuit
Purple	Outer circuit

2.1.42. The first wave of funding saw improvements to the 13km Pink Pedalway and the connections leading to it, creating a higher quality cycle link from the NNUH and UEA, through Norwich city centre, to Heartsease and Broadland.

Figure 2.7 - **Cycle network**



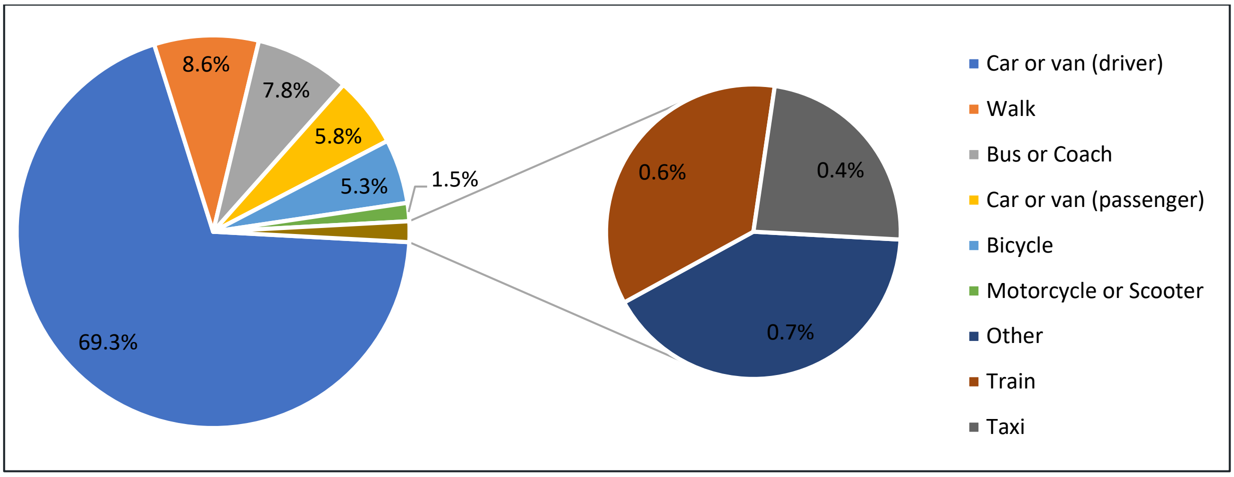
STUDY AREA TRAVEL PATTERNS

2.1.43. This section considers the current situation in the study area in terms of journey patterns (investigating origin-destination information and key locations with regard to employment and tourism) and behaviours (with regard to mode share and traffic volumes), and highway safety.

Mode Share

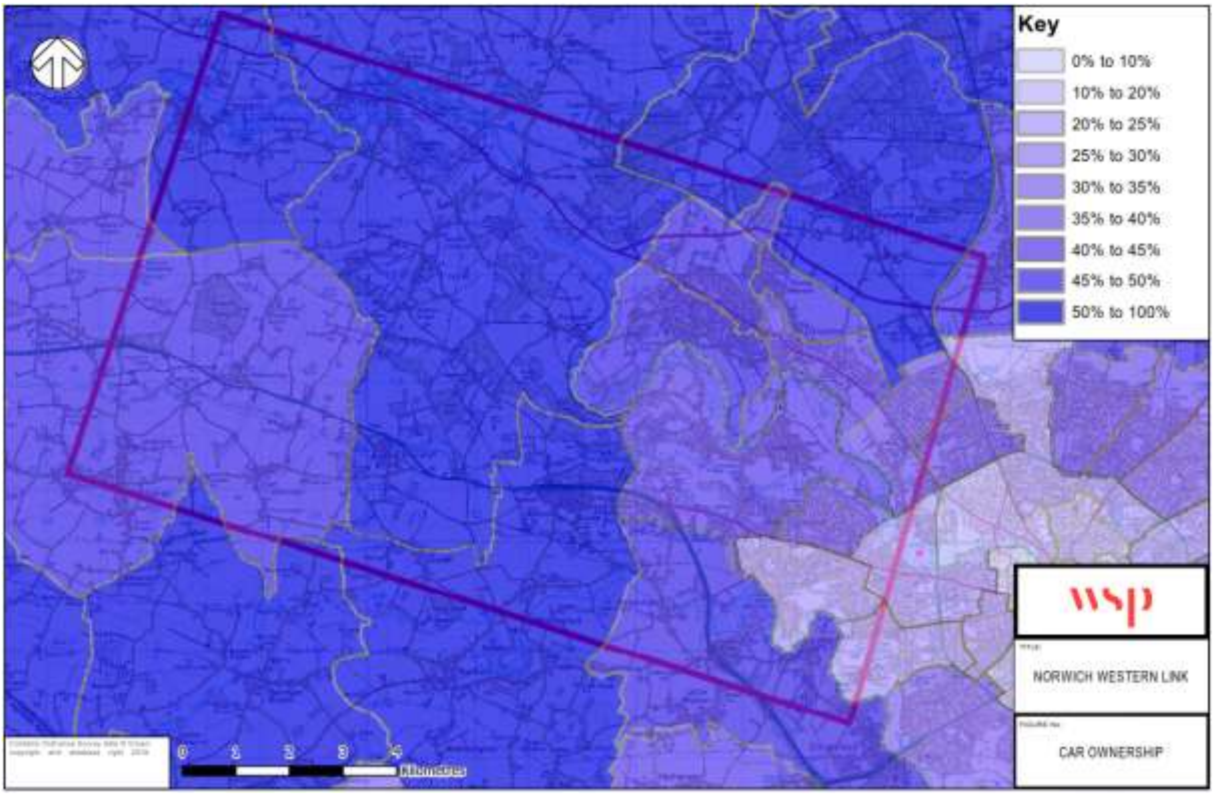
2.1.44. The car represents the dominant mode of travel to work within the study area. **Figure 2.8** indicates the mode share for all usual residents aged 16 to 74, excluding those who work from home or are unemployed. Approximately three-quarters (75.1%) of residents within the NWQ travel to work by car, as either a driver (69.3%) or a passenger (5.8%), which is supported by the majority of the study area having access to two or more cars. **Figure 2.9** shows areas having households with two or more vehicles.

Figure 2.8 - Modal share for journeys to work



Source: 2011 Census

Figure 2.9 - Households with two or more vehicles

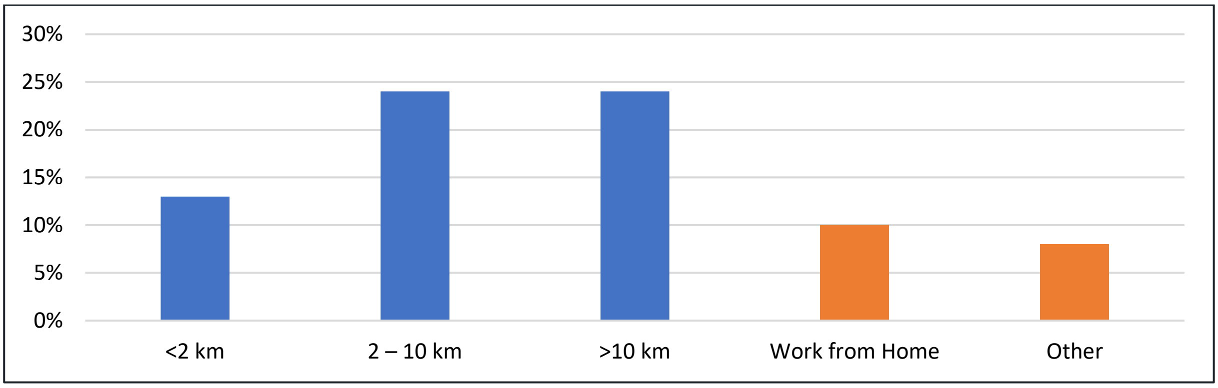


Source: 2011 Census

2.1.45. Much smaller proportions use public transport modes such as bus (7.8%) and train (0.6%) to travel to work. This could be attributable to areas within the NWQ having poor public transport connections to the city centre and / or the distance being too great to use active modes of transport such as cycling and walking. This indicates the need for improved public transport connections between the western areas of the study area to Norwich city centre. The data also highlights the need for improved transport links, due to the volume of journeys undertaken by road and the high percentage of car ownership within the study area.

2.1.46. Whilst the majority of journeys to work are undertaken by car, 37% of journeys are under 10km (**Figure 2.10**), which suggests a high level of car use is for short journeys, indicating there are potential opportunities for encouraging modal shift away from private car usage to other, more sustainable modes of transport.

Figure 2.10 - Average distance travelled to work



Source: 2011 Census

2.2. EXISTING COMMUNITY AND LAND USE

2.2.1. Norwich is the county city of Norfolk, and is a key regional centre in the East of England. It is approximately 185km north-east of London, and occupies a strategically significant position within East Anglia. Norwich is directly served by a number of trunk roads, including the A11 (linking Norwich to London, via the M11), and the A47 (linking Norwich to Great Yarmouth and Lowestoft in the east and King's Lynn in the west). Norwich is also served by the A140 (linking Norwich to Cromer in the north and Ipswich in the south, via the A14) and the A146 (linking Norwich to Lowestoft).

2.2.2. Norwich is also an important rail node for the East of England, with a mainline link to London and providing connections to coastal locations such as Cromer, Great Yarmouth and Lowestoft.

2.2.3. The city performs a regional role in delivering growth and as a major employment, shopping and service centre, and a focus for transportation. Following the completion of the NDR, which was subsequently designated as an A-Road in the route hierarchy (A1270) and named Broadland Northway, there have been calls to complete the 'missing link' between the A47 and A1067.

2.2.4. The study area encompasses the western fringe of Norwich and settlements, including; Bawburgh, Marlingford, Honingham, Hellesdon, Drayton, Taverham, Costessey, New Costessey, Ringland, Hockering, Weston Green, Weston Longville, North Tuddenham, Primrose Green, Lenwade, Alderford, Morton, Upgate, Felthorpe, Thorpe Marriott, Horsford, Elsing and Lyng.

EXISTING LAND USE

2.2.5. The study area has a mixture of land uses, including; rural farmland, parkland, the River Wensum, the River Tud, residential areas (including the relatively new development at Queen's Hills of over 2,000 dwellings), and Longwater Business and Retail Park. The study area also includes the River Wensum

Valley and a number of environmental designations including a SAC, designated due to its international importance in biodiversity conservation, and a Site of Special Scientific Interest (SSSI).

2.2.6. A key land feature in this area is a disused airfield near Weston Green (named Royal Air Force Attlebridge). There are also popular recreational facilities including Roar Dinosaur Park, off Weston Hall Road, the Merryhill Country Park along Telegraph Hill (South central), and the Wensum Valley Hotel, Golf & Country Club (Northeast).

TOPOGRAPHY AND GEOLOGY

2.2.7. The Norwich area is underlain by Cretaceous Upper Chalk beds up to 200m thick, which dip gently eastward. These beds are mostly covered by Pleistocene and Recent deposits. These deposits lie unconformably (i.e. they are no longer in their original sequence of deposition) on the Chalk surface, which is generally exposed in the river valleys.

2.2.8. The oldest Pleistocene formation is the Norwich Crag, extensive to the east but gradually disappearing to the west of Costessey. The Crag comprises interbedded sands and gravels with occasional lenticular clays. To the north of the River Wensum, Crag is overlain by Corton Till comprising glacial deposits of intercalated, mainly unbedded clays and loamy sands. South of the Wensum, Corton Till is absent and Lowestoft Till lies directly on either the Chalk surface or the Crag. The Lowestoft Till extends northwest by Easton and Weston Longville.

2.2.9. Glacial Sands and Gravels occur as masses below, within and above the Lowestoft Till. These sands and gravels are extensive around the city area and are commonly exposed in river valleys.

2.2.10. Valley Gravels occur sporadically, with recent alluvium, mainly silty or fine sand, occupying the valley centres and the recent river terraces.

2.2.11. Away from the Wensum river valley, soils are sandy, or sand and coarse loamy, generally well drained and with a few stones. Water logging may occur where water tables are high. Soil associations (Soil Survey of England and Wales; Soils of Eastern England).

2.2.12. To the northwest the associations are 551b, 551c, 572a and 861c. Along parts of the Wensum valley soils are silty and clayey, possibly with humus layering and a high water table, and are described as type 1024a (Adventurers 1).

CULTURAL HERITAGE

2.2.13. Archaeological features have been recorded in the east and west of Norwich, including numerous cropmarks. Occupation and activity has been particularly concentrated on river systems, along valley bottoms and on river terraces above the Wensum valley. There are no Scheduled Ancient Monuments on the English Heritage Sites and Monuments Records and no locally designated sites of archaeological importance.

2.2.14. There are numerous listed buildings to the west of Norwich. Morton Lodge, a grade II listed building, is located adjacent to the A1067 at Attlebridge and is the closest to scheme.

2.3. SUMMARY OF EXISTING ENVIRONMENTAL CONDITIONS

2.3.1. Early plans to link the A47 (west) to the A47 (east) via the A1067 were not progressed due to environmental concerns, and potential effects upon the River Wensum SAC (and SSSI). Since the adoption and completion of the A1270, there has been sustained local pressure for a NWL to ease perceived traffic problems in the local area and enhance strategic connectivity. Combined with

Highways England's intention to upgrade the A47 to dual carriageway between North Tuddenham and Easton, Norfolk County Council committed to revisit the feasibility and need for a NWL. Norfolk County Council is progressing the NWL project on the basis that a crossing of the River Wensum is compatible with the indicative proposals already provided to Natural England and the Environment Agency.

Constraints

2.3.2. The study area covers some 13,713ha, and the relevant environmental constraints have been shown in **Figure 2.11**, however, it does not necessarily identify all the constraints that have informed the study and assessment of options in subsequent chapters of this report. For example, the Norwich City Centre Air Quality Management Area (AQMA) and the majority of the Noise Important Areas (NIAs) are not within the study area that has been created, however, they are important environmental constraints, and may be affected (positively or negatively) with regard to the various options which include improvements to existing roads. The extent of the AQMA and NIAs within the immediate surroundings of Norwich City Centre have been shown in **Figure 2.12**. The key environmental constraints within the NWQ are discussed by topic in the following sections.

Figure 2.11 - Environmental constraints in the study area

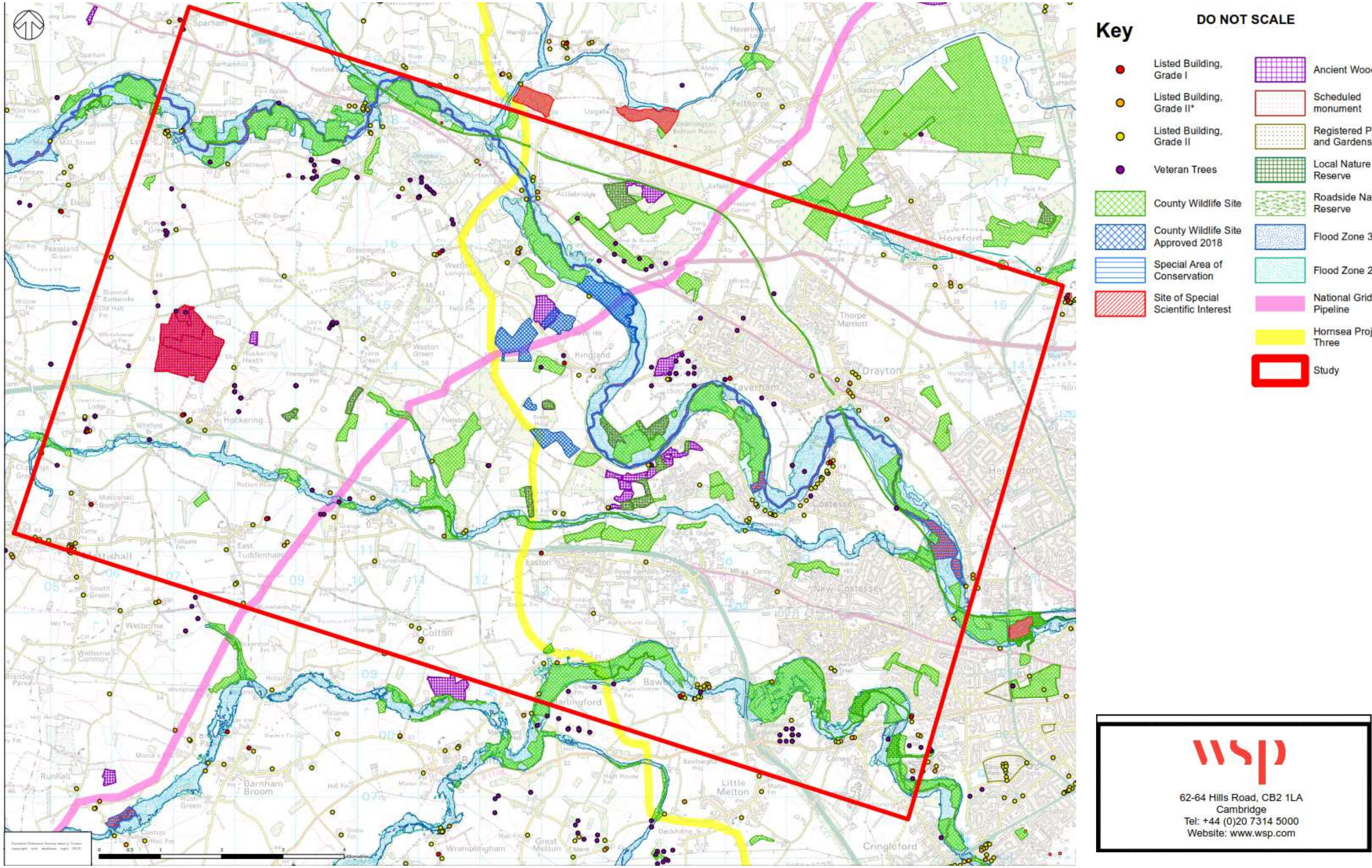
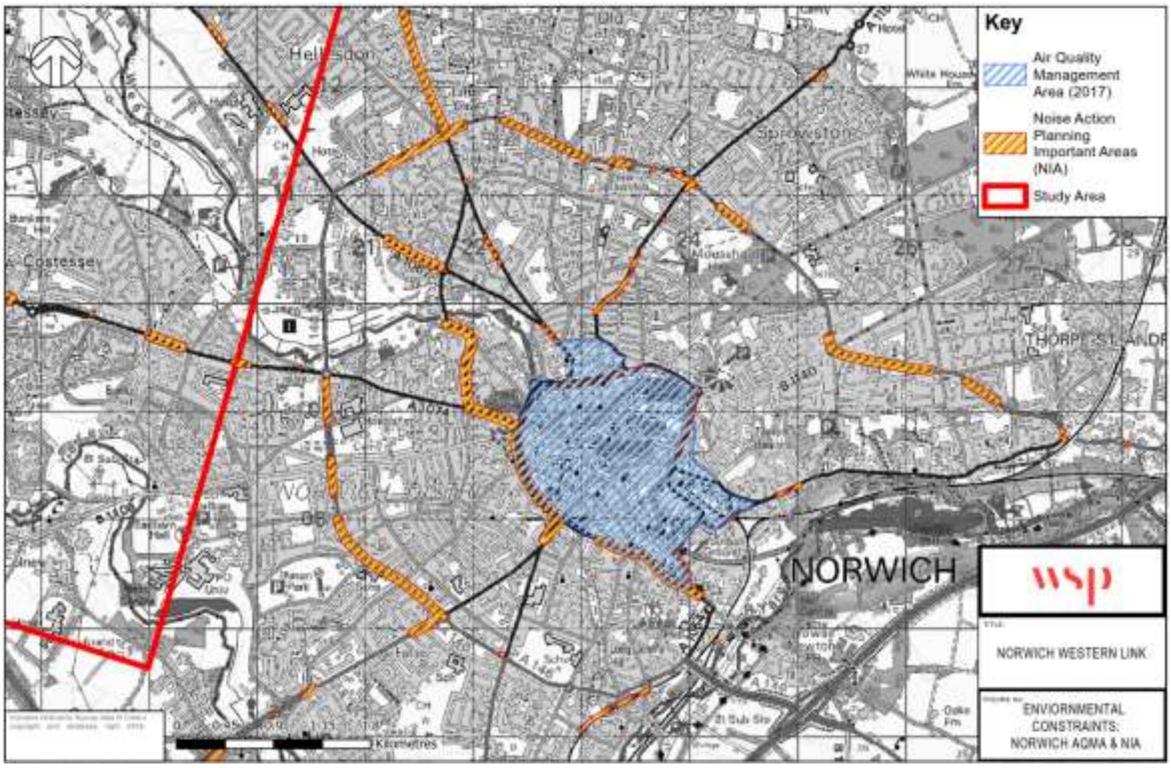


Figure 2.12 - Norwich city centre AQMA and NIA environmental constraints



Air quality

2.3.3. The main source of air pollution within the study area is likely to be from road traffic emissions. The vast majority of the study area falls outside of an AQMA. The closest AQMA is east of the study area, within the Norwich City Centre area, known as the Central Norwich AQMA. It was declared an AQMA for nitrogen dioxide (NO2) in 2012.

Noise

2.3.4. The existing major sources of traffic noise in the study area are likely to be associated with the A47 and A1074 to the south, and the A1067 to the north, along with the newly opened A1270. There are three NIAs along the A47, five along the A1074, 11 along the A1067 and several in Norwich city centre.

Greenhouse gases

2.3.5. In 2016 the East of England region released 33 million tonnes of CO2 into the atmosphere, of which 47% was from the transport sector[11]. Even though total CO2 emissions in the region decreased by 5% in 2016 compared to 2015, transport emissions increased by 2%.

2.3.6. To reduce greenhouse gas emissions, Norwich City Council partnered with Norfolk County Council to introduce a Low Emission Zone (LEZ). The LEZ was introduced using an innovative approach through obtaining a Traffic Regulation Condition via the area Traffic Commissioner to regulate vehicle

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[11] Department for Environment, Food and Rural Affairs, June 2018, Local Authority Carbon Dioxide Emissions Estimates 2016, Statistical Release: National Statistics

emissions and buses. An engine switch-off policy was introduced within the LEZ to restrict idling of vehicles in October 2018. Other measures are also in place including the encouragement of eco-driving to minimise fuel consumption.

Landscape / townscape

2.3.7. There are no statutorily designated sites for landscape, such as Areas of Outstanding Natural Beauty (AONB) or National Parks, within the study area. As the scheme progresses, further investigation and LVIA (Landscape and Visual Impact Assessment) will be carried out in relation to the local landscape setting of a proposed NWL.

2.3.8. The closest large settlement to the study area is Norwich itself, however the study area encompasses a relatively rural landscape with small settlements and isolated dwellings. Therefore, the baseline conditions for townscape as an environmental constraint are likely to be negligible.

Historic environment

2.3.9. Within the study area there are a number of statutorily designated archaeological and built heritage assets. There is a total of 186 listed buildings, of which 12 are Grade I, 19 Grade II* and 155 Grade II and a total of nine Scheduled Monuments.

2.3.10. The River Wensum Valley geology includes areas of natural sand and gravel which, along with the riverine topography, provide an indication of suitability for early settlement due to the preference for well-drained gravels close to predictable resources provided by rivers. The study area therefore has high potential for archaeological deposits, the value and integrity of which is insufficiently understood to inform an assessment at this stage.

Biodiversity

2.3.11. In the wider area there are a range of ecological resources that may be affected by the proposals. These include designated sites of ecological interest as well as species that are protected by law, or otherwise of particular nature conservation importance.

2.3.12. Sites at a distance from the proposals may also be at risk from indirect effects. Within the immediate area of the scheme options, the most significant ecological site is the River Wensum SAC / SSSI. Four further sites of European importance at a greater distance from the scheme options will also require consideration in a Habitats Regulations Assessment (HRA) for the proposals. The immediate area of the scheme options contains three further nationally designated sites: Hockering Wood SSSI, Bowthorpe Marsh Local Nature Reserve (LNR) and Earlham Park Woods LNR.

2.3.13. This area also includes 75 County Wildlife Sites (CWS) and five Roadside Nature Reserves (RNR). These sites include a wide range of habitat types of value for different ecological features, including areas of Ancient Woodland and Veteran Trees as well as wetland and marsh associated with the River Wensum and River Tud floodplain, mature woodland and grassland. The area supports a diversity of wildlife including and the protected species including: otter *Lutra lutra,* water vole *Arvicola amphibius*, great crested newt *Triturus cristatus*, Norfolk hawker dragonfly *Aeshna isoceles*, Desmoulin's, whorl snail *Vertigo moulinsiana*, brook lamprey *Lampetra planeri*, bullhead *Cottus gobio* and ten species of bat including barbastelle[12] *Barbastella barbastellus*. Also recorded are a number of rare plant species including: fen pondweed *Potamogeton coloratus*, opposite-leaved pondweed *Groenlandia densa*, large yellow-sedge *Carex flava* and tubular water-dropwort *Oenanthe fistulosa.*

Water environment

2.3.14. There are two watercourses which are designated as 'main rivers' within the study area which could be impacted upon; these are the River Wensum and the River Tud. There is a Flood Zone 3 area (1 in 100 or greater annual probability of river flooding) surrounding the River Wensum, and scattered areas of designated Flood Zone 2 (between a 1 in 100 and 1 in 1000 annual probability of river flooding) and Flood Zone 3 around the River Tud. The River Wensum and River Tud form part of the Wensum Operational Catchment and are monitored under the Water Framework Directive (WFD). Both rivers are heavily modified, and according to the 2016 Cycle Two Assessment, both rivers have an overall environmental classification rating of 'moderate'. There is also a minor unnamed watercourse near the Foxburrow Plantation, which is partially within a Flood Zone 3 area.

Key Challenges

2.3.15. The key environmental challenges affecting the NWL study area and potential mitigation measures are outlined in **Chapter 5**.

2.4. DRAINAGE AND HYDROLOGY

Minor rivers and streams are likely to run dry during periods of low groundwater levels, in particular during summer months. This is typical of Chalk areas, where surface waters have high base flow indices, i.e. are largely fed by groundwater.

Areas of the study area have been designated as protected resources and of high groundwater vulnerability. Also, source protection zones have been designated around the public water supply abstraction point on the River Wensum at Costessey which feeds into Heigham Water Treatment Works.

Drainage measures would need to be provided on cut slopes and carriageways to deal with groundwater and surface runoff. At this stage, it is proposed that all runoff would be treated through SUDS with outfalls where necessary to groundwater only, and details will be developed at Stage 3.

2.5. PUBLIC UTILITIES (STATUTORY SERVICES)

The study area has a network of public utilities (services including electricity, gas and communications), concentrated mainly in urban areas and along roads. The construction of sections of a route in these areas would involve disturbance to, and possibly relocation of these services. It is expected that utility plant would be encountered where route links cross or follow existing roads, in which case normal countermeasures would be taken.

Overhead High Voltage electricity cables run west of Easton as do the strategic natural gas pipeline (part of the national grid), and the proposed Orsted Cable while other major utility plant are located in predominantly urban areas within the study area.

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[12] The barbastelle *Barbastella barbastellus* is one of the UK's rarest mammals. Few maternity roost sites are known in the UK. The barbastelle is widely distributed across southern England and across Wales but is likely to have been significantly under-recorded within its range (JNCC).

3. DESCRIPTION OF SCHEME OPTIONS

3.1. DEVELOPMENT OF ROUTE OPTIONS

OPTIONS CONSIDERED

3.1.1. In order to develop a list of options which would address the identified existing and forecast issues within the study area a structured approach was taken in accordance with the Department for Transport (DfT) Web based Transport Analysis Guidance (WebTAG). The methodology used and the work undertaken in 2018 study has been fully documented within the Options Assessment Report.

3.1.2. In the development of potential options, the study followed the guidance set out within step 5 of DfTs appraisal process and a wide a range of options were considered, including all modes, infrastructure, regulation, pricing and other ways of influencing behaviour.

3.1.3. A set of high-level objectives were developed with particular consideration of the key themes emerging from earlier reviews of national and sub-national policy and strategy. Further to this a set of specific objectives were also developed to both support the high-level objectives and respond to the local challenges identified and need for intervention.

3.1.4. In order to further enhance the methodology for developing a long list of options, evidence was gathered from a non- statutory public consultation which focused on developing an understanding of people's experience of living in, and travelling through, the area to the west of Norwich.

3.1.5. The evidence captured included the top 10 most frequently identified transport issues within the area. Further analysis of members of the public were asked to provide their preference of potential options to explore from a list.

3.1.6. Key stakeholders were also invited to a series of workshops in order to understand their views and preferences for potential options. This included various councils, LEPs, environmental groups and business and industry representatives.

3.1.7. Options from previous studies were also considered and included within the process going forward. A total of 82 options were developed and taken forward for assessment. These options fell into a range of potential solutions which focused on resolving the identified issues and included:

- New link highway options
- Network improvement schemes
- Demand management
- Active travel
- Information
- Freight
- Public transport options
- Do nothing

3.1.8. New link highway options were developed based upon alignments from previous studies, identified gaps in the network, connections with the A47, engineering constraints and the physical and environmental constraints. Where possible, the alignments aim to avoid these constraints. Network improvement schemes were identified based upon existing network constraints. These options provide an opportunity to tackle congestion and improve reliability through upgraded link and junction capacity schemes.

3.1.9. In an effort to tackle demand based issues, a number of demand management, freight and improved information schemes were identified. These schemes seek to address issues related to rat-running, safety, severance and connectivity. Active travel and public transport options were also developed to encourage modal shift and reduce private vehicle trips on the existing road network.

3.1.10. Using the DfTs, Early Assessment and Sifting Tool (EAST) an assessment and sifting exercise was undertaken which considered the DfT's 5 case assessment criteria this included Economic, Strategic, Management, Financial and Commercial Cases while Environmental criteria (Having regard to EAST and the National Policy Statement for National Networks (NPSNN)) was included.

3.1.11. The EAST usually challenges environmental matters within the Economic Case assessment within the four parameters of air quality, noise, natural environment and streetscape. Given that any new highway construction across the River Wensum is likely to have negative impacts upon an environment of high value, there would be virtually no distinction between many options from an environmental perspective using the EAST methodology alone, as the categories are quite coarse and some include more than one topic which may lead to misleading results. Therefore, the EAST methodology was supplemented and expanded to include additional environmental topics with the application of a scoring system that has allowed greater differentiation between options.

3.1.12. An initial round of sifting led to the removal of all options which did not directly score as highly as the do nothing scenario. This initial sifting led to the discounting of 56 options. In order to further reduce the number of potential options a second round of sifting compared the remaining highway options geographically and removed the weaker options from competing pairs. However, the remaining non-highway options were carried through in consideration that they should be considered potentially as part of future transport packages.

3.1.13. The shortlisted options are presented below:

HIGHWAY OPTIONS

- Route Option A, runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road, at its junction with Porters Lane and the B1535, to the south.
- Route Option B, West runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road to the south, between Morton on the Hill and Attlebridge.
- Route Option C, runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road to the west of its junction with the A1270.
- Route Option D runs from the A47 at its junction with Taverham Road to the A1067 Fakenham Road to the west of its junction with the A1270. The route passes to within approximately 47m of houses on Taverham Road.

NON- HIGHWAY OPTIONS

- Option 39: Improvements to existing junctions
- Option 40: Signing and lining improvements
- Option 41: Signal improvements
- Option 44: New / improved crossing points
- Option 49: Improvements to existing bus services (28, 29 and X29)
- Option 50: Improvements to existing bus services (23, 23A and 24)
- Option 55: Promote cycling schemes
- Option 58: Mobility as a service scheme

- Option 68: Lorry management strategy
- Option 74: New bus route connecting Dereham, Hellesdon and Norwich Airport

3.2. SHORTLISTED OPTION OVERVIEW

3.2.1. Further investigation of the 4 route options resulted in splitting of Options B and D in to a further 2 sub options now known as Option B West and Option B East and Option D West and Option D East. A more detailed description of the shortlist options can be found in **Section 6.2** with a map of the junctions provided within **Figure 6.4.**

Option A

3.2.2. This option is an upgrade to the existing B1535, linking to the A47 at the Wood Lane junction north of Honingham. This option would significantly realign the current B road, smoothing it out to make it a higher standard route. The route would join the A1067 via a new junction at Lenwade and make use of the existing bridge across the River Wensum at Attlebridge.

3.2.3. The existing river crossing at Attlebridge is utilised and therefore does not require a new crossing of the River Wensum. This option does not cross the River Tud.

Option B East (New Viaduct)

3.2.4. An upgrade to the existing A1067 and a new route just to the east of Weston Longville, linking to the A47 at Wood Lane. This option would see a new viaduct crossing of the Wensum created, joining the A1067 to the east. A new bridge would have to meet current environmental criteria with respect to the River Wensum for which both costs and environmental discussion is considered in the following chapters.

Option B West (Utilising Existing Bridge)

3.2.5. An upgrade to the existing A1067 and a new route just to the east of Weston Longville, linking to the A47 at Wood Lane. The West option connects into the A1067 via existing River Wensum bridge at Attlebridge.

Option C

3.2.6. An upgrade to the existing A1067 and a new route just to the west of Ringland, linking to the A47 at Wood Lane and the A1067 north of Ringland close to Old Hall Farm (formally Attlebridge Hall), crossing the River Wensum on a new viaduct.

3.2.7. The route would require a new viaduct crossing of the River Wensum flood plain just north of Ringland, this option does not cross the River Tud.

Option D West (A47 Taverham Lane Junction)

3.2.8. An upgrade to the existing A1067 and a new route just to the west of Ringland, linking to the A1067 in the same location as Option C. Variant D West sees a connection at the approximate location of the existing A47/Taverham road junction,

3.2.9. The route would require a new viaduct crossing of the River Wensum flood plain, additionally this route would require a viaduct crossing of the Tud in the south.

Option D East (Taverham Lane and Easton Junction)

3.2.10. An upgrade to the existing A1067 and a new route just to the west of Ringland, linking to the A1067 in the same location as Option C. Option D East sees a connection to the A47 further east just outside Easton.

3.2.11. The route would require a new viaduct crossing of the River Wensum flood plain, additionally this route would require a viaduct crossing of the Tud in the south.

Do Nothing

3.2.12. The do nothing option which has no proposed measures is included throughout in order to provide a base from which to make comparisons. Within the Do Nothing the A47 Dualling scheme is included as this is a Highways England scheme which will progress as a standalone scheme.

3.3. POTENTIAL PACKAGE MEASURES

3.3.1. The five remaining new highway link options and the existing link upgrade options were shortlisted based on their performance against all other options using the original sifting process discussed within the Options Appraisal Report. These options now provide a platform from which to produce the most suitable scheme for a NWL. However, in order to produce an option which best addresses as many objectives as possible the remaining non-highway options, which cover public transport, active travel, freight, and network improvement were carried through so that they may be considered in terms of complementing the 5 shortlisted new highways options and the existing highway upgrade route option.

3.3.2. The public consultation on potential route options for the Norwich Western Link was carried out between 26 November 2018 and 18 January 2019. While this consultation was to provide information on the route option proposals, obtain feedback on each option and help identify a preferred route for the Norwich Western Link, information gathered also indicated where various stakeholders considered gaps may still occur in terms of the objectives.

3.3.3. Some stakeholders suggested a range of complementary transport measures, including walking and cycling measures and the implementation of traffic management should be considered along with the final preferred route in order to maximise the use of non-car modes of transport but also to discourage rat running.

3.3.4. Barton Willmore LLP on behalf of Norwich Airport Limited proposed that as well as a link that the provision of a comprehensive network of cycle and pedestrian routes and links to allow people the choice to travel by sustainable modes should be considered.

3.3.5. Several Parish councils expressed concerns that dependent on the preferred option that rat running and inappropriate HGV movements may still occur and that again additional measures should be considered where possible to compliment the preferred route and help to address existing issues.

3.4. COST ESTIMATES

BACKGROUND

3.4.1. Costs estimates have been built up for each of the highway link options, with allowance for risk, and inflation that have been used, are the latest available, at Q1 2019 prices.

3.4.2. Linear construction through local topography creates cuttings and embankments, and therefore earthworks costs have been estimated on the basis of cut and fill quantities, with appropriate rates for each. To meet sustainability objectives and minimise costs, it has been assumed at this stage that where possible, surplus material can be used within or adjacent to the site for essential landscaping mitigation.

- Each options costs have been developed in consideration to
- Costs related to viaduct
- Bridges
- Dualing of the A1067
- Works costs include an estimated allowance for public utility diversions (no consultation with utility companies has been undertaken as part of this scheme assessment at this stage).
- Land and compensation cost estimates provided by the County Council's land surveyors, Norfolk Property Services.

Table 3.1 – Estimated Scheme Costs

OPTION	COST ESTIMATE (2019) (£, 000)				
	Basic works construction costs	Basic works construction costs (incl. preliminaries allowance)	Gross scheme construction cost estimate	Basic scheme estimate incl. prep and supervision (excl risk).	Initial high level financial case estimate (using indicative details (excl vat)
Option A	£23,870,910	£29, 361, 220	£36,852,662	£45,686,557	£58, 581, 638
Option B West	£56,482,281	£68,625,971	£88,818,134	£99, 598,036	£125, 812, 752
Option B East	£75,853,543	£91,403, 520	£108, 056,585	£120,279, 642	£152, 198, 117
Option C	£74,453,217	£89, 76,126	£102, 650,535	£114, 780,854	£146, 717,216
Option D West	£83,505,923	£99,998,343	£122, 035, 996	£134, 854,823	£171, 318, 013
Option D East	£78,253,425	£93,708,476	£113, 046,129	£125, 523,543	£159,963,153

Gross scheme estimates include allowances for land, statutory utility, and environmental mitigation costs.

Basic scheme estimates include estimated design, preparation and supervision fees

Initial high-level estimates include risk and inflation allowances

4. ENGINEERING ASSESSMENT

4.1. BASIS OF OPTION ENGINEERING ASSESSMENT

TECHNICAL STANDARDS

4.1.1. The proposed routes have been developed following key technical guidance contained in the Design Manual for Roads and Bridges (DMRB), as listed below:

- TD 9/93 – Highway Link Design (DMRB Vol 6, Section 1, Part 1)
- TD 27/05 – Cross-Sections and Headrooms (DMRB Vol 6, Section 1, Part 2)
- TD 16/07 – Geometric Design of Roundabouts (DMRB Vol 6, Section 2, Part 3)
- TD 42/95 – Geometric Design of Major/Minor Priority Junctions (DMRB Vol 6, Section 2, Part 6)
- TD 41/95 – Vehicular Access to All-Purpose Trunk Roads (DMRB Vol 6, Section 2, Part 7)
- TA 46/97 – Traffic Flow Ranges for Use in the Assessment of New Rural Roads (DMRB Vol 5, Section 1, Part 3)

OUTLINE DESIGN CONSIDERATIONS

4.1.2. The proposed routes are designed to follow the below broad principles and assumptions:

4.1.3. Provisional route paths will aim to avoid constraints as shown on the constraints plans whilst staying within the geometric parameters for the design speed, and modified, as necessary, to take account of additional mitigation measures, and other requirements identified at later stages.

4.1.4. Provisional vertical profiles will be within maximum gradients for the respective design speed, produced from three-dimensional (3-D) digital terrains created using UK Governments Open Source Light Detection and Ranging (LIDAR) mapping data, but may need to be revisited at later stages when a topographical survey is available.

4.1.5. An approximate earthworks balance is sought where possible, with highway sections in “cut” proposed to offset embankments or “fill” sections, and reduce the need for importing or exporting earthwork material for each route.

4.1.6. Road cross sections are typical and standard throughout the lengths of each link section to enable a consistent approach for assessment at this early scheme stage. The road cross-sections are to be refined at later stages to consider pinch points, superelevation, local widening, and tie-ins to junctions and structures.

4.1.7. At-grade junctions are to be provided to link the A1067, while grade separated junctions with the A47 have been used based on advice on junction type given by HE for the North Tuddenham to Easton dualling scheme. All junction arrangements are to suit the road connections and traffic requirements.

4.1.8. Existing local roads which intersect with the Route links will either be linked with a junction, crossed by an overpass or underpass, or diverted as appropriate, with consideration of the Option’s junction strategy.

4.1.9. Requirements for street lighting, road side facilities, road furniture, pavements, Vehicle restraint systems, fencing, local connections, utility diversions and temporary works will be considered in detail at a later stage.

4.1.10. Provisions for pedestrian and cyclist facilities will be developed in detail at later stages

4.1.11. Existing Public Rights of Way (PRoW) are to be maintained where practicable. Any PRoW severed by the route is linked to alternative crossing locations or PRoW by use of the proposed cycleway/footway.

4.1.12. As all routes are still provisional, the outline designs have aimed to ensure compliance, and avoid Departures from Standard for proposed route strategies, horizontal and vertical link curvature, vertical grades and junction layouts. However, designs will need to be further developed for a full visibility assessment taking into account the placement of vehicular restraint systems, fencing, existing vertical obstructions etc, and checks on cross-section transitions and carriageway superelevation. Similarly, compliance to requirements for drainage, pavement, structures, signs and road markings can only be confirmed at the detailed design stage.

4.2. ENGINEERING DESCRIPTION OF EACH OPTION

OPTION A

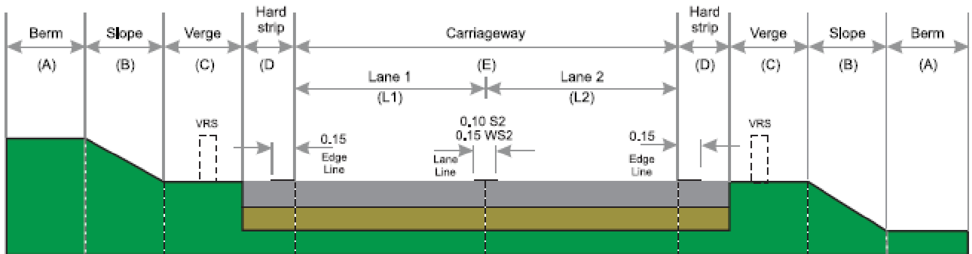
Overview

4.2.1. This route has been designed as an upgrade of the existing B1535, and as far as possible, keeps to alignment of the existing route, avoiding the villages of Weston Longville and Weston Green.

4.2.2. The Option A route is designed as a single carriageway rural all-purpose road with a design speed of 100kph (60mph). Refer to figures in Appendix A for outline route layout illustrating the indicative preliminary horizontal and vertical alignment of the route.

4.2.3. A single carriageway cross section (S2) standard has been chosen in accordance with TA 46/97- Traffic Flow Ranges for Use in the Assessment of New Rural Roads, with recommended rural carriageway standards for forecast traffic flows intended to be used. The single carriageway standard is adopted because the opening year Annual Average Daily Traffic (AADT) for this route, is less than the minimum 11,000 recommended for a dual carriageway. The typical proposed road (carriageway and hardstrips) would be 9.3m in width, with 2.5m wide verges on either side. See **Figure 4.1** below from TD 27/05 showing the standard cross section for rural all-purpose roads – single carriageway.

Figure 4.1 - Dimensions of Cross-Section Components for Rural All-Purpose Roads Mainline – Single Carriageway (DMRB TD 27/05)



<table>
<tr><th rowspan="2">Road Type</th><th rowspan="2">A</th><th rowspan="2">B</th><th rowspan="2">C[2]</th><th rowspan="2">D[3, 11]</th><th colspan="2">E[3]</th><th rowspan="2">D[3, 11]</th><th rowspan="2">C[2]</th><th rowspan="2">B</th><th rowspan="2">A</th></tr>
<tr><th>L1</th><th>L2</th></tr>
<tr><td rowspan="2">Single (S2)</td><td rowspan="2">Varies</td><td rowspan="2">Varies</td><td rowspan="2">2.50</td><td rowspan="2">1.00</td><td colspan="2">7.30</td><td rowspan="2">1.00</td><td rowspan="2">2.50</td><td rowspan="2">Varies</td><td rowspan="2">Varies</td></tr>
<tr><td>3.65</td><td>3.65</td></tr>
<tr><td rowspan="2">Wide Single (WS2)</td><td rowspan="2">Varies</td><td rowspan="2">Varies</td><td rowspan="2">2.50</td><td rowspan="2">1.00</td><td colspan="2">10.00</td><td rowspan="2">1.00</td><td rowspan="2">2.50</td><td rowspan="2">Varies</td><td rowspan="2">Varies</td></tr>
<tr><td>5.00</td><td>5.00</td></tr>
</table>

Single Carriageway

Source: TD 27/05 (Design Manual for Roads and Bridges)

4.2.4. Due to the rural and constrained nature of this route's corridor, with several existing accesses, a design speed greater than 100kph was not deemed appropriate for safety and practical reasons. Overtaking opportunities are provided in both directions along most of the route.

Horizontal Alignment, Land Use and Constraints

4.2.5. This route would mostly run along the existing B1535 corridor, deviating east at the southern approach to the Wood Lane B1535/A47 junction, with a length of approximately 6.4km.

4.2.6. The following local roads are being considered to be either upgraded, stopped up, or diverted to facilitate the new link:

- The western section of Morton Lane where it connects to the existing B1535 will be diverted to the south so a staggered at-grade junction can be formed with Option A and Sandy Lane.
- A section of the existing B1535 east of Option A will be extinguished so that traffic can use Rectory Road to join Option A at an at-grade junction.
- A section of Rectory Road that crosses and travels west of Option A will be extinguished as far as an existing property access and traffic will be diverted via Breck Road to a new at grade junction with option A.
- A section of Breck Road will be stopped up where it crosses Option A and a new at grade junction will be formed on the east side of Option A and a new at grade junction will also be formed to TWA Bark Supplies.
- A section of Ley's Lane and the B1535 will be stopped up where they cross Option A, with a new at grade junction to the east and a staggered junction to the west, with traffic that would have joined the B1535 from Sandy Lane diverted to the new staggered junction.
- A small section of Wood Lane will be stopped up where it crosses Option A and a new at-grade junction provided.

Junctions and Links

4.2.7. At its northern end, this route forms an at-grade junction in the village of Lenwade, with a four-arm roundabout linking the A1067 at the existing junction and Porter Lane.

4.2.8. Existing B1535 priority junctions with Morton Lane and Sandy Lane are to be upgraded to a staggered junction. A new simple junction will be constructed for Rectory Road on the West Side of the alignment, with the Eastern side of Rectory Road restricted for access only. A staggered junction will also be provided for the Breck Road and Sandy Lane B1535 crossing. A simple or ghost island junction will be formed to allow local traffic to join Wood Lane; and access to existing property along the B1535 including to "Roarr! Dinosaur Adventure" and Weston Park is to be maintained.

Topography and Profile

4.2.9. The route alignment gently rises from North to South with a peak in the middle– the alignment falls at either end towards junctions with the A47 and A1067 at profile grades of approximately 0 to 4%.

4.2.10. The road vertical gradients are to comply with requirements of TD9/93 with a maximum desirable value of 6% as an all-purpose rural single carriageway.

4.2.11. The road vertical profile is aligned assuming the route would tie in to the A47 connector and underpass. This is based on an initial HE junction strategy for the A47 dualling at this location.

4.2.12. Based on the existing ground profile and the proposed vertical alignment, cut depths will be up to 5m.

4.2.13. Information from British Geological Survey (BGS) borehole records presents the underlying geology for this option as a mix of glaciofluvial sand & gravel and till (chalky boulder clays) with underlying upper chalk. Around the village of Lenwade and the River Wensum in the north, predominantly river terrace deposits are reported with underlying upper chalk.

Structures

4.2.14. The key structures currently envisaged for Route Option A are:

Table 4.1 – Option A Structures Schedule

Structure	Type
Box culvert	Buried
Box culvert	Buried
Pedestrian crossing	Overbridge
Pedestrian crossing	Overbridge
Pedestrian crossing	Underpass
Pedestrian crossing	Overbridge

Drainage

4.2.15. The drainage strategy envisages directing surface water to a series of basins where the run off will be attenuated and discharged to ground via infiltration or to existing watercourses, subject to confirmation of ground conditions in the relevant locations.

Public Utilities

4.2.16. There is a concentration of existing statutory utility services along this route particularly at the junction with the A1067 in Lenwade. The following services were found to be present from desktop utility searches of the area: BT (Overhead), Electricity (Underground and Overhead), Virgin Media (Underground) and Water (Underground). There is a likelihood that additional property connections, not shown on the utility undertaker record plans, would be also be existent as there are a significant number of properties with frontages on the B1535. The utility records for this route are shown in Appendix B.

A47 Tie-in

4.2.17. The NWL A47 junction for route A is assumed have the same arrangement as the HE proposed A47/B1535 junction due to similar levels of predicted traffic flows. Further discussions are ongoing to confirm the Highway England's A47 junction layout.

Departure from Standards

4.2.18. Full details of Departures are yet to be identified at the current design stage for this route Option, but the restricted link corridor may limit achieving full TD 42/95 junction visibility. Additionally, the horizontal curve on the A1067 approach is two steps below the desirable minimum required by TD 9/93.

Buildability

4.2.19. The construction of most of the route is expected to be carried out along the line of the existing route, some disruption to traffic will be expected during the construction period. Temporary diversions will need to be implemented for through traffic along the B1535, and alternative temporary routes may need to be provided to facilitate property access.

4.2.20. There will also be significant work to divert and relocate existing utility services and individual property connections which may cause localised disruption.

OPTION B EAST AND B WEST

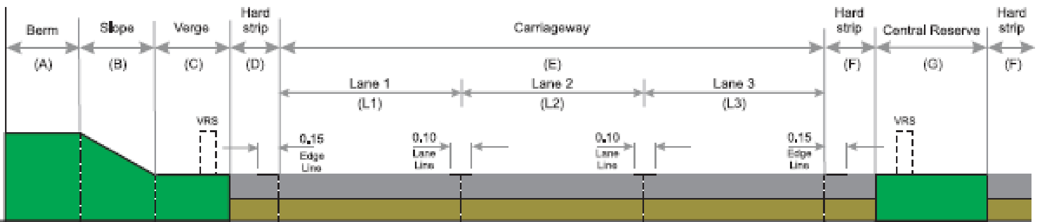
Overview

4.2.21. The Option B route is designed to a higher standard than Option A due to the significantly increased traffic it attracts. The proposed road is a rural, all-purpose dual carriageway, with a 2.5m wide central reservation and a design speed of 120 kph (70mph). Refer to Appendix A for indicative layout plan.

4.2.22. The intent is for the horizontal and vertical alignments to comply with design standards (TD9/93) for a 120 kph (70mph) design speed.

4.2.23. A dual 2 lane carriageway cross section (D2AP) standard has been chosen in accordance with TA 46/97- Traffic Flow Ranges for Use in the Assessment of New Rural Roads, with recommended rural carriageway standards for forecast traffic flows intended to be used. The typical proposed road (carriageway central reserve and hardstrips) would be 21.1m in width, with 2.5m wide verges on either side. See **Figure 4.2** below from TD 27/05 showing the standard cross section for rural all-purpose roads – dual carriageway.

Figure 4.2 - Dimensions of Cross-Section Components for Rural All-Purpose Roads Mainline – Dual Carriageway (DMRB TD 27/05)



Road Type	A	B	C[2]	D[3, 11]	E[3] L1	E[3] L2	E[3] L3	F[5]	G[2]
Dual 2 Lane (D2AP)	Varies	Varies	2.50	1.00	7.30 3.65	3.65[9]	N/A	1.00	2.50
Dual 3 Lane (D3AP)	Varies	Varies	2.50	1.00	11.00 3.65	3.70	3.65	1.00	2.50

Dual Carriageway

Source: TD 27/05 (Design Manual for Roads and Bridges)

Variants of Option B

4.2.24. There are two variants of Route Option B, B West and B East.

B West

4.2.25. The Route B West variant joins the A1067 at the existing Marl Hill Road junction in Attlebridge and involves the widening of approximately 2.7km of the existing A1067 towards Norwich. This variant would require improvements to, or replacement of the existing bridge over the River Wensum at Attlebridge. There is a risk of the works encroaching on a Grade II listed building along the A1067 and restrictions may be imposed by the Environment Agency on improvements to the existing bridge over the Wensum.

B East

4.2.26. The Route B East variant joins the A1067 east of the junction with the Old Fakenham Road and involves the widening of approximately 1.7km of the existing A1067 towards Norwich. A new viaduct would be built over the River Wensum, whilst retaining the existing crossing of the River Wensum by the A1067 at Attlebridge.

Horizontal Alignment, Land Use and Constraints

4.2.27. The route would mainly pass through greenfield, and run east of the old airfield site avoiding Morton Hall and the villages of Weston Longville and Weston green, then deviate west at its southern extent to join the Wood Lane B1535/A47 junction. Route Option B East comprises approximately 5.9km of new link while Option B West comprises approximately 5.5km of new link.

4.2.28. The following local roads are under consideration to be either upgraded, stopped up, or diverted to facilitate the new link:

- Ringland Lane, Breck Road, and Weston Road will be realigned on approaches to the proposed NWL crossing structures.
- A section of The Broadway will also be stopped up towards the centre of the route, with traffic diverted to Weston Road via Breck Road.

Junctions and Links

4.2.29. In contrast with Route Option A, simple and ghost island junctions along the new link are not permitted following guidance in TD 42/95 for dual carriageways. This non-provision of direct local road connections aligns with the objective of taking traffic away from the local roads.

4.2.30. For both variants of this option, the northern junction with the A1067 is a three-arm roundabout. The A1067 junction for Option B East is located just east of Attlebridge, whilst the Option B West variant is west of Attlebridge

4.2.31. There are no simple junctions along the link on this option, and road crossing bridges are proposed.

Topography and Profile

4.2.32. The proposed vertical profiles for both route variants undulate as necessary to allow headroom at proposed crossing structure locations along the link.

4.2.33. Maximum gradients of 4% are applied as desired by TD9/93 for an all-purpose rural dual carriageway.

4.2.34. The road vertical profile is refined to minimise earthworks, and bring it in line with the draft HE junction strategy, with a potential tie in to an A47 underbridge at the grade-separated junction.

4.2.35. Based on the existing ground profile and the proposed vertical alignment, cut depths will be up to 8m and fill heights will be up to 10m.

4.2.36. Information from BGS borehole records indicate an underlying geology generally comprising a mix of glaciofluvial sand & gravel, till (chalky boulder clays), with some crag deposits near the centre of the alignment. Near Attlebridge and the River Wensum there are predominantly river terrace deposits over glaciofluvial sand & gravel and upper chalk. For the A1067, the underlying geology comprises mostly crag and river terrace deposits at up to 4m depths, with some glaciofluvial sand & gravel and till (chalky boulder clays)

Structures

4.2.37. The proposed key structures for Route Option B West and B East along the link are:

Table 4.2 – Option B West Structures Schedule

Structure	Type
Wildlife crossing	Overpass
Road crossing bridge - Ringland Lane	Underbridge
Road crossing bridge – Weston Road	Overbridge
Road crossing bridge – Breck Road	Overbridge
Wildlife underpass/bridge	Underpass
Wildlife underpass/box culvert	Underpass
Pedestrian crossing	Overbridge
A1067 Structures	
Existing Attlebridge diversion culvert	Underbridge
Existing Attlebridge no. 1	Underbridge
Existing Attlebridge no. 2	Underbridge
Pedestrian crossing at Old Farm Hall	Overbridge

Table 4.3 – Option B East Structures Schedule

Structure	Type
Viaduct crossing – River Wensum	Underbridge
Road crossing bridge - Ringland Lane	Underbridge
Road crossing bridge – Weston Road	Overbridge
Road crossing bridge – Breck Road	Overbridge
Wildlife underpass/bridge	Underpass
Wildlife underpass/box culvert	Underpass
Pedestrian crossing	Overbridge
A1067 Structures	
Pedestrian crossing at Old Farm Hall	Overbridge

4.2.38. The A1067 proposed structures are also identified in the above tables.

Drainage

4.2.39. The drainage strategy envisages directing surface water to a series of basins where the run off will be attenuated and discharged to ground via infiltration or to existing watercourses, subject to confirmation of ground conditions in the relevant locations.

4.2.40. Works within the flood plain would require compensatory flood storage basins. The management of water run-off during flood events will also need to be considered.

Public Utilities

4.2.41. Statutory undertaker records indicate existing utilities are present within the route corridor, mostly around Attlebridge and the section of A1067 to widened, with some isolated crossing points along the new link. The services in this area to be affected include: BT (Underground and overhead), Electricity (Overhead), Virgin Media (Underground), and Water (Underground). Utility record plans for this route are in Appendix B. The route B alignment is likely to cross the proposed Orsted Hornsea 3 cable route, currently under Development Consent Order (DCO) examination. There is also a high voltage electricity overhead line with pylons crossing the route, and vertical clearances to this line are yet to be established.

A47 Tie-in

4.2.42. The proposed grade separated A47 junction is proposed at the same location as the Option A junction. However, unlike for Option A, the significantly higher traffic flows for this route, and the dual carriageway will necessitate upgrades to the eventual HE junction to accommodate the NWL.

Departure from Standards

4.2.43. Due to proximity of some property frontages, and potential length of any service roads, it is deemed impractical to remove the existing direct accesses to the A1067 for both route variants. This will be non-compliant with the objective of TD 41/95 to limit direct access to the trunk road network. Central reservation openings are however not considered, and maintained accesses only allow “left in” and “left out” movements, with vehicles using roundabouts at the A1067/NWL and A1067/A1270 junctions as turnaround points. Though minor improvements would be implemented to the existing accesses ensure safe entry and egress, the A1067 turning restriction will be a significant operational constraint for this option.

Buildability

4.2.44. Significant online construction work will be required with this Option for works at the junction with the A1067, as well as the widening and upgrades of the A1067. Temporary diversions and accesses will need to be provided.

The River Wensum crossings for this option will entail considerable work to erect any new structure across its banks, with the upgrade of the A1067 bridges having the added challenge of demolition of the existing structures. There are also smaller crossing structures along the link route length which necessitate deep cuttings or embankments. For the western variant, there is also a significant risk that the Environmental Agency/Natural England may set an onerous requirement regarding shading of any proposed A1067 structures – either widened, twined or replacements. If this becomes the case, and approach roads need to be elevated with considerable high embankments, there will be further impact on the existing buildings (including a listed building) and surrounding vegetation. Access including to/from side roads and property will also become impractical along a significant extent of the A1067.

4.2.45. It is anticipated that upgrades will be required to the A47 junctions that will be constructed as part of the Highways England scheme to accommodate a dual carriageway; likely to include the introduction of roundabouts on the approach to the grade separated connector road. With proper planning and coordination, the tie-in works could be carried out with minimal or no disruption to A47 mainline traffic.

OPTION C

Overview

4.2.46. The Option C route connects to the A1067 further east of Option B. This route initially follows the same alignment as Option B, from its proposed A47 junction, then deviates north-east to link the A1067 approx. 600m east of the A1270 roundabout.

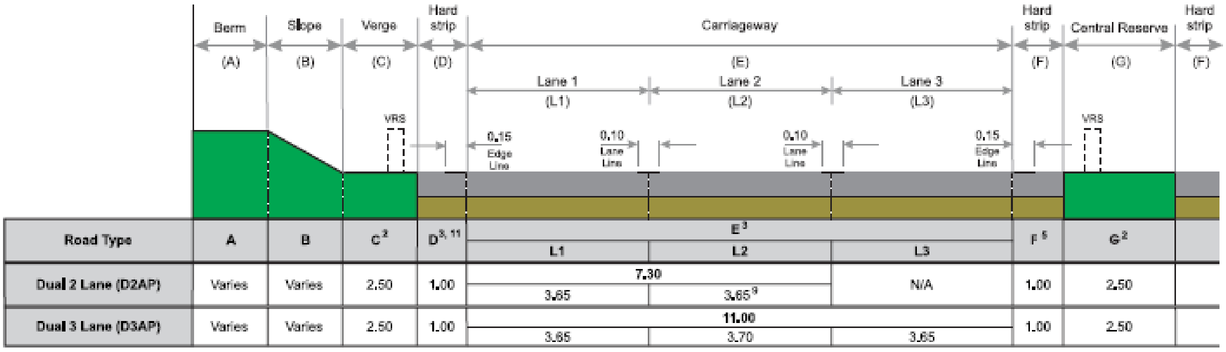
4.2.47. This option includes dualling approximately 600m of the existing A1067.

4.2.48. Refer to figures Appendix A for indicative layout plan.

4.2.49. The intent is for the horizontal and vertical alignments to comply with design standards (TD9/93) for a 120kph (70mph) design speed.

4.2.50. A dual 2 lane carriageway cross section (D2AP) standard has been chosen in accordance with TA 46/97- Traffic Flow Ranges for Use in the Assessment of New Rural Roads, with recommended rural carriageway standards for forecast traffic flows intended to be used. The typical proposed road (carriageway, central reserve and hardstrips) would be 21.1m in width, with 2.5m wide verges on either side. See **Figure 4.3** below from TD 27/05 showing the standard cross section for rural all-purpose roads – dual carriageway.

Figure 4.3 - Dimensions of Cross-Section Components for Rural All-Purpose Roads Mainline – Dual Carriageway



Dual Carriageway

Source: TD 27/05 (Design Manual for Roads and Bridges)

Horizontal Alignment, Land Use and Constraints

4.2.51. This route runs slightly further east of the old airfield site when compared to route Option B, with the proposed link approximately 5.8km long.

4.2.52. The following local roads are under consideration to be either upgraded, stopped up, or diverted to facilitate the new link:

- Ringland Lane, Breck Road, an unclassified road, and Weston Road will be realigned on approaches to the proposed NWL crossing structures.
- A section of The Broadway will also be stopped up towards the centre of the route, with traffic diverted to Weston Road via Breck Road.

Junctions and Links

4.2.53. The junction strategy for this option is similar to that for Option B as the same carriageway standard and design speed apply. TD 42/95 does not permit simple or ghost island junction along the new link and the strategy to limit direct connections enables the objective of taking traffic away from local roads.

4.2.54. For this option, the link's northern junction with the A1067 is a three-arm roundabout, located east of Attlebridge. There are no simple junctions along the link on this option, and road crossing bridges are proposed.

Topography and Profile

4.2.55. The vertical profile of Option C rises gently from the north and the junction with the A1067, approximately following the profile of the existing ground. Forming a crest towards the middle of the alignment, nominally at Weston Green and falls back towards the proposed junction with the A47. Profile grades are between approximately 0 and 4%

4.2.56. Maximum gradients are not to exceed 4% as required by TD9/93 for an all-purpose rural dual carriageway.

4.2.57. The road's vertical profile has been adjusted in line with the draft HE junction strategy with a potential tie in to an A47 underbridge at the grade-separated junction.

Embankments and Cuttings

4.2.58. Based on the existing ground profile and the proposed vertical alignment in some sections, cut depths will be up to 7m and fill heights will also be up to 11m.

4.2.59. Information from BGS borehole records suggest the following underlying geology: generally, a mix of Glaciofluvial Sand & Gravel, Till (Chalky Boulder Clays) with some crag deposits near the centre of the alignment. Near Attlebridge and the River Wensum there are Predominantly River Terrace deposits over Glaciofluvial Sand & Gravel and Upper Chalk. For the A1067, mostly Crag and River Terrace Deposits up to 4m depth Minimal Glaciofluvial Sand & Gravel and Till (Chalky Boulder Clays)

Structures

4.2.60. The proposed key structures for Route Option C are:

Table 4.4 – Option C Structures Schedule

Structure	Type
Viaduct crossing – River Wensum	Underbridge
Wildlife overpass/bridge	Overpass
Road crossing bridge – Ringland Lane	Underbridge
Road/pedestrian bridge – Unclassified Road	Overbridge
Road crossing bridge – Weston Road	Underbridge
Road crossing bridge – Breck Road	Overbridge
Wildlife overpass/bridge	Overpass
Wildlife underpass/box culvert	Underpass
Pedestrian bridge	Overbridge

Drainage

4.2.61. The drainage strategy envisages directing surface water to a series of basins where the run off will be attenuated and discharged to ground via infiltration or to existing watercourses, subject to confirmation of ground conditions in the relevant locations.

4.2.62. Works within the flood plain would require compensatory flood storage basins. The management of water run-off during flood events will also need to be considered.

Public Utilities

4.2.63. There are a few utility services crossing the new link including BT (Underground), Electricity (Overhead), Virgin Media (Underground), and Water (Underground), and there may be some property connections particularly to the Merryhill Country Park. The route C alignment is likely to cross the proposed Orsted Hornsea 3 cable route, currently under DCO examination. There is also a high voltage electricity overhead line with pylons crossing the route, and vertical clearances to this line are yet to be established.

A47 Tie-in

4.2.64. This route option will have the same A47 junction with route Option B East and West.

Departures from Standard

4.2.65. There are no Departures for Standard identified for the curvature, or gradients at the current design stage for this route option.

Buildability

4.2.66. There will be minimal online construction for the 600m of widening and the roundabout on the A1067, needing temporary A1067 diversions. The route then follows a more easterly path than option B Extensive works are anticipated to construct the viaduct structure across the River Wensum and smaller crossing structures along the link route length, which necessitate deep cuttings or embankments. Upgrades similar to that for Option B, are expected to enable tie-in to the Highways England A47 junction.

OPTION D

Overview

4.2.67. This Option forms a junction with the A1067 in the same location as Option C, connecting just north of the village of Ringland and West of the Wensum Valley Golf Club. The route then follows a more easterly path than option C, initially just west of Ringland, crossing Ringland Lane and Weston Road. The route then deviates further east crossing Honingham Lane and Weston Road before splitting into two alternatives for connection to the A47, both east of Honingham and both crossing the River Tud.

4.2.68. In common with option C this option proposes dualling approximately 600m of the existing A1067.

4.2.69. The route is designed to have the same standard as Options B and C with a dual carriageway section and design speed of 120kph (70mph).

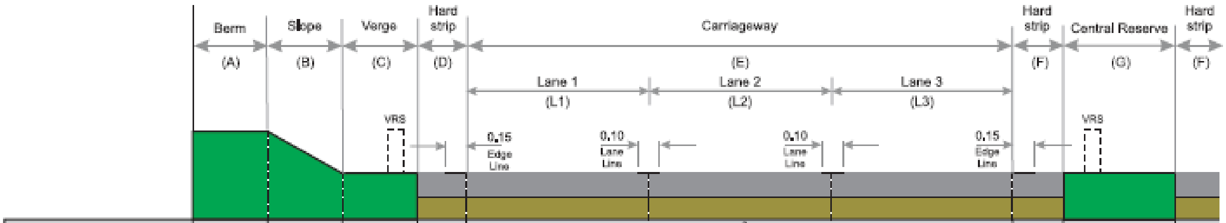
4.2.70. In contrast to Routes B and C, this route involves crossing the River Tud in addition to the River Wensum.

4.2.71. Refer to **Appendix A** for indicative layout plan.

4.2.72. The intent is for the horizontal alignment to comply with design standards (TD9/93) for a 70mph design speed.

4.2.73. A dual 2 lane carriageway cross section (D2AP) standard has been chosen in accordance with TA 46/97- Traffic Flow Ranges for Use in the Assessment of New Rural Roads, with recommended rural carriageway standards for forecast traffic flows intended to be used. The typical proposed road (carriageway central reserve and hardstrips) would be 21.1m in width, with 2.5m wide verges on either side. See **Figure 4.4** below from TD 27/05 showing the standard cross section for rural all-purpose roads – dual carriageway.

Figure 4.4 - Dimensions of Cross-Section Components for Rural All-Purpose Roads Mainline – Dual Carriageway



Road Type	A	B	C[2]	D[3, 11]	E[3] L1	E[3] L2	E[3] L3	F[5]	G[2]
Dual 2 Lane (D2AP)	Varies	Varies	2.50	1.00	7.30 (3.65)	7.30 (3.65[9])	N/A	1.00	2.50
Dual 3 Lane (D3AP)	Varies	Varies	2.50	1.00	11.00 (3.65)	11.00 (3.70)	11.00 (3.65)	1.00	2.50

Dual Carriageway

Source: TD 27/05 ((Design Manual for Roads and Bridges)

Variants of Option D

4.2.74. There are two variants of Route Option D, D East and D West.

D West

4.2.75. The Route D variant is further west crossing the river Tud and joining the A47 in the approximate location of the existing Taverham Road/Blind Lane junction with a grade separated junction to the proposed A47.

D East

4.2.76. Route D East envisages a connection to the A47 further east, with a crossing of the River Tud and then connecting into the A47 just outside Easton some 600m further east than option D West with a grade separated junction to the proposed A47.

Horizontal Alignment, Land Use and Constraints

4.2.77. This route will run between Merryhill Country Park and Ringland, predominantly through greenfield, with variants for Options D West and Option D East having respective lengths of approximately 5.5km and 5.9km. Both route options are within 10 to 20m of an existing water reservoir, south of Ringland.

4.2.78. The southern section of the western route variant was realigned to avoid potential impact to an existing high voltage electric pylon (transmission tower), but is still within 20m of the pylon.

4.2.79. Although no local roads are proposed to be diverted or stopped up, Ringland Lane, Honingham Lane, Weston Road, and an Unclassified Road may need to be realigned on approaches to the proposed NWL crossing structures.

Junctions and Links

4.2.80. For this option, the northern junction with the A1067 is a three-arm roundabout, located east of Attlebridge, as per option C. Road crossings are proposed for Ringland lane, Honingham Lane and Weston Road.

Topography and Profile

4.2.81. The profiles for the option D rise from the A1067 junction, over the River Wensum, and undulate to enable the provision of road crossing structures with gradients between 0 and 4 %. For both variants, road profiles are elevated on the approach to proposed A47 junctions.

4.2.82. Maximum gradients are not to exceed 4% as required by TD9/93 for an all-purpose rural dual Carriageway.

4.2.83. The vertical grade on the A47 approach was adjusted to reflect the HE junction strategy and the road profile elevated towards a potential overbridge.

4.2.84. Based on the existing ground profile and the proposed vertical alignment, cut depths and fill heights in some sections will be up to 13m.

4.2.85. Information from BGS borehole records indicate for majority of the route, an underlying geology comprising a mix of glaciofluvial sand & gravel and till (chalky boulder clays) over upper chalk. Near Attlebridge and River Wensum, predominant crag deposits over upper chalk are reported.

Structures

4.2.86. The structures are currently envisaged for Route Option D are:

Table 4.5 - Option D West Structures Schedule

Structure	Type
Viaduct crossing – River Wensum	Underbridge
Wildlife overpass/bridge	Overpass
Road crossing bridge – Ringland Lane	Overbridge
Road crossing bridge – Weston Road	Underbridge
Road crossing bridge – Honingham Lane	Underbridge
Wildlife overpass/bridge	Overpass
Pedestrian Crossing Bridge – Unclassified Road	Overbridge
Road crossing bridge – Weston Road	Overbridge
Viaduct crossing – River Tud	Underbridge

Table 4.6 – Option D East Structures Schedule

Structure	Type
Viaduct crossing – River Wensum	Underbridge
Wildlife overpass/bridge	Overpass
Road crossing bridge – Ringland Lane	Overbridge
Road crossing bridge – Weston Road	Underbridge
Road crossing bridge – Honingham Lane	Underbridge
Wildlife overpass/bridge	Overpass
Road crossing bridge – Unclassified Road	Overbridge
Road crossing bridge – Weston Road	Overbridge
Viaduct crossing – River Tud	Underbridge

Drainage

4.2.87. The drainage strategy envisages directing surface water to a series of basins where the run off will be attenuated and discharged to ground via infiltration or to existing watercourses, subject to confirmation of ground conditions in the relevant locations.

4.2.88. Works within the flood plain would require compensatory flood storage basins. The management of water run-off during flood events will also need to be considered.

Public Utilities

4.2.89. In addition to property service connections that may need to be diverted, the following existing crossing services may be impacted: BT (Underground and overhead), Electricity (Underground and overhead), Foul Sewer (Underground), Virgin Media (Underground), and Water (Underground).

4.2.90. The route D alignment is likely to cross the proposed Orsted Hornsea 3 cable route, currently under DCO examination.

4.2.91. There is also a strategic gas main that runs within the existing route corridor, and will be crossed by the proposed route.

4.2.92. There is also a high voltage electricity overhead line with pylons crossing the route, and vertical clearances to this line are yet to be established.

A47 Tie-in

4.2.93. The A47 grade-separated junction for Route D West is to be located near the Taverham Road/Blind Lane junction, while the Route D East proposed junction is approx. 600m further east, and closer to Easton.

4.2.94. Both junction variants may need to accommodate a number of side roads and local roads, including Dereham Road, Church Lane and Blind Lane.

Departures from Standard

4.2.95. There are no Departures identified at the current design stage for this route option.

Buildability

4.2.96. Full details of Departures yet to be identified at the current design stage for these route Options, but the Option D West Tud River crossing is in very close proximity to the A47, and at later design stages, the vertical on the A47 approach might likely exceed the 4% maximum specified by TD 9/93. Both Options D East and D West profiles have a vertical curve below desirable minimum at one location.

4.2.97. Extensive works are anticipated to construct the viaduct structure across the River Wensum and smaller crossing structures along the link route length, which necessitate deep cuttings or embankments. There is also an additional structure crossing over the River Tud that will need to be constructed.

4.2.98. There is likely to be a considerable reconfiguration of the Highways England A47 junction arrangement with this Option. Unless an agreement is reached to deliver the full A47 junction, adequate for the Option D routes, in advance, as part of the Highways England scheme, A47 mainline traffic disruption and diversions would be required.

4.2.99. Substantial diversion of existing utilities is expected for this Option with potential protection of a crossing strategic gas main, and additional mitigation if clearances from overhead lines are deemed insufficient, with lengthy lead times for engagement of statutory undertakers.

4.3. PRELIMINARY CONSIDERATION OF STRUCTURES

Each of the proposed routes will require structures of some type, whether culverts for drainage, footbridges/underpasses for PRoW or major crossings of side roads or rivers. In principle, all structures would be designed to minimise their impact upon the surrounding landscape, with a consideration for maintenance to ensure this can be undertaken with minimal disruption to the environment and traffic.

RIVER WENSUM CROSSING

4.3.1. Options B East, C, D West and D East would cross the Wensum floodplain at different locations along the Wensum valley between Attlebridge and Ringland, and crossing lengths vary from approximately 460m to 650m.

4.3.2. One of the general requirements for this scheme is to minimise the footprint on the valley floor and not to obstruct the flood plain. Therefore, a crossing option comprising a main span over the River Wensum, connected by embankments that incorporates a series of flood arches is discounted.

4.3.3. The most economical and practical form of construction for a crossing of this length would be a multi-span bridge (viaduct). Long span alternatives would be much more expensive than a multi-span viaduct and therefore long span construction bridge forms have not been considered.

4.3.4. The overall length of the viaduct, the span arrangement and most appropriate construction form are driven by the external factors and requirements associated with the River Wensum and its flood plain. This includes geology, topography and environmental factors which are discussed in detail in previous and subsequent sections of this report. This section of the report deals mainly with the engineering aspects.

4.3.5. The following principal design requirements have been identified:

- No adverse impact on the River Wensum SAC;
- Limit loss of floodplain associated with viaduct supports and earthworks;
- Preferred option to be sympathetic to landscape;
- Maintain visual permeability of the river valley;
- Mitigate the impact of shading by the bridge deck; retain sufficient light to valley floor;
- Choice of structural forms and method of construction to enable safe constructability;
- Minimise construction impact in the valley; and
- Durable and low maintenance construction to minimise maintenance activities, in accordance with BD 57/01 and BA 57/01 – Design for Durability.

Material Options (Steel vs Concrete)

4.3.6. The construction cost of steel bridge decks tends to be roughly the same as or perhaps a bit higher than concrete bridge decks. However, savings can be realised in the form of smaller foundations as well as smaller lifting plant or temporary works requirement during construction. Steel bridges typically require more maintenance compared to concrete options as they require periodic repainting, typically every 25 years. However, the differential has been reduced in recent years by use of long life corrosion protection systems, or through the use of permanent enclosures in accordance with BD 67/96 "Enclosure of Bridges". Furthermore, the use of weathering steel eliminates painting and can be a good option provided its appearance is acceptable from the architectural point of view.

4.3.7. Permanent enclosures have the additional benefit of providing internal access for inspection and future maintenance and therefore may be desirable where environmental designations necessitate.

4.3.8. The main benefit of a concrete based option is the durability and the reduced maintenance requirement/costs during the service life compared to steel based option, beside route inspections.

Concrete Superstructure Options

4.3.9. Possible concrete superstructure construction types to be considered include the following three main types:

I. Precast pre-stressed beams acting compositely with in-situ concrete slab deck

II. In-situ post-tensioned box deck

III. Segmental precast post-tensioned box deck.

4.3.10. A composite bridge deck that comprises precast pre-tensioned concrete bridge beams and in-situ concrete slab is a well-established and proven form of construction. Some types of precast beams, those shaped like a "U" for example, are available up to 50 metres in length, although constraints on transportation and lifting normally limit their use to about 40 metres, subject to route verification. Given the proximity of the A1067, it is likely that such beams could be brought to site.

4.3.11. Precast beams are manufactured in a well-controlled factory environment and are therefore of high-quality and durable. They can be quickly erected on site and two or more spans can be built simultaneously. However, good access for craneage will be required.

4.3.12. Construction of the deck slab would involve insitu concrete construction and use of temporary falsework and formwork above the river and the floodplain.

4.3.13. Post-tensioned concrete box girders are structurally very efficient in terms of pre-stressing or transverse distribution of internal forces. Constant depth box construction is suited typically from 30 to 60 metres whilst a variable depth box girder can typically provide spans up to 200 metres.

4.3.14. Various methodologies to construct the deck can be used, whether precast or insitu. A segmental form of construction would see concrete segments, typically approximately 3m in length, being lifted into position either span-by-span or extending either side from a pier, as a balanced cantilever. This would require access for lifting everywhere beneath the span. Insitu construction could be considered – travelling forms could be used in the same way as the above, but would involve wet concrete work over the River and its floodplain. Alternatively, incremental launching construction can be used which is particularly suited for erecting a viaduct over an environmentally sensitive area because the construction impact on the valley floor can be minimised. Once the piers have been constructed, the main construction takes place in the construction yard beyond the abutment. The bridge is cast in segments within the compound, and once a segment has gained sufficient strength, it is pushed into the span to allow the next segment to be cast.

4.3.15. All three options would comply with BD 57/01 and BA 57/01 – Design for Durability. In relation to post-tensioned construction segmental structures, these would feature externally bonded tendons accommodated within the deck void, with deflectors located inside the box as well. This would allow the tendons to be readily accessible for inspection and maintenance, and avoids durability issues with grouted internal post-tensioning.

Steel Superstructure Options

4.3.16. Some typical steel superstructure construction types are listed below. All these options utilise an in-situ slab acting compositely with the steel beams.

I. Steel composite box girder (twin box under each carriageway)

II. Composite deck with steel “I” girders and concrete deck slab

4.3.17. The economics of these forms are dependent on site-specific span and construction depth constraints.

4.3.18. A steel-concrete composite bridge with steel “I” girders is a versatile form of construction and is used extensively for highway bridges. As mentioned previously, steel girders are lighter than concrete of comparable strength, which typically results in smaller foundations and possibly easier construction.

4.3.19. “I” girders are used in multi-girder or ladder deck arrangements. The latter is more suited for wide decks and becomes economical for spans longer than 35m. The construction depth of a ladder deck option is greater than for a multi-girder equivalent, therefore if slenderness is important then a multi-girder option may be preferable. For stability, steel beams are usually lifted in braced pairs. As a pair of ladder-deck beams is heavier than a braced pair of multi-girder beams, the size of lifting plant and its foundations can also be a governing factor.

4.3.20. Spans up to 40-50metres can be of constant depth. If it was desired to maximise the span, the aesthetic impact of the corresponding depth of the longitudinal plate girders could be reduced by employing a varied depth along their length. For spans above 50m varying-depth girders would be more economical given the weight savings possible in the mid-span regions. However, this would typically preclude launching as a method of installation.

4.3.21. A composite box girder deck offers many benefits over plate “I” girders, although they have disadvantages as well. This option is mostly used for spans longer than 45m. In addition, box girders are structurally more efficient due to their torsional stiffness and strength. This is particularly beneficial for decks curved in plan (route option C).

4.3.22. A steel box option offers a better resilience of the steel work when compared to "I" girders as there are less exposed external surfaces. However, inspection access inside the box will be required. The inside of a box is a confined space and associated hazards would need to be mitigated and managed. This may lead to higher inspection cost. In recent years, this requirement has been mitigated or minimised by using weathering steel or sealing the box to the outside and providing monitoring points for the steel thickness throughout the box. However, access inside the box can never be fully ruled out, so needs to be designed for.

4.3.23. Steel bridges can be erected in various ways, but the two main methods are lifting roughly span-by-span, or incremental launching. The former would require crane platforms at each span within the footprint of the viaduct, whereas, for the post-tensioned concrete box, the latter would minimise the construction impact on the valley floor.

Substructure Options (Foundations)

4.3.24. The current geotechnical information available is limited to the geotechnical desk study, refer to Appendix C. The desk study had identified that the existing geotechnical condition contains alluvium overlaying chalk substrate.

4.3.25. The most appropriate pile type would depend on the exact geological conditions. However, environmental constraints are likely to dictate the pile type. In this instance driven piles are not suitable for the heavy foundation loads; their use would increase the number of piers within the floodplain which is not acceptable.

4.3.26. Continuous Flight Auger (CFA) piling does not require the handling and processing of a supporting fluid on the environmentally sensitive site. It is also one of the quietest forms of piling. However, the maximum pile length achievable with the CFA method is limited by the capacity of the CFA rig. Bigger and deeper piles would require a larger rig.

4.3.27. Longer spans would require two rows of CFA piles connected to a pile-cap. Given the high risk of groundwater entering excavation in alluvium, dewatering measures will be required in addition to temporary supports for the excavation.

4.3.28. The alternative would be traditional rotary bored piles, which can produce longer and larger diameter piles. Casing and the use of a supporting fluid "Bentonite" would however be necessary. The size of the piling plant would need to be reviewed to identify the optimum between pile capacity and rig size.

4.3.29. Bored piles can offer the benefit of providing longer spans whilst allowing a straight pier to pile (single row) connection, thus omitting the requirement for pile caps.

4.3.30. Piling options may need to be discussed with the Environment Agency and Natural England at the design stage.

Intermediate Support Piers

4.3.31. Maintaining the visual permeability of the valley is a key requirement. Great care should be taken to ensure that the piers are visually unobtrusive, as much as it is practicable.

4.3.32. Several pier configurations and surface finishes are possible – the selection of deck types directly influences the options available in terms of number and arrangement of the bearings and the design of the pier head. For instance, box girders are advantageous as they normally need only two bearings at each pier, whilst multiple girders require more bearings spaced wider.

4.3.33. A single column pier can be provided; however, it needs to be larger to have the necessary flexural strength and have an enlarged pier head to accommodate bearings. The alternative is to have two but more slender columns. Other options such as leaf or portal piers can be investigated, however, they may be considered to be visually obtrusive and unattractive in this case.

Abutments

4.3.34. The abutments and wing walls would be constructed in reinforced concrete (RC). The most appropriate abutment construction, from an aesthetic point of view, would be a bank seat type abutment. In addition, as it is likely that bearings and expansion joints would be used, an inspection gallery would be required in the abutment so that they can be inspected.

RIVER TUD CROSSING

4.3.35. Options D-West and D-East will cross the River Tud at different locations with the length of crossing varying from approximately 150m to 200m. The most economical and practical form of construction for a crossing of this length would be a multi span bridge. An alternative option of a long span construction such as a cable stayed bridge would be much more expensive than a multi-span bridge and therefore this option has been discounted going forward.

4.3.36. Similar to the River Wensum Crossing, the overall length of the Tud crossing, span arrangement and most appropriate construction form are driven by the external factors and requirements associated with the River Tud and its flood plain – including geology, topography and environmental factors which are discussed in detail in other sections of this report.

4.3.37. There are several possible superstructure options that can be considered for this crossing, refer to sub-section 1.1.2. A composite bridge deck comprising precast pre-tensioned concrete beams or steel "I" girders and RC slab would be suitable for a crossing of this length. Both options are well-established and used extensively for highway bridges. In addition, they may be relatively cheaper compared to box options.

4.3.38. The alternative is a box girder deck option, either steel or post-tensioned. There are several construction methods available for these options. The one that may be particularly suits the proposed bridge is incremental launching. This method minimises construction activities and the use of temporary works and heavy plants in the flood plain and near the River Tud. However, both of these options are relatively more expensive than the girder options.

4.3.39. The substructure options are the same as set out for the River Wensum crossing.

5. ENVIRONMENTAL ASSESSMENT

5.1. INTRODUCTION

5.1.1. The information contained in this chapter is an overview of the environmental impacts of the proposed scheme. This section uses the environmental issues identified in the SOBC that are relevant to the scheme to assess the route options that were taken to public consultation.

5.1.2. This section will include:

- Baseline conditions;
- Environmental effects;
- Mitigation; and
- Consultation.

5.1.3. The assessments of the environmental impacts of NWL are based upon a series of WebTAG assessments that have been carried out in accordance with TAG Unit A3 'Transport Analysis Guidance - Environmental Impact Appraisal' (December 2015) which is only applicable for the following environmental topics:

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

5.1.4. WebTAG environmental impact worksheets are the Department for Transport's guidance to presenting the results of a transport scheme appraisal as part of a business case.

5.1.5. Highways England are progressing plans for the A47 North Tuddenham to Easton dualling scheme after consultation with the public in August 2017. Currently NCC are in communication with Highways England regarding potential junction options on the route to ensure this is compatible with the final preferred NWL option and the A47. As the details of the proposed A47 are not yet finalised, and as the NWL will need to link in to the A47, it has been necessary to include an eastern and a western leg for Route Option D (referred to as "east" and "west"). The potential environmental impacts Route Option D East and West are considered to be the same, unless stated otherwise.

5.2. NOISE

5.2.1. This section considers the noise impacts, associated with road traffic from the five route options, which have been assessed using the Simple Assessment principles set out in the *Design Manual for Roads and Bridges*, Volume 11[13] (referred to in this report as 'DMRB'), which is outlined below.

[13] Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7, Noise and Vibration (DMRB 11.3.7, HD213/11)

5.2.2. Within the study area existing major sources of traffic noise are considered to comprise the A47 and the A1074 to the south, the A1067 to the north and the newly opened A1270.

5.2.3. There are three Noise Important Areas (NIAs) along the A47, five along the A1074, 11 along the A1067 and several in Norwich city centre. Only the NIAs on the A1067 are considered in this report; the NIAs along the A47 will be materially altered by the proposed dualling of the A47, and those on the A1074 are some distance from the site and likely to be more affected by the dualling of the A47 than by the proposed NWL.

5.2.4. For each route option, the Simple Assessment principles set out in the DMRB have been used.

5.2.5. DMRB gives guidance and interpretation on the magnitude of noise impact from road traffic noise sources and it sets out impact scales for classifying the magnitude of short-term and long-term impacts, as shown in **Table 5.1** and **Table 5.2**.

Table 5.1 - DMRB short-term impact scale

Change in Noise Level dB(A)	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor or low
3.0 – 4.9	Moderate or medium
5+	Major or high

Table 5.2 - DMRB long-term impact scale

Change in Noise Level dB(A)	Magnitude of Impact
0	No change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor or low
5.0 – 9.9	Moderate or medium
10+	Major or high

5.2.6. The criteria above reflect key benchmarks that relate to human perception of sound. A change of 1dB is classed in DMRB as the smallest change that is considered perceptible in the short term, a 3dB change is considered to be the smallest change in noise that is perceptible in the long term, and a 10dB change is approximately a halving or doubling of loudness.

5.2.7. While all changes in noise are assessed, moderate or major impacts or benefits are considered ‘significant’ in the context of environmental impact assessments.

5.2.8. Short-term is defined in DMRB as the change that would occur in the opening year of a scheme, i.e. the difference that the scheme makes to the predicted sound levels upon opening. The long-term assessment is typically taken to be the 15th year after the year of opening, although it may be an earlier year if the traffic flow is anticipated to be higher in that earlier year than in the 15th year.

5.2.9. The two comparisons for a DMRB simple assessment are:

- Do Nothing scenario in the baseline year against Do-Something scenario in the baseline year (short-term); and
- Do Nothing scenario in the baseline year against Do-Something scenario in the future assessment year (long-term).

5.2.10. In this instance, the baseline year is 2025 and the future year is 2040.

5.2.11. The short-term assessment, Do Nothing 2025 to Do-Something 2025, provides a more direct indication as to the effect of the scheme. The long-term assessment, Do Nothing 2025 to Do-Something 2040, includes the effect of traffic growth on top of the effect of the scheme itself, thereby potentially masking or exacerbating the effects of the scheme.

5.2.12. DMRB requires daytime traffic movements to be considered for both assessments, and night-time flows to be considered for the long-term assessment.

5.2.13. For the night-time assessment, DMRB requires the properties exposed to a night-time sound level of more than 55dB $L_{night,outside}$ to be identified, in two situations:

- Where the existing $L_{night,outside}$ is below 55dB and the proposed road increase the $L_{night,outside}$ value to more than 55dB; and
- Where the existing $L_{night,outside}$ is above 55dB and the proposed road increases this value further.

5.2.14. DMRB requires vibration to be considered if it is likely to be a potential problem. In this instance, road traffic vibration is considered unlikely to be an issue, therefore it is not considered.

5.2.15. To calculate the level of noise generated by traffic on a road, DMRB refers to the Calculation of Road Traffic Noise (CRTN)[14], albeit with some additional guidance included in DMRB to allow for advances in road technology since the publication of CRTN.

5.2.16. CRTN sets out standard procedures for calculating noise levels from road traffic. The calculation method uses a number of input variables, including traffic flow volume, average vehicle speed, percentage of heavy goods vehicles, type of road surface, site geometry and the presence of noise barriers or acoustically absorbent ground, to predict the $L_{A10,18hrs}$ or $L_{A10,1hr}$ noise level for any receptor point at a given distance from the road.

5.2.17. CRTN is only valid for traffic flows of more than 50 vehicles per hour or 1,000 vehicles per 18 hours. Below 200 vehicles per hour or 4,000 vehicles per 18 hours, a specific correction must be applied to account for the low traffic volumes.

5.2.18. The prediction method set out in CRTN has been used to calculate road traffic noise levels in this assessment.

5.2.19. The $L_{night,outside}$ values used to identify where receptors are exposed to a night-time L_{Aeq} sound level of more or less than 55dB have been calculated using the Transport Research Laboratory (TRL) End Correction Method (*Method for converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise*

[14] Department of Transport and The Welsh Office (1988), Calculation of Road Traffic Noise (CRTN)

Indices for Road Noise Mapping) to convert the calculated $L_{A10,18hrs}$ daytime values. This is as described in DMRB.

5.2.20. The calculation of $L_{night,outside}$ values is a separate calculation from the assessment of night-time traffic noise levels, which uses the one hour CRTN calculation, with the eight hour night-time traffic flows spread across eight, one hour periods.

5.2.21. The noise levels for all the route options have been calculated, using the CRTN calculation method, taking account of the assumptions described above. The traffic flows have been used as provided.

5.2.22. The following noise contour plots are shown in Appendix D:

- Do-Something 2025 daytime noise levels;
- Change in noise levels between Do Nothing 2025 daytime and Do-Something 2025 daytime;
- Do-Something 2040 daytime noise levels;
- Change in noise levels between Do Nothing 2025 daytime and Do-Something 2040 daytime;
- Do-Something 2040 night-time noise levels; and
- Change in noise levels between Do Nothing 2025 night-time and Do-Something 2040 night-time.

5.2.23. The assessment set out here considers the short-term impact, between the 'Do Nothing' and 'Do-Something' scenarios, both in the year of opening 2025, and the long-term impact, between the 'Do Nothing' scenario in 2025 and the 'Do-Something' scenario in 2040. This later scenario considers both daytime and night-time noise levels.

LIMITATIONS AND ASSUMPTIONS ON MODELLING

5.2.24. It has been necessary to make the following assumptions or alterations to the noise modelling, to account for particular limitations:

- The study area/calculation area is shown in Figure D.1 in Appendix D.
- Within this area, all residential receptors have been assessed, as identified in the supplied GIS information. A total of 958 residential receptors have been assessed.
- A total of ten non-residential sensitive receptors have been assessed, comprising schools, churches, children's nurseries, village halls and doctor's surgeries.
- Commercial and industrial premises and public houses are not included as sensitive receptors in the calculations.
- The lower limit of validity for CRTN is 1,000 vehicles in an 18 hour day; any roads with a flow of less than 1,000 vehicles per 18 hour day is assumed to have a flow of 1,000 vehicles, even if the anticipated flows are very small, but non-zero. It is assumed that some level of traffic on these roads is possible, so adopting the lowest permissible CRTN values is considered reasonable. Roads with a zero flow have been modelled with zero flow.
- A similar approach is used for the night-time scenarios, using the one hour L_{A10} calculation in CRTN, where a lower limit of 50 vehicles applies.
- Vehicle speeds have been modelled in accordance with the supplied traffic flow information, and not using the default CRTN values.
- No details are available of the junctions between the five route options and the dualled A47. The five route options have therefore been modelled as far as the A47 ground contour where it ties in with the surrounding ground levels. For Route Option B Western and Eastern variants, and Route Option C, the new roads are modelled to within 8 metres of the edge of the A47 carriageway. For Route Options A and D, the new roads are modelled to within 20 metres of the edge of the A47.

This may affect the accuracy of the calculated sound levels close to these junctions, however, the effects should be negligible further from the junctions.

- The plans for each Route Option show a number of short local roads that are proposed to tie a particular option to existing local roads. This is particularly the case where a route option cuts across an existing road. However, no traffic data has been provided for these roads nor are there detailed plans. These proposed links are therefore not included in the modelling, and any existing roads are modelled as being stopped up.
- Noise has been modelled based on the traffic data provided.
- All junctions have been joined centre line to centre line, effectively butting all roads together.
- Roundabouts where traffic data have been supplied for individual arms have been accurately modelled geographically. Where traffic data have not been supplied for individual arms, the roads joined by the roundabout are modelled as abutting at the approximate centre of the roundabout.
- Road widths are modelled based on supplied mapping and plans, and aerial photography.
- All roads are assumed to have impervious bitumen surfaces, with a texture depth of 2mm.
- Ground contours are taken from OS mapping, supplied by the client.
- The ground is modelled as 100% acoustically absorbent.
- Reflections from buildings have been modelled in accordance with CRTN.
- The A47 is included in its modified form in all scenarios, including the Do Nothing scenarios.
- Modifications to the A1067 are only included in the relevant modelled options.
- All buildings are modelled at a height of 8 metres above ground level.
- The CadnaA Building Evaluation tool has been used rather than individual receptors. This simplifies the calculation of road traffic noise at a particular building, by taking the highest value incident on the building, irrespective of calculation height or façade. Locations where the highest noise level moves from one façade to another are ignored with just the net change at that building considered, for example, as a result of a new road introduced on the opposite side of a building.
- The noise model includes any topographical information and bridges/embankments provided by the design team along each of the routes.
- The noise model has been configured for downwind propagation, which is considered a worst-case assumption.

5.2.25. Any further limitations or assumptions that are route-specific are set out in each sub-section below.

ROUTE OPTION A

Baseline Conditions

5.2.26. Route Option A runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road at its junction with Porters Lane and the B1535.

5.2.27. From the proposed junction with the A47 it initially follows a similar alignment to Wood Lane, before branching off to the north-west and skirting the western edge of the former RAF Attlebridge. To the north-west of the former airfield it roughly follows the alignment of the B1535 until joining with the A1067.

5.2.28. Throughout its length it passes close to a small number of isolated properties off Sandy Lane and Leys Lane, and along the existing B1535.

5.2.29. The closest properties on Sandy Lane are approximately 120 metres away from the proposed carriageway edge.

5.2.30. Further north, the route passes close to Woodforde Farm, as it crosses Breck Road.

5.2.31. The closest villages at the northern end of Route Option A are Lenwade and Great Witchingham, which lie along the A1067 immediately either side of the existing junction with the B1535 and the proposed junction with Route Option A.

5.2.32. The baseline conditions have been established through calculation for the 'Do Nothing' situation for the year 2025 for both daytime and night-time. Noise contour plans setting out the 2025 baseline situations are shown in Appendix D, as Figure D.2 and Figure D.4 respectively.

Environmental Effects

5.2.33. It is noted that the traffic flow anticipated for Route Option A is significantly lower than the flows for the other options. The overall number of properties predicted to have a positive or negative change in noise level is shown in **Table 5.3** for the year of opening (2025) and **Table 5.4** for the long-term scenario (2040).

Table 5.3 - Overall number of properties affected by Route Option A in the short-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	579	5
No change	113	2
Decrease in noise level of at least 0.1dB LA10,18h	266	3

Table 5.4 - Overall number of properties affected by Route Option A in the long-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	857	8
No change	37	2
Decrease in noise level of at least 0.1dB LA10,18h	64	0

5.2.34. There is predicted to be a net impact on 313 properties in the short-term and on 793 properties in the long-term as a result of Route Option A. This is despite the traffic data suggesting that this option will carry significantly less traffic than the other route options.

5.2.35. The short-term and long-term impact summary tables are shown in **Table 5.5** and **Table 5.6** respectively.

Table 5.5 - DMRB short-term noise impact for Route Option A (daytime)

Change in Noise Level dB(A)		Number of Dwellings	Number of other sensitive receptors
Increase in noise level, LA10,18h	0.1 – 0.9	563	5
	1.0 – 2.9	10	0
	3.0 – 4.9	2	0
	5+	4	0
No Change	0	113	2
Decrease in noise level, LA10,18h	0.1 – 0.9	252	3
	1.0 – 2.9	8	0
	3.0 – 4.9	2	0
	5+	4	0

5.2.36. It can be seen from **Table 5.5** that although Route Option A is predicted to lead to an adverse impact at a large number of properties; however, the majority of these impacts are less than +1dB, which would be classed as a negligible impact in the short-term.

5.2.37. A total of six properties would be subject to moderate or major adverse impacts, and six properties would benefit from moderate or major reductions in traffic noise, in the short-term.

5.2.38. The effects on non-residential properties are negligible.

Table 5.6 - DMRB long-term noise impact for Route Option A

Change in Noise Level dB(A)		Number of Dwellings (daytime)	Number of other sensitive receptors (daytime)	Number of Dwellings (night-time)
Increase in noise level, LA10,18h	0.1 – 2.9	802	8	782
	3.0 – 4.9	24	0	22
	5.0 – 9.9	27	0	7
	10+	4	0	6
No Change	0	37	2	122
Decrease in noise level, LA10,18h	0.1 – 2.9	58	0	12
	3.0 – 4.9	2	0	4
	5.0 – 9.9	3	0	2
	10+	1	0	1

5.2.39. As with the short-term impacts, the majority of the long-term impacts for residential properties would be considered as negligible, as they are below +3dB.

5.2.40. The large number of impacts for residential properties is a result of the large area over which a change of up to +3dB is predicted, as shown by the yellow shaded area in Figures D.7 and D.9.

5.2.41. In the daytime, a total of 31 properties would be subject to moderate or major adverse impacts, and four properties would benefit from moderate or major reductions in traffic noise, in the long-term. At night, a total of 13 properties would be subject to moderate or major adverse impacts, and three properties would benefit from moderate or major reductions in traffic noise.

5.2.42. The following changes in the $L_{night,outside}$ values are predicted for residential properties:

- 21 properties where the Do Nothing value is less than 55dB and the Do-Something value is more than 55dB; and
- 100 properties where the Do Nothing value is more than 55dB and the Do-Something value is greater than the Do Nothing value.

5.2.43. The effects on non-residential properties are negligible.

5.2.44. The potential impacts of Route Option A on the A1067 NIAs has been determined by considering the basic noise levels (BNLs) on the road close to the NIAs. It has been determined that, in the short-term where the effect can be more directly attributed to Route Option A, reductions of 0.3 to 0.4dB are predicted at the NIAs to the east of the junction with the A1270. The NIAs to the west of that junction are predicted to be subject to an increase in traffic noise of 0.2dB.

5.2.45. All of these values are considered to be negligible in magnitude.

ROUTE OPTION B WEST

Baseline Conditions

5.2.46. Route Option B West runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road between Morton on the Hill and Attlebridge.

5.2.47. From the proposed junction with the A47 it heads north-east then north after crossing Breck Road, running roughly parallel with Wood Lane until it skirts the eastern edge of the village of Weston Longville, approximately 280 metres from the proposed carriageway. After crossing Ringland Lane it turns slightly north-east again, running roughly parallel with Marl Hill Road until joining with the A1067.

5.2.48. The route passes immediately to the east of a small number of properties around the junction of Weston Green Road, approximately 45 metres from the proposed carriageway.

5.2.49. Close to the junction with the A1067, there are a number of properties to the north-east, on The Street. There are also properties to the west of this junction in Morton on the Hill, and to the east in the village of Attlebridge.

5.2.50. The baseline conditions have been established through calculation for the 'Do Nothing' situation for the year 2025 for both daytime and night-time. Noise contour plans setting out the 2025 baseline situations are shown in Appendix D as Figure D.2 and Figure D.10 respectively.

Environmental Effects

5.2.51. It is noted that the 2040 calculations, daytime and night-time, show a significant increase in traffic noise on the southern section of Hase's Lane and Collen's Green, as shown by the red area to the west of Route Option B West in Figures D.12 and D.14. This is a result of the assumption that roads that have non-zero flows that are lower than the lowest valid flow for CRTN are assumed to have a flow equal to that lowest valid value.

5.2.52. It was considered reasonable that where roads are anticipated to have some traffic, i.e. non-zero flows, then the minimum valid CRTN traffic flow should be assumed. However, for Route Option B West, this results in a significant increase on Hase's Lane and Collen's Green that may not occur in practice.

5.2.53. Notwithstanding this potential over-estimate of impact, it is considered reasonable to proceed on the basis of valid CRTN flows rather than ignoring roads where the flows are very small.

5.2.54. The overall number of properties predicted to have a positive or negative change in noise level is shown in **Table 5.7** for the year of opening (2025) and **Table 5.8** for the long-term scenario (2040).

Table 5.7 - Overall number of properties affected by Route Option B West in the short-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	365	5
No change	62	2
Decrease in noise level of at least 0.1dB LA10,18h	531	3

Table 5.8 - Overall number of properties affected by Route Option B West in the long-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	828	9
No change	11	1
Decrease in noise level of at least 0.1dB LA10,18h	119	0

5.2.55. There is predicted to be a net benefit for 166 properties in the short-term and a net impact on 709 properties in the long-term as a result of Route Option B West.

5.2.56. As noted previously, long-term traffic growth suggests a wider range of adverse impacts than is likely to result just from Route Option B West itself. The short-term net benefit is considered a better indicator of likely effect for this option.

5.2.57. The short-term and long-term impact summary tables are shown in **Table 5.9** and **Table 5.10** respectively.

Table 5.9 - DMRB short-term noise impact for Route Option B West (daytime)

Change in Noise Level dB(A)		Number of Dwellings	Number of other sensitive receptors
Increase in noise level, LA10,18h	0.1 – 0.9	166	0
	1.0 – 2.9	113	1
	3.0 – 4.9	57	1
	5+	29	1
No Change	0	62	1
Decrease in noise level, LA10,18h	0.1 – 0.9	413	5
	1.0 – 2.9	49	1
	3.0 – 4.9	18	0
	5+	51	0

5.2.58. It can be seen from **Table 5.9** that Route Option B West is predicted to lead to benefits and negative impacts in the higher categories and the same in the lower categories which overall results in a balance of both positive and negative effects.

5.2.59. A total of 86 properties would be subject to moderate or major adverse impacts, and 69 properties would benefit from moderate or major reductions in traffic noise, in the short-term.

5.2.60. Three non-residential properties are impacted, with one property falling into each noise increase category band. The benefits are largely negligible.

Table 5.10 - DMRB long-term noise impact for Route Option B West

Change in Noise Level dB(A)		Number of Dwellings (daytime)	Number of other sensitive receptors (daytime)	Number of Dwellings (night-time)
Increase in noise level, LA10,18h	0.1 – 2.9	667	7	757
	3.0 – 4.9	70	1	57
	5.0 – 9.9	79	1	36
	10+	12	0	8
No Change	0	11	1	68
Decrease in noise level, LA10,18h	0.1 – 2.9	63	0	22
	3.0 – 4.9	20	0	2
	5.0 – 9.9	33	0	5
	10+	3	0	3

5.2.61. In the long-term, the effect of network traffic growth suggests that Route Option B East is likely to be detrimental overall, with a larger number of adverse impacts in each category than equivalent benefits for residential properties.

5.2.62. In the daytime, a total of 91 properties would be subject to moderate or major adverse impacts, and 36 properties would benefit from moderate or major reductions in traffic noise, in the long-term. At night, a total of 44 properties would be subject to moderate or major adverse impacts, and eight properties would benefit from moderate or major reductions in traffic noise.

5.2.63. The following changes in the $L_{night,outside}$ values are predicted for residential properties:

- 33 properties where the Do Nothing value is less than 55dB and the Do-Something value is more than 55dB; and
- 100 properties where the Do Nothing value is more than 55dB and the Do-Something value is greater than the Do Nothing value.

5.2.64. The effects on non-residential properties tend towards negligible, with only one property falling into each of the minor and moderate categories.

5.2.65. The potential impacts of Route Option B West on the A1067 NIAs has been determined by considering the basic noise levels (BNLs) on the road close to the NIAs. It has been determined that, in the short-term where the effect can be more directly attributed to this option, increases of 0.8 to 0.9dB are predicted at the NIAs to the east of the junction with the A1270. The NIAs to the west of that junction are predicted to be subject to a decrease in traffic noise of 0.7dB.

5.2.66. While these changes are larger than those predicted for Route Option A, they would still be classed as negligible in magnitude.

ROUTE OPTION B EAST

Baseline Conditions

5.2.67. Route Option B East runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road to the east of Attlebridge.

5.2.68. From the proposed junction with the A47 it heads north-east then north after crossing Breck Road, running roughly parallel with Wood Lane until it skirts the eastern edge of the village of Weston Longville. After crossing Ringland Lane it turns eastwards, skirting the northern edge of Morton Hall, until joining with the A1067.

5.2.69. The route passes immediately to the east of a small number of properties around the junction of Weston Green Road, approximately 45 metres from the proposed carriageway. Due to the proximity of these properties, there would be a greater chance of adverse noise impacts during the operational phases.

5.2.70. The route also passes within 280 metres of Morton Hall, and within 85 metres of Ivy Cottages, close to the A1067.The proposed works in this area include a viaduct crossing over the River Wensum and the construction of a roundabout to form a junction with the A1067.

5.2.71. The baseline conditions have been established through calculation for the 'Do Nothing' situation for the year 2025 for both daytime and night-time. Noise contour plans setting out the 2025 baseline situations are shown in Appendix D as Figure D.2 and Figure D.16 respectively.

Environmental Effects

5.2.72. It is noted that the 2040 calculations, daytime and night-time, show a significant increase in traffic noise on the southern section of Hase's Lane and Collen's Green. This was also the case for Route Option B West and is similarly a result of the assumption that roads that have non-zero flows that are lower than the lowest valid flow for CRTN are assumed to have a flow equal to that lowest valid value. As with Route Option B West, this is considered an appropriate assumption for roads with non-zero flows below the limit of validity for CRTN.

The overall number of properties predicted to have a positive or negative change in noise level is shown in **Table 5.11** for the year of opening (2025) and **Table 5.12** for the long-term scenario (2040).

Table 5.11 - Overall number of properties affected by Route Option B East in the short-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	286	3
No change	34	1
Decrease in noise level of at least 0.1dB LA10,18h	638	6

Table 5.12 - Overall number of properties affected by Route Option B East in the long-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	758	8
No change	9	1
Decrease in noise level of at least 0.1dB LA10,18h	191	1

5.2.73. There is predicted to be a net benefit for 352 properties in the short-term and a net impact on 567 properties in the long-term as a result of Route Option B East.

5.2.74. As noted previously, long-term traffic growth suggests a wider range of adverse impacts than is likely to result just from Route Option B East itself. The short-term net benefit is considered a better indicator of likely effect for this route.

5.2.75. The short-term and long-term impact summary tables are shown in **Table 5.13** and **Table 5.14** respectively.

Table 5.13 - DMRB short-term noise impact for Route Option B East (daytime)

Change in Noise Level dB(A)		Number of Dwellings	Number of other sensitive receptors
Increase in noise level, LA10,18h	0.1 – 0.9	122	0
	1.0 – 2.9	109	3
	3.0 – 4.9	30	0
	5+	25	0
No Change	0	34	1
Decrease in noise level, LA10,18h	0.1 – 0.9	401	4
	1.0 – 2.9	168	2
	3.0 – 4.9	18	0
	5+	51	0

5.2.76. It can be seen from **Table 5.13** that Route Option B East is predicted to lead to benefits across all categories for residential properties, with a benefit of more than 1dB to a significant number of properties overall.

5.2.77. A total of 55 properties would be subject to moderate or major adverse impacts, and 69 properties would benefit from moderate or major reductions in traffic noise, in the short-term.

5.2.78. The effects on non-residential properties are minor, with a near-balance between impacts and benefits.

Table 5.14 - DMRB long-term noise impact for Route Option B East

Change in Noise Level dB(A)		Number of Dwellings (daytime)	Number of other sensitive receptors (daytime)	Number of Dwellings (night-time)
Increase in noise level, LA10,18h	0.1 – 2.9	630	8	787
	3.0 – 4.9	71	0	51
	5.0 – 9.9	42	0	13
	10+	15	0	11
No Change	0	9	1	68
Decrease in noise level, LA10,18h	0.1 – 2.9	136	1	19
	3.0 – 4.9	19	0	1
	5.0 – 9.9	33	0	5
	10+	3	0	3

5.2.79. In the long-term, the effect of network traffic growth suggests that Route Option B East is likely to be detrimental overall, with a larger number of adverse impacts in each category than equivalent benefits for residential properties.

5.2.80. In the daytime, a total of 57 properties would be subject to moderate or major adverse impacts, and 36 properties would benefit from moderate or major reductions in traffic noise, in the long-term. At night, a total of 24 properties would be subject to moderate or major adverse impacts, and eight properties would benefit from moderate or major reductions in traffic noise.

5.2.81. The following changes in the $L_{night,outside}$ values are predicted for residential properties:

- 28 properties where the Do Nothing value is less than 55dB and the Do-Something value is more than 55dB; and
- 100 properties where the Do Nothing value is more than 55dB and the Do-Something value is greater than the Do Nothing value.

5.2.82. The effects on non-residential properties are largely negligible.

5.2.83. The potential impacts of Route Option B East on the A1067 NIAs has been determined by considering the basic noise levels (BNLs) on the road close to the NIAs. It has been determined that, in the short-term where the effect can be more directly attributed to Route Option B East, increases of 0.7 to 0.8dB are predicted at the NIAs to the east of the junction with the A1270. The NIAs to the west of that junction are predicted to be subject to a decrease in traffic noise of 0.7dB.

5.2.84. These outcomes are almost identical to the outcomes for Route Option B West. All of the changes would be classed as negligible in magnitude.

ROUTE OPTION C

Baseline Conditions

5.2.85. Route Option C runs from the A47 at its junction with Wood Lane and Berrys Lane to the A1067 Fakenham Road to the west of its junction with the A1270.

5.2.86. From the proposed junction with the A47 it heads north-east, following the same alignment as Route Options B Western and Eastern variants and running roughly parallel with Wood Lane. After crossing Breck Road it continues north-east, turning more easterly after crossing Ringland Lane before turning northward again and joining with the A1067.

5.2.87. The route only passes close to a small number of properties, notably Low Farm and Old Hall Farm, Old Hall Farm Cottages and Woodstock close to the junction with the A1067.

5.2.88. The baseline conditions have been established through calculation for the 'Do Nothing' situation for the year 2025 for both daytime and night-time. Noise contour plans setting out the 2025 baseline situations are shown in Appendix D as Figure D.2 and Figure D.22 respectively.

Environmental Effects

5.2.89. The overall number of properties predicted to have a positive or negative change in noise level is shown in **Table 5.15** for the year of opening (2025) and **Table 5.16** for the long-term scenario (2040).

Table 5.15 - Overall number of properties affected by Route Option C in the short-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	286	2
No change	59	1
Decrease in noise level of at least 0.1dB LA10,18h	613	7

Table 5.16 - Overall number of properties affected by Route Option C in the long-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	798	9
No change	23	0
Decrease in noise level of at least 0.1dB LA10,18h	137	1

5.2.90. There is predicted to be a net benefit for 327 properties in the short-term and a net impact on 661 properties in the long-term as a result of Route Option C.

5.2.91. As noted previously, long-term traffic growth suggests a wider range of adverse impacts than is likely to result just from Route Option C itself. The short-term net benefit is considered a better indicator of likely effect for Route Option C.

5.2.92. The short-term and long-term impact summary tables are shown in **Table 5.17** and **Table 5.18** respectively.

Table 5.17 - DMRB short-term noise impact for Route Option C (daytime)

Change in Noise Level dB(A)		Number of Dwellings	Number of other sensitive receptors
Increase in noise level, LA10,18h	0.1 – 0.9	203	1
	1.0 – 2.9	48	1
	3.0 – 4.9	14	0
	5+	21	0
No Change	0	59	1
Decrease in noise level, LA10,18h	0.1 – 0.9	491	6
	1.0 – 2.9	46	0
	3.0 – 4.9	9	0
	5+	67	1

5.2.93. It can be seen from **Table 5.17** that Route Option C is predicted to lead to benefits and negative impacts in the higher categories which overall lead to slighter greater benefits than negative impacts for residential properties.

5.2.94. A total of 35 properties would be subject to moderate or major adverse impacts, and 76 properties would benefit from moderate or major reductions in traffic noise, in the short-term.

5.2.95. The effects on other sensitive receptors (non-residential) are largely negligible, although one property is predicted to receive a major benefit.

Table 5.18 - DMRB long-term noise impact for Route Option C

Change in Noise Level dB(A)		Number of Dwellings (daytime)	Number of other sensitive receptors (daytime)	Number of Dwellings (night-time)
Increase in noise level, LA10,18h	0.1 – 2.9	682	9	765
	3.0 – 4.9	62	0	39
	5.0 – 9.9	45	0	16
	10+	9	0	10
No Change	0	23	0	72
Decrease in noise level, LA10,18h	0.1 – 2.9	67	0	56
	3.0 – 4.9	9	0	0
	5.0 – 9.9	61	1	0
	10+	0	0	0

5.2.96. In the long-term, the effect of network traffic growth suggests that Route Option C is likely to be detrimental overall, but with the impacts weighted towards an increase of less than 1dB, which would be classed as negligible for residential properties.

5.2.97. In the daytime, a total of 54 properties would be subject to moderate or major adverse impacts, and 61 properties would benefit from moderate or major reductions in traffic noise, in the long-term. At night, a total of 26 properties would be subject to moderate or major adverse impacts, and no properties would benefit from moderate or major reductions in traffic noise.

5.2.98. The following changes in the $L_{night,outside}$ values are predicted for residential properties:

- 15 properties where the Do Nothing value is less than 55dB and the Do-Something value is more than 55dB; and
- 100 properties where the Do Nothing value is more than 55dB and the Do-Something value is greater than the Do Nothing value.

5.2.99. The effects on non-residential properties are largely negligible, although one property is predicted to receive a moderate benefit.

5.2.100. The potential impact of Route Option C on the A1067 NIAs has been determined by considering the basic noise levels (BNLs) on the road close to the NIAs. It has been determined that, in the short-term where the effect can be more directly attributed to Route Option C, increases of 0.9 to 1dB are predicted at the NIAs to the east of the junction with the A1270. The NIAs to the west of that junction are predicted to be subject to a decrease in traffic noise of 1.1dB.

5.2.101. These outcomes are similar to those of Route Options B Western and Eastern variants, but overall they would be classed as minor impacts, both adverse and beneficial, rather than negligible.

ROUTE OPTION D (WEST AND EAST)

Baseline Conditions

5.2.102. Route Option D runs from the A47 at its junction with Taverham Road to the A1067 Fakenham Road to the west of its junction with the A1270. Route Option D comprises two separate legs and is referred to as "Route Option D East" and "Route Option D West". The option assessed for noise was Route Option D West. However, whilst the two legs would have slightly different impacts in terms of noise, it is considered that there is no material difference in the assessment of the impacts of these two Route Options overall. The route passes to within approximately 47 metres of the houses on Taverham Road.

5.2.103. From the proposed junction with the A47 it heads north-east, running roughly parallel with Taverham Road, until it turns north-west and crosses Honingham Lane. It then turns back north-eastwards as it passes the village of Ringland, before joining the A1067.

5.2.104. The route passes close to a small number of properties, including Low Farm, Old Hall Farm, Old Hall Farm Cottages, Woodstock, Gamekeepers Cottage and The Kennels, Ebony Hall and properties near the junction with the A47.

5.2.105. There are properties close to the junction with the A1067, including Low Farm, Old Hall Farm, Old Hall Farm Cottages and Woodstock.

5.2.106. The baseline conditions have been established through calculation for the 'Do Nothing' situation for the year 2025 for both daytime and night-time. Noise contour plans setting out the 2025 baseline situations are shown in Appendix D as Figure D.2 and Figure D.28 respectively.

Environmental Effects

5.2.107. The overall number of properties predicted to have a positive or negative change in noise level is shown in **Table 5.19** for the year of opening (2025) and **Table 5.20** for the long-term scenario (2040).

Table 5.19 - Overall number of properties affected by Route Option D in the short-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	439	4
No change	37	0
Decrease in noise level of at least 0.1dB LA10,18h	482	6

Table 5.20 - Overall number of properties affected by Route Option D in the long-term

	Number of Dwellings	Number of other sensitive receptors
Increase in noise level of at least 0.1dB LA10,18h	780	9
No change	29	0
Decrease in noise level of at least 0.1dB LA10,18h	149	1

5.2.108. There is predicted to be a net benefit for 43 properties in the short-term and a net impact on 631 properties in the long-term as a result of Route Option D.

5.2.109. As noted previously, long-term traffic growth suggests a wider range of adverse impacts than is likely to result just from Route Option D itself. The short-term net benefit is considered a better indicator of likely effect for Route Option D.

5.2.110. The short-term and long-term impact summary tables are shown in **Table 5.21** and **Table 5.22** respectively.

Table 5.21 - DMRB short-term noise impact for Route Option D (daytime)

Change in Noise Level dB(A)		Number of Dwellings	Number of other sensitive receptors
Increase in noise level, LA10,18h	0.1 – 0.9	336	3
	1.0 – 2.9	45	1
	3.0 – 4.9	17	0
	5+	41	0
No Change	0	37	0
Decrease in noise level, LA10,18h	0.1 – 0.9	355	5
	1.0 – 2.9	44	0
	3.0 – 4.9	10	0
	5+	73	1

5.2.111. It can be seen from **Table 5.21** that Route Option D is predicted to lead to a balance between benefits and impacts across the categories for residential properties.

5.2.112. A total of 58 properties would be subject to moderate or major adverse impacts, and 83 properties would benefit from moderate or major reductions in traffic noise, in the short-term.

5.2.113. The effects on non-residential properties are largely negligible, although one property is predicted to receive a major benefit.

Table 5.22 - DMRB long-term noise impact for Route Option D

Change in Noise Level dB(A)		Number of Dwellings (daytime)	Number of other sensitive receptors (daytime)	Number of Dwellings (night-time)
Increase in noise level, LA10,18h	0.1 – 2.9	666	9	716
	3.0 – 4.9	41	0	36
	5.0 – 9.9	53	0	28
	10+	20	0	12
No Change	0	29	0	89
Decrease in noise level, LA10,18h	0.1 – 2.9	74	0	73
	3.0 – 4.9	29	0	0
	5.0 – 9.9	46	1	3
	10+	0	0	1

5.2.114. In the long-term, the effect of network traffic growth suggests that Route Option D is likely to be detrimental overall, but with the impacts weighted towards an increase of less than 1dB, which would be classed as negligible for residential properties.

5.2.115. In the daytime, a total of 73 properties would be subject to moderate or major adverse impacts, and 46 properties would benefit from moderate or major reductions in traffic noise, in the long-term. At night, a total of 40 properties would be subject to moderate or major adverse impacts, and four properties would benefit from moderate or major reductions in traffic noise.

5.2.116. The following changes in the $L_{night,outside}$ values are predicted for residential properties:

- 21 properties where the Do Nothing value is less than 55dB and the Do-Something value is more than 55dB; and
- 100 properties where the Do Nothing value is more than 55dB and the Do-Something value is greater than the Do Nothing value.

5.2.117. The effects on non-residential properties are largely negligible, although one property is predicted to receive a moderate benefit.

5.2.118. The potential impacts of Option D on the A1067 NIAs has been determined by considering the basic noise levels (BNLs) on the road close to the NIAs. It has been determined that, in the short-term where the effect can be more directly attributed to Route Option D, increases of 0.3 to 0.5dB are predicted at the NIAs to the east of the junction with the A1270. The NIAs to the west of that junction are predicted to be subject to a decrease in traffic noise of 0.9dB.

5.2.119. These outcomes are similar to those from Route Option B Western and Eastern variants and Route Option C and would be classed as negligible in magnitude.

Mitigation

5.2.120. The mitigation options across all six options are similar, whereby a low noise road surface would provide a meaningful benefit along the full length of the route. Depending on the type of surfacing used, reductions of between 2 and 5dB (A) should be possible. A low noise surface may be particularly effective for Route Option C, where the affected receptors are less densely agglomerated, so a measure that offers a blanket reduction across the entire route would be more effective.

5.2.121. The geographical extent of the largest impacts is largely limited to the areas directly adjacent to the Route Option A alignment, just to the south of its centre. An acoustic barrier along parts of the southern half of Route Option A would reduce the largest impacts, however, there are few properties that would directly benefit from this.

5.2.122. Some large impacts are predicted along the majority of the length of Route Option B Western and Eastern variants. Receptors along the route are generally sparse and isolated, although the route passes close to Weston Longville and Weston Green, and roadside acoustic barriers on the western side of the road would benefit both villages. The lengths and heights of such barriers would need to be determined, and consideration should be given to the potential for reflections from such structures to elevate noise levels to the east of the road.

5.2.123. The geographical spread of impacts that result from Route Option C are similar to that of Route Options B Western and Eastern variants, although the extent of the largest impacts to the west of the road is smaller, thereby reducing the impacts at Weston Longville and Weston Green. The majority of the properties, affected by Route Option C, are isolated properties and as such roadside barriers may be less effective.

5.2.124. The geographical spread of impacts that result from Route Option D are similar to the Route Option B Western and Eastern variants and Route Option C, although the extent of the largest impacts is shifted eastwards. The western fringes of Ringland are predicted to fall into the largest two impacts categories, and an acoustic barrier along this section of Route Option D would be of benefit.

5.2.125. An acoustic barrier on the western side of Route Option D to screen Honingham Park would also be beneficial.

Summary of Potential Noise Impacts

5.2.126. The overall impact of the five route options are summarised below. The impacts are presented without the mitigation options outlined above, which would be determined during the next phase of works, and therefore represents a worst-case scenario. With the adoption of mitigation measures, it is predicted that the adverse impacts would reduce and the benefits experienced at properties would likely increase.

5.2.127. **Table 5.23** sets out a summary of the short-term daytime outcomes.

Table 5.23 - Summary of DMRB short-term noise impacts for all options

Change in Noise Level dB(A)		Route Option A	Route Option B Western Variant	Route Option B Eastern Variant	Route Option C	Route Option D
Increase in noise level, LA10,18h	0.1 – 0.9	563	166	122	203	336
	1.0 – 2.9	10	113	109	48	45
	3.0 – 4.9	2	57	30	14	17
	5+	4	29	25	21	41
No Change	0	113	62	34	59	37
Decrease in noise level, LA10,18h	0.1 – 0.9	252	413	401	491	355
	1.0 – 2.9	8	49	168	46	44
	3.0 – 4.9	2	18	18	9	10
	5+	4	51	51	67	73

5.2.128. It can be seen from **Table 5.23** that although Route Option A adversely impacts more properties and benefits fewer properties than the other route options in the short-term, the changes in noise that result from Route Option A are almost all less than ±1dB, which would be classed as negligible changes. There are few properties predicted to fall into the categories above 1dB, although as noted previously, the traffic volume on Route Option A is lower than the other options.

5.2.129. Route Option B Western and Eastern variants are very similar in terms of their effect, with Option B East being marginally less impactful and significantly more beneficial in the 1 to 2.9dB category.

5.2.130. Route Options C and D are more balanced in terms of impacts and benefits, with Route Option C being the least impactful of the two.

5.2.131. **Table 5.24** sets out only the number of properties predicted to be subject to moderate and major changes in traffic noise only.

Table 5.24 - Summary of DMRB short-term noise moderate and major impacts for all options

Change in Noise Level dB(A)	Route Option A	Route Option B Western Variant	Route Option B Eastern Variant	Route Option C	Route Option D
Moderate or major increase (3.0+)	6	86	55	35	58
Moderate or major decrease (3.0+)	6	69	69	76	83

5.2.132. Route Option A gives the most balanced outcome, and Route Options B East, C and D all shown net benefits, when considering the moderate and major changes only.

5.2.133. Overall, in the short-term, Route Option A is predicted to be the most desirable option followed by Route Options B East and C, from a noise perspective.

5.2.134. **Table 5.25** sets out a summary of the long-term daytime outcomes.

Table 5.25 - Summary of DMRB long-term daytime noise impacts for all options

Change in Noise Level dB(A)		Route Option A	Route Option B Western Variant	Route Option B Eastern Variant	Route Option C	Route Option D
Increase in noise level, LA10,18h	0.1-2.9	802	667	630	682	666
	3-4.9	24	70	71	62	41
	5-9.9	27	79	42	45	53
	10+	4	12	15	9	20
No Change	0	37	11	9	23	29
Decrease in noise level, LA10,18h	0.1-2.9	58	63	136	67	74
	3-4.9	2	20	19	9	29
	5-9.9	3	33	33	61	46
	10+	1	3	3	0	0

5.2.135. **Table 5.25** shows that all of the route options offer fewer benefits in the long-term, which is primarily a result of network traffic growth, which masks to a large degree any benefits offered by the NWL. It is considered that the long-term impacts are less useful in determining the relative benefits of one option over another. Whilst Route Options B East and C are considered to offer the most desirable balance; Route Option A adversely impacts (in terms of moderate and major impacts) the fewest properties and is therefore considered the preferred option in terms of noise.

5.2.136. **Table 5.26** sets out a summary of the long-term night-time outcomes.

Table 5.26 - Summary of DMRB long-term night-time noise impacts for all options

Change in Noise Level dB(A)		Route Option A	Route Option B Western Variant	Route Option B Eastern Variant	Route Option C	Route Option D
Increase in noise level, LA10,18h	0.1-2.9	782	757	787	765	716
	3-4.9	22	57	51	39	36
	5-9.9	7	36	13	16	28
	10+	6	8	11	10	12
No Change	0	122	68	68	72	89
Decrease in noise level, LA10,18h	0.1-2.9	12	22	19	56	73
	3-4.9	4	2	1	0	0
	5-9.9	2	5	5	0	3
	10+	1	3	3	0	1

5.2.137. **Table 5.26** suggests that the options are relatively evenly matched during the night-time; with Route Option A, marginally, the optimum choice as it adversely affects (in terms of moderate and major impacts) the fewest properties.

5.2.138. Again, network traffic growth disguises any potential benefits of the scheme, which all of the options showing more impacts than benefits.

5.2.139. **Table 5.27** sets out a summary of the moderate and major changes only for the long-term scenarios.

Table 5.27 - Summary of DMRB long-term noise moderate and major impacts for all options

Change in Noise Level dB(A)	Route Option A (Day/Night)	Route Option B Western Variant (Day/Night)	Route Option B Eastern Variant (Day/Night)	Route Option C (Day/Night)	Route Option D (Day/Night)
Moderate or major increase (3.0+)	31 / 13	91 / 44	57 / 24	54 / 26	73 / 40
Moderate or major decrease (3.0+)	4 / 3	36 / 8	36 / 8	61 / 0	46 / 4

5.2.140. The six options are considered to be equal in terms of their potential effect on the NIAs. The majority of anticipated changes in traffic noise level are likely to be negligible, at least in the short-term, which excludes the effect of traffic growth.

5.2.141. The above assessment focuses on the magnitude of change as a result of the route options in the Do Something scenario against the Do Nothing scenario, in line with the requirements of the DMRB. However, the absolute noise levels should also be considered to provide context.

5.2.142. Whilst there are some major adverse impacts predicted with regards to change for all of the route options, the absolute noise levels across the calculation area remain low for the most part. With the exception of a very narrow corridor along each route option (and the future dualled A47), the noise levels fall below the Significant Observed Adverse Effect Level (SOAEL) and for the majority of the calculation area the noise levels fall below the Lowest Observed Adverse Effect Level (LOAEL).

5.2.143. The LOAEL and SOAEL is defined qualitatively in the Noise Policy Statement for England (NPSE) as the "*level above which adverse effects on health and quality of life can be detected*" and the "*level above which significant adverse effects on health and quality of life occur*" respectively. There are no set values for the LOAEL or SOAEL in government policy or guidance, the guidance advises that these values are different for different noise sources, for different receptors and at different times and should be defined on a strategic or project basis accounting for the specific features of that area, source or project. For this project, and for many other similar projects, the LOAEL has been defined as 52 dB $L_{A10,18h}$ (free-field) and the SOAEL has been defined as 65 dB $L_{A10,18h}$ (free-field). Further details on the derivation of the LOAEL and SOAEL are provided in Appendix D.

5.2.144. As can be seen from the noise contour maps in Appendix D, there are very few areas that exceed the SOAEL but there will be some areas that exceed the LOAEL as a result of the proposed route options. However, mitigation measures will be explored to minimise the adverse impacts arising as a result of the final route option and to keep absolute noise levels as low as practicable.

5.2.145. On the basis of the assessment set out in this report, it is considered that Route Option A is the best option from a noise perspective as it adversely affects (in terms of moderate and major impacts) the fewest properties. However, Route Option A also benefits the fewest number of properties and has a much wider low level adverse impact, while carrying significantly less traffic than the other options. Route Option B East and Route Option C offer the most desirable balance in terms of impacts and benefits in terms of noise.

5.2.146. Furthermore, should mitigation measures be employed (in the form of a low-noise road surface and/or acoustic barriers, where appropriate), it is anticipated that the adverse impacts presented would reduce both in terms of the number of properties affected and the magnitude of the adverse change and that the beneficial impacts presented would increase both in terms of the number of properties affected and the magnitude of the beneficial change.

5.3. AIR QUALITY

5.3.1. The air quality impacts of NWL scheme have been appraised following TAG Unit A3 Environmental Impact Appraisal Guidance: Chapter 3.3 'Air Quality Impacts' (31 May 2019). The appraisal considers the scheme impacts in terms of changes in ambient annual mean concentrations of nitrogen dioxide (NO_2) and fine particulates ($PM_{2.5}$) at locations with relevant human exposure (residential premises, schools and hospitals). The appraisal reports its findings in terms of:

- Changes in the numbers of properties with improvement, worsening or no change in annual mean NO_2 and $PM_{2.5}$ in the scheme opening year (in this case 2025).
- Changes in total emissions of oxides of nitrogen (NO_x) and $PM_{2.5}$ between the opening year and forecast year (in this case 2040) and beyond to 60-years after the opening year.
- Monetary valuation of the health impacts in terms of changes in exposure to annual mean NO_2 and $PM_{2.5}$ over a 60-year period from the opening year. The method used for monetary valuation depends on if the scheme is likely to affect compliance with EU limit values and then if the air quality impacts are likely to have a net present value (NPV) of more than £50,000,000 – as may be the case for very large transport infrastructure projects. In the case of the NWL scheme options it is considered likely that the NPV would be substantially lower than this threshold.

5.3.2. The findings were captured for each scheme option in worksheets and an Appraisal Summary Table (AST), which can be found in Appendix E.

5.3.3. The appraisal undertaken was based on traffic data derived from the NATS Saturn models for the without scheme scenario and six scheme options in the opening and forecast years.

5.3.4. As per the TAG methodology, the traffic data were screened following DMRB HA207/07 guidance[15] to define the 'affected road network' (ARN) for each option. This process removed road links with changes that would give rise to imperceptible air quality impacts. The applied criteria are:

- Road alignment change of 5m or more;
- Daily traffic flows change by 1,000 annual average daily traffic (AADT) flow or more;
- Heavy-duty vehicle flows change by 200 AADT or more;
- Daily average speed change by 10 km/hr or more; and
- Peak hour speed change by 20 km/hr or more.

5.3.5. The traffic model for this assessment stops on the outskirts of Norwich city centre and as such the impacts within Norwich are not modelled.

5.3.6. Highways England's air quality screening method, background pollutant data from Defra's Pollution Climate Mapping (PCM) model and Defra's NO_x to NO_2 calculation method were used in estimating annual mean concentrations of NO_2 and $PM_{2.5}$.

5.3.7. Notable limitations of the TAG methodology include:

- Emission factors for NO_x and $PM_{2.5}$ have been published by Defra for each year up to and including 2030. Predictions beyond 2030 (including the forecast year) assume 2030 emissions, which means

[15] http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf

that progressive improvements to the vehicle fleet giving rise to lower/zero emissions are not accounted for in later years.

- Traffic growth between the open year and forecast year is assumed to linear. Beyond the forecast year it is assumed to be zero up to the 60th year in the appraisal period (i.e. traffic levels are constant from the forecast year onwards).
- The TAG methodology is not intended for formal Environmental Impact Assessment purposes (TAG provides a high-level scheme appraisal). It is not possible to address air quality impacts at specific individual premises or determine likely significant effects.

BASELINE CONDITIONS

5.3.8. The main sources of air pollution in the study area are emissions due to road traffic.

5.3.9. The study area does not lie in an Air Quality Management Area (AQMA). The closest AQMA is east of the study area, within Norwich city centre area, known as Central Norwich AQMA. This was declared in 2012 due to exceedance of the national air quality objective for annual mean NO_2 (40µg/m^3) due to emissions from road transport[16].

5.3.10. The nearest monitoring point is approximately 4km east of the study area, operated by Broadland District Council. Annual mean NO_2 concentrations at this suburban location have been less than 20µg/m^3 in recent years.

5.3.11. According to information published by Defra on EU limit value compliance, there are no locations within the study area exceeding limit values for NO_2 or $PM_{2.5}$.

ENVIRONMENTAL EFFECTS

5.3.12. A quantitative appraisal of each of the six route options, and of the roads and wider highway network that would be affected by them, has been undertaken to identify any routes that may experience an increase or decrease in air pollution during operation of the scheme. The findings are summarised in **Table 5.28**. In considering the results it should be noted that a negative valuation (i.e. -£ for the NPV) indicates a net dis-benefit, whilst a positive valuation indicates a net benefit. The valuations for NO_x and $PM_{2.5}$ were based on damage costs there are no exceedances of EU limit values in the study area and the likely total NPV for the air quality impacts of any option is less than £50,000,000.

[16] Defra, UK Air, Air Information Resource. Online at: [https://uk-air.defra.gov.uk/aqma/details?aqma_ref=1519#951]

Table 5.28 - Air quality appraisal results

Impact of the Scheme	Route Option A	Route Option B West	Route Option B East	Route Option C	Route Option D	
					WEST	EAST
Number of properties with an improvement in open year	1,500	10,214	8,249	8,613	10,112	10,112
Number of properties with no change in opening year	0	0	0	0	129	129
Number of properties with a deterioration in opening year	2,235	5,339	5,338	5,729	7,178	7,196
Change in NO_x emissions (tonnes) over 60-year appraisal period following opening	-290	9	119	112	308	308
Change in $PM_{2.5}$ emissions (tonnes) over 60-year appraisal period following opening	-25	1	10	8	28	28
NPV of changes in NO_x emissions over 60-year appraisal period following opening	£1,382,496	£331,271	-£144,635	-£184,194	-£1,058,211	-£1,058,211
NPV of changes in $PM_{2.5}$ emissions over 60-year appraisal period following opening	£2,220,433	£397,228	-£403,887	-£269,001	-£1,971,176	-£1,971,176
Total NPV of changes in air quality over 60-year appraisal period following opening	£3,602,929	£728,499	-£548,522	-£453,195	-£3,029,388	-£3,029,388

AFFECTED ROAD NETWORK

5.3.13. The traffic effects on the ARN vary according to the influence the different route options are predicted to have on traffic flows. Whilst the TAG assessment can account for the differences in exposure for human properties, it does not account for sensitive ecological receptors within 200m of the ARN. There are two sensitive ecological receptors within 200m of the ARN that are affected by all route options:

- **River Wensum SAC/SSSI** – with affected links crossing at Swanton Morley, Norwich Road/ Fakenham Road, Route Options and lanes between Fakenham Road and A47; and
- **Swannington Upgate Common SSSI** – road through Upgate in Scenarios Route Option B West and East.

5.3.14. The predicted traffic effects on the ARN relating to each route option are outlined below.

ROUTE OPTION A

5.3.15. Based on predicted traffic flows, the ARN for Route Option A is the smallest with an increase seen on the route option and along Norwich Road to the west of the junction. A reduction in flows is seen on Norwich Road to the east of the junction and on the lanes following the route alignment.

5.3.16. Route Option A is predicted to affect 3,735 properties, of which 429 lie within 50m of the ARN in both the 'without-scheme' and 'with-scheme' scenario. Of the 3,735 properties, 1,500 are predicted to experience an improvement in air quality and 2,235 a worsening in air quality

5.3.17. The calculated NO_x emissions for the ARN in the opening year and forecast year are taken from the TAG worksheet table and are given in **Figure 5.1**.

Figure 5.1 - Total NO_x emissions for Route Option A

Air Quality Valuation Workbook - Worksheet 2

Regional Air Quality

Scheme name: NWL Option A **Opening year:** 2025 **Forecast year:** 2040

		Without scheme		With scheme		Change in emissions	
		Opening year	Forecast year	Opening year	Forecast year	Opening year	Forecast year
NOx emissions in tonnes per year	Areas not exceeding limit values	498.99	399.88	491.08	395.53	-7.91	-4.35
	Areas exceeding limit values	0.00	0.00	0.00	0.00	0.00	0.00

Qualitative comments: Custom exceedance method applied as no exceedances of EU limit value

Data sources: WSP Transport Planning team (2019)

5.3.18. Route Option A is predicted to lead to a small decrease in NO_x emissions in both the opening (1.6%) and the forecast year (1.1%). This is due to a predicted decrease in the number of vehicle kilometres travelled in the study area as a result of the route.

ROUTE OPTION B WEST

5.3.19. The ARN for Route Option B West extends from Swanton Morley and Bawdeswell in the west to the edges of Norwich in the east. Increases in traffic flows are predicted at:

- South of Swanton Morley and along the A47 up to the route alignment;
- Along Norwich Road / Fakenham Road from west of the junction through to Drayton;
- Along the A1270 up to the junction with the A140;
- From Fir Covert Road up to the A140 via Felthorpe; and
- Along the A140 from the A1270 to Fifers Lane junction.

5.3.20. Decreases in traffic flows are predicted at:

- North of Swanton Morley and along Norwich Road;
- Along various lanes between Fakenham Road and the A47 near the route alignment;
- From Reepham to the A1270 via Swannington;

- Route from Drayton to the A1074 via Costessey;
- Route going south from Taverham through Ringlands to the A47; and
- From the A47/A1074 junction to New Costessey along the A1074.

5.3.21. Route Option B West is predicted to affect 15,553 properties, of which 1,785 are within 50m of the ARN.

5.3.22. The calculated NO_x emissions for the ARN in the opening year (2025) and forecast year (2040) are taken from the TAG Worksheet table and are given in **Figure 5.2**.

Figure 5.2 - Total NO_x emissions for Route Option B West

Air Quality Valuation Workbook - Worksheet 2

Regional Air Quality

Scheme name: NWL Option B **Opening year:** 2025 **Forecast year:** 2040

		Without scheme		With scheme		Change in emissions	
		Opening year	Forecast year	Opening year	Forecast year	Opening year	Forecast year
NOx emissions in tonnes per year	Areas not exceeding limit values	498.99	399.88	474.33	403.85	-24.66	3.97
	Areas exceeding limit values	0.00	0.00	0.00	0.00	0.00	0.00

Qualitative comments: Custom exceedance method has been applied as no exceedances of EU limit value

Data sources: WSP Transport Planning team (2019)

5.3.23. Route Option B West is predicted to lead to a small decrease in NO_x emissions in the opening (4.9%) and a small increase in the forecast year (1%). This is due to a predicted decrease in the number of vehicle kilometres travelled in the study area as a result of the scheme in the opening year with an increase in the future year.

ROUTE OPTION B EAST

5.3.24. The ARN for Route Option B East extends from Swanton Morley and Bawdeswell in the west to the edges of Norwich in the East. Increases in traffic flows are predicted at:

- South of Swanton Morley and along the A47 up to the route alignment;
- Along Norwich Road / Fakenham Road from west of the junction through to Drayton;
- Along the A1270 up to the junction with the A140;
- From Fir Covert Road up to the A140 via Felthorpe; and
- Along the A140 from the A1270 to Fifers Lane junction.

5.3.25. Decreases in traffic flows are predicted at:

- North of Swanton Morley and along Norwich Road;
- Along various lanes between Fakenham Road and the A47 near the route alignment;
- From Reepham to the A1270 via Swannington;
- Route going south from Taverham through Ringlands to the A47; and
- From the A47/A1074 junction to New Costessey along the A1074.

5.3.26. Route Option B East is predicted to affect 13,587 properties of which 1,519 are within 50m of the ARN.

5.3.27. The calculated NO_x emissions for the ARN in the opening year (2025) and forecast year (2040) are taken from the TAG Worksheet table and are given in **Figure 5.3**.

Figure 5.3 - Total NO_x emissions for Route Option B East

Air Quality Valuation Workbook - Worksheet 2

Regional Air Quality

Scheme name: Opt B Alt **Opening year:** 2025 **Forecast year:** 2040

		Without scheme		With scheme		Change in emissions	
		Opening year	Forecast year	Opening year	Forecast year	Opening year	Forecast year
NOx emissions in tonnes per year	Areas not exceeding limit values	498.99	399.88	474.06	406.01	-24.93	6.13
	Areas exceeding limit values	0.00	0.00	0.00	0.00	0.00	0.00

Qualitative comments: TAG Unit A3 Custom Exceedance method has been applied

Data sources: Traffic data provided by WSP Transport planners (2019)

5.3.28. Route Option B East is predicted to lead to a small decrease in NO_x emissions in the opening (5%) and a small increase in the forecast year (1.5%). This is due to a predicted decrease in the number of vehicle kilometres travelled in the study area as a result of the route in the opening year, with an increase in the future year.

ROUTE OPTION C

5.3.29. The ARN for Route Option C extends from Swanton Morley and Bawdeswell in the west to the edges of Norwich in the East. Increases in traffic flows are predicted at:

- South of Swanton Morley and along the A47 up to the route alignment;
- From the A47 Honnigham to Kimberley;
- Along Norwich Road / Fakenham Road from west of the junction through to Drayton;
- Along the A1270 up to the junction with the A140;
- From Fir Covert Road up to the A140 via Felthorpe; and
- Along the A140 from the A1270 to Fifers Lane junction.

5.3.30. Decreases in flows are predicted at:

- North of Swanton Morley and along Norwich Road;
- Along various lanes between Fakenham Road and the A47 near the route alignment;
- From Reepham to the A1270 via Swannington;
- Route going south from Taverham through Ringlands to the A47; and
- From the A47/A1074 junction to New Costessey along the A1074.

5.3.31. Route Option C is predicted to affect 14,342 properties, of which 1,594 are within 50m of the ARN.

5.3.32. The calculated NO_x emissions for the ARN in the opening year (2025) and forecast year (2040) are taken from the TAG Worksheet table and are given in **Figure 5.4**.

Figure 5.4 - Total NO_x emissions for Route Option C

Air Quality Valuation Workbook - Worksheet 2

Regional Air Quality

Scheme name: Opt C **Opening year:** 2025 **Forecast year:** 2040

		Without scheme		With scheme		Change in emissions	
		Opening year	Forecast year	Opening year	Forecast year	Opening year	Forecast year
NOx emissions in tonnes per year	Areas not exceeding limit values	498.99	399.88	478.78	405.15	-20.21	5.26
	Areas exceeding limit values	0.00	0.00	0.00	0.00	0.00	0.00

Qualitative comments: TAG Unit A3 Custom Exceedance method has been applied

Data sources: Traffic data provided by WSP Transport planners (2019)

5.3.33. Route Option C is predicted to lead to a small decrease in NO_x emissions in the opening (4%) and a small increase in the forecast year (1.3%). This is due to a predicted decrease in the number of vehicle kilometres travelled in the study area as a result of the route in the opening year, with an increase in the future year.

ROUTE OPTION D

5.3.34. The ARN for Route Option D West extends from Swanton Morley and Bawdeswell in the west to the edges of Norwich in the East. Increases in traffic flows are predicted at:

- South of Swanton Morley and along the A47 up to the route alignment;
- From the A47 Honnigham to Kimberley;
- Along Norwich Road / Fakenham Road from west of the junction through to Drayton;
- Along the A1270 up to the junction with the A140;
- Along the A47 from the junction with the Route Option heading east;
- From Fir Covert Road up to the A140 via Felthorpe; and
- Along the A140 from the A1270 to Fifers Lane junction.

5.3.35. Decreases in flows are predicted at:

- North of Swanton Morley and along Norwich Road;
- Along various lanes between Fakenham Road and the A47 near the route alignment;
- From Reepham to the A1270 via Swannington;
- Route going south from Taverham through Ringlands to the A47; and
- From the A47/A1074 junction to New Costessey along the A1074.

5.3.36. Where there are differences between Route Options D West and east, these are detailed below.

Route Option D West

5.3.37. Route Option D Western leg is predicted to affect 17,419 properties, of which 1,927 are within 50m of the ARN.

Route Option D East

5.3.38. Route Option D Eastern leg is predicted to affect 17,437 properties, of which 1,932 are within 50m of the ARN.

5.3.39. The calculated NO_x emissions for Route Option D (West and East) for the ARN in the opening year and forecast year are taken from the TAG Worksheet table and are given in **Figure 5.5**.

Figure 5.5 - Total NO_x emissions for Route Option D (West and East)

Air Quality Valuation Workbook - Worksheet 2

Regional Air Quality

Scheme name: Opt D **Opening year:** 2025 **Forecast year:** 2040

		Without scheme		With scheme		Change in emissions	
		Opening year	Forecast year	Opening year	Forecast year	Opening year	Forecast year
NOx emissions in tonnes per year	Areas not exceeding limit values	498.99	399.88	480.07	408.71	-18.92	8.83
	Areas exceeding limit values	0.00	0.00	0.00	0.00	0.00	0.00

Qualitative comments: TAG Unit A3 Custom Exceedance method has been applied

Data sources: Traffic data provided by WSP Transport planners (2019)

5.3.40. Route Option D is predicted to lead to a small decrease in NO_x emissions in the opening (3.8%) and a small increase in the forecast year (2.2%) than other route options. This is due to a predicted decrease in the number of vehicle kilometres travelled in the study area as a result of the scheme in the opening year, with an increase in the future year.

MITIGATION

5.3.41. The purpose of the TAG appraisal for air quality is to identify broad impacts across the study area. It is not possible to identify potential significant effects that may require mitigation. The Stage 3 detailed design should allow for the identification of any significant effects in sufficient detail to allow suitable mitigation measures to be drawn up.

5.3.42. At this stage, the construction of the NWL is not considered to give rise to exceedances of the EU limit value for annual mean NO_2. However, further modelling to predict ambient annual mean NO_2 concentrations would be required to determine if the effects of the Scheme in 2025 could be considered significant or not.

CONSULTATION

5.3.43. No consultation, specific to air quality, has been undertaken at this stage for any of the route options.

Conclusion

5.3.44. In the short-term (opening year), there are apparent benefits with all options - except Route Option A - in terms of greater numbers of properties experiencing improvements in air quality than worsening. The greatest benefit in the opening year is with Route Option B West.

Beyond the opening year, with the clear exception of Route Option A, the year-on-year increases in vehicle kilometres mean that option benefits are eroded. Over the 60-year period, Route Option A has most benefit with an NPV of £3,602,929, Route Option B West has some benefit with an NPV of £728,499 whilst the other options have dis-benefits. The greatest long-term dis-benefits are indicated for Route Option D where both the West and East variants have an NPV of -£3,029,388.

5.4. GREENHOUSE GASES

5.4.1. The scheme will result in changes in vehicle flow and composition that have the potential to impact on emissions of greenhouse gases from the ARN.

5.4.2. The appraisal has been undertaken following TAG Unit A3.4 'Greenhouse Gases' (31 May 2019) methodology. CO_2 emissions have been calculated for the opening and forecast years. The monetary valuation method requires emission to be forecast for a 60-year appraisal period. To provide this data the emissions between the opening and forecast years have been estimated by linear interpolation. CO_2 emissions have been calculated on the same basis as NO_x and $PM_{2.5}$ emissions and is subject to similar limitations (**Section 5.3**).

5.4.3. The results of the assessment are summarised in **Table 5.29** which shows the change in CO_2 equivalent (CO_{2e}) emissions, in tonnes, attributable to the scheme being in place and demonstrates the Net Present Value (NPV) of the CO_{2e} emissions associated with the implementation of the proposed scheme over a 60-year period.

BASELINE CONDITIONS

5.4.4. The affected road network covers South Norfolk, Norwich and Broadland local authorities. The National Atmospheric Emissions Inventory (NAEI) CO_2 interactive maps provides a breakdown of emissions sources by local authority. The 2016 CO_2 emission estimations from the NAEI[17] for these areas indicate that in total 2.1 million tonnes of CO_2 were emitted in 2016, of which one third (729 kilotonnes) was from road transport sources.

5.4.5. To reduce greenhouse gas emissions, Norwich City Council partnered with Norfolk County Council to introduce a Low Emission Zone (LEZ) in Norwich in 2018. The LEZ was introduced using an innovative approach through obtaining a Traffic Regulation Condition via the area Traffic Commissioner to regulate vehicle emissions and buses.

5.4.6. Environmental Effects **Table 5.29** shows emissions of greenhouse gases in terms of CO_{2e} for the 'without scheme' and the six route options, as well as the number of vehicle kilometres travelled, for both the opening and forecast years.

[17] National Atmospheric Emissions Inventory CO_2 interactive maps - http://naei.beis.gov.uk/laco2app/

Table 5.29 - Greenhouse Gases: CO_{2e} emissions for the six options

	Without Scheme	Route Option A	Route Option B West	Route Option B East	Route Option C	Route Option D West	Route Option D East
Opening Year 2025							
CO_{2e} (tonnes)	293,996	289,468 (-4,527)	279,664 (-14,332)	279,535 (-14,461)	282,008 (-11,987)	282,782 (-11,213)	282,782 (-11,213)
Veh Km travelled	5,950,805	5,857,892 (-92,913)	5,666,571 (-284,234)	5,662,877 (-287,928)	5,707,558 (-243,247)	5,716,648 (-234,157)	5,716,648 (-234,157)
Forecast Year 2040							
CO_{2e} (tonnes)	333,008	329,445 (-3,563)	335,889 (2,880)	337,659 (4,650)	336,907 (3,898)	339,963 (6,954)	339,963 (6,954)
Veh Km travelled	6,788,116	6,713,175 (-74,941)	6,834,367 (46,251)	6,869,683 (81,567)	6,853,722 (65,606)	6,924,931 (136,815)	6,924,931 (136,815)
Overall Assessment Score							
Change in CO_{2e} emissions (tonnes) over 60-year appraisal period following opening	NA	-196,560	14,970	93,590	79,530	223,240	223,240
Total NPV of changes in CO_{2e} over 60-year appraisal period following opening	NA	£8,622,855	-£1,358,528	-£4,900,284	-£4,149,699	-£10,575,555	-£10,575,555

ROUTE OPTION A

5.4.7. The scheme option is indicated to have a net benefit in terms of emissions of greenhouse gases of £8,622,855, expressed as the NPV of change in emissions over the 60-year appraisal period. This is due to reductions in vehicle kilometres travelled in both the opening year and forecast year compared to the situations without the scheme.

ROUTE OPTION B WEST

5.4.8. The scheme option is indicated to have a net dis-benefit in terms of emissions of greenhouse gases of -£1,358,528, expressed as the NPV of change in emissions over the 60-year appraisal period. This is due to a reduction in vehicle kilometres travelled in the opening year and a small increase in the forecast year compared to without the scheme.

ROUTE OPTION B EAST

5.4.9. The scheme option is indicated to have a net dis-benefit in terms of emissions of greenhouse gases of -£4,900,284, expressed as the NPV of change in emissions over the 60-year appraisal period. This is due to a reduction in vehicle kilometres travelled in the opening year and an increase in the forecast year compared to without the scheme.

ROUTE OPTION C

5.4.10. The scheme option is indicated to have a net dis-benefit in terms of emissions of greenhouse gases of -£4,149,699, expressed as the NPV of change in emissions over the 60-year appraisal period. This is due to a reduction in vehicle kilometres travelled in the opening year and a small increase in the forecast year compared to without the scheme.

ROUTE OPTION D WEST AND EAST

5.4.11. The scheme option is indicated to have a net dis-benefit in terms of emissions of greenhouse gases of -£10,575,555, expressed as the NPV of change in emissions over the 60-year appraisal period. This is due to a reduction in vehicle kilometres travelled in the opening year and an increase in the forecast year compared to without the scheme.

MITIGATION

5.4.12. The scheme should seek to support and encourage low/zero carbon modes of transport (such as walking and cycling) as far as possible.

CONCLUSION

5.4.13. The most beneficial of the options in terms of greenhouse gases is Option A where there is a net reduction in CO_{2e} emissions over the 60-year appraisal period associated with reductions in vehicle kilometres travelled on the road network. The other options have net dis-benefits due to increases in vehicle kilometres travelled. The greatest dis-benefit is with Option D West and East variants. Dis-benefits in CO_{2e} emissions are not uncommon for schemes that create additional road space to relieve congestion in other areas. However, over the 60-year appraisal period the changes in CO_{2e} emissions are relatively very small in the context of regional emissions for road transport and do not account for electrification of the vehicle fleet beyond 2030.

5.5. LANDSCAPE

INTRODUCTION AND METHODOLOGY

5.5.1. This section sets out a simple landscape and visual assessment for the Norwich Western Link Stage 2 Options Selection Report and considers the potential effects on landscape character and visual receptors resulting from each of the six proposed scheme options. The assessment of landscape character and visual amenity are two distinct but related areas.

5.5.2. Landscape Character Assessment is the process whereby the different elements that form the landscape are recorded and assessed. DMRB Interim Advice Note (IAN) 135/10 describes the process as “the assessment of a combination of physical (e.g. landform, vegetation, buildings), aesthetic/perceptual (e.g. scale, appearance, tranquillity) and cultural/social (e.g. human interaction, land use, heritage) aspects which together make up the character of the area. An assessment is also made as to the quality, or condition, of the landscape, which involves consideration of the physical state of the landscape and of the features and elements which make up landscape character”.

5.5.3. Visual amenity assessment is the assessment of the impact to receptors from locations inhabited and frequented by people. Effects upon the visual amenity, which is defined in IAN 135/10 as “the value of a particular area or view in terms of what is seen”, are also considered and assessed.

5.5.4. Preliminary site visits were undertaken in January and March 2019.

STUDY AREA

5.5.5. In accordance with IAN 135/10 the landscape assessment study area “should cover the proposed project site and wider landscape context within which the project may influence landscape”.

5.5.6. The IAN 135/10 states for visual assessment the study area is the “area within which a proposed development may have an influence or effect on visual amenity”.

5.5.7. For the purposes of this assessment, the study area for each option comprises a 1km buffer either side for both landscape and visual impacts, extending to the same extent at the junctions, this assumes that the likelihood of significant effects beyond this would be relatively low. Whilst distant views may be possible beyond 1km, within which there may be potential for awareness of each option, the likelihood of significant effects is substantially reduced.

METHODOLOGY

5.5.8. The following tables set out the effect rating criteria used within this assessment for landscape and visual effects. The ratings have been used to identify where potential significant effects may occur to help with the selection of the preferred route from the six options.

5.5.9. **Table 5.30** below identifies the landscape effect ratings, based on IAN 135/10 and the descriptor for each rating.

Table 5.30 – Landscape effect ratings

Effect Rating	Descriptor
Very Large (Beneficial)	The project would: ▪ Greatly enhance the character (including quality and value) of the landscape ▪ Create an iconic high quality feature and/or series of elements. ▪ Enable a sense of place to be created or greatly enhanced.
Large Beneficial (Positive)	The project would: ▪ Enhance the character (including quality and value) of the landscape. ▪ Enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development. ▪ Enable a sense of place to be enhanced.
Moderate Beneficial (Positive)	The project would: ▪ Improve the character (including quality and value) of the landscape. ▪ Enable the restoration of characteristic features and elements partially lost or diminished as a result of changes from inappropriate management or development. ▪ Enable a sense of place to be restored.
Slight Beneficial (Positive)	The project would: ▪ Complement the character (including quality and value) of the landscape. ▪ Maintain or enhance characteristic features and elements. ▪ Enable some sense of place to be restored.
Neutral Effect	The project would: ▪ Maintain the character (including quality and value) of the landscape. ▪ Blend in with characteristic features and elements. ▪ Enable a sense of place to be retained.
Slight Adverse (Negative)	The project would: ▪ Not quite fit the character (including quality and value) of the landscape. ▪ Be at variance with characteristic features and elements. ▪ Detract from a sense of place.
Moderate Adverse (Negative)	The project would: ▪ Conflict with the character (including quality and value) of the landscape. ▪ Have an adverse impact on characteristic features or elements. ▪ Diminish a sense of place
Large Adverse (Negative)	The project would: ▪ Be at considerable variance with the character (including quality and value) of the landscape. ▪ Degrade or diminish the integrity of a range of characteristic features and elements. ▪ Damage a sense of place.

Effect Rating	Descriptor
Very Large Adverse (Negative)	The project would: ▪ Be at complete variance with the character (including quality and value) of the landscape. ▪ Cause the integrity of characteristic features and elements to be lost. ▪ Cause a sense of place to be lost.

5.5.10. **Table 5.31** below identifies the visual effect ratings, based on IAN 135/10 and the descriptor for each rating.

Table 5.31 – Visual Effects Ratings

Effect Rating	Descriptor
Very Large (Beneficial)	The project would create an iconic new feature that would greatly enhance the view.
Large Beneficial (Positive)	The project would lead to a major improvement in a view from a highly sensitive receptor.
Moderate Beneficial (Positive)	The proposals would cause obvious improvement to a view from a moderately sensitive receptor, or perceptible improvement to a view from a more sensitive receptor.
Slight Beneficial (Positive)	The project would cause limited improvement to a view from a receptor of medium sensitivity, or would cause greater improvement to a view from a receptor of low sensitivity.
Neutral Effect	No perceptible change in the view.
Slight Adverse (Negative)	The project would cause limited deterioration to a view from a receptor of medium sensitivity, or cause greater deterioration to a view from a receptor of low sensitivity.
Moderate Adverse (Negative)	The project would cause obvious deterioration to a view from a moderately sensitive receptor, or perceptible damage to a view from a more sensitive receptor.
Large Adverse (Negative)	The project would cause major deterioration to a view from a highly sensitive receptor and would constitute a major discordant element in the view.
Very Large Adverse (Negative)	The project would cause the loss of views from a highly sensitive receptor and would constitute a dominant discordant feature in the view.

BASELINE CONDITIONS

5.5.11. There are no statutory designated sites for landscape within the identified study area.

5.5.12. The following Natural England National Character Area (NCA) profiles extend to within the study areas:

- NCA 78 – Central North Norfolk; and
- NCA 85 – Mid Norfolk.

5.5.13. The study area also incorporates three separate local landscape character assessments which classify local Landscape Character Area's (LCA) using reference ID's specific to their district council area. These are outlined below along with the name of the LCA's:

- South Norfolk District Councils; South Norfolk Landscape Assessment (2001):
  - LCA A3 – Tud Rural River Valley;
  - LCA G1 – Easton Fringe Farmland;
- Broadland District Council; Landscape Character Assessment; SPD (2013) including:
  - LCA A1 – River Wensum;
  - LCA D2 – Weston Green;
- Breckland District Landscape Character Assessment (2007), including:
  - LCA A4 – River Wensum and Blackwater;
  - LCA A5 – Upper Tud Valley; and
  - LCA B6 – Wensum and Tud Tributary Farmland.

5.5.14. The six proposed routes are located to the west of Norwich between the A1067 and the A47 and cross the Wensum and Tud River valleys. The area is characterised by a low lying gently undulating landscape, rarely exceeding 50m Above Ordnance Datum (AOD) and dissected by river valleys creating a more intricate landscape to the north and south of the study area that comprise small fast-flowing rivers and wide, lush river valleys with wooded valley slopes.

5.5.15. It is a relatively tranquil agricultural landscape with extensive areas of arable land and some pasture along valley floors, much of it having been enclosed by the 16th century with a sporadically rationalised patchwork field system, sinuous lanes and mixed hedges with hedgerow oaks. Woodland typically comprises mature oak, beech woodland and areas of conifer plantation resulting in a relatively well-wooded landscape.

5.5.16. There are 18th-century estates, such as Morton and Weston Hall in the north with its associated parkland and associated farmland, and a variety of churches such St Peters in Ringland, which are often prominent features of the skyline. There is a mix of villages and numerous scattered farmhouses and property within a complex network of minor roads. There is also a sporadic network of public rights of ways, with Marriott's Way and Sustrans Route 1 sharing a former railway line to the north of the A1067 and within the defined study area.

Route Option A

5.5.17. The following landscape character areas (LCA), taken from desk-based information, are located within the study area and are described in a north to south orientation:

- The most northerly 1km is located within A1: River Wensum;

- 2km within D2: Weston Green;
- 3km within B6 - Wensum and Tud Tributary Farmland; and
- The A47 junction within A5: Upper Tud Valley.

5.5.18. The landscape is predominantly arable farmland, with small to medium scale regular fields enclosed by trimmed hedgerow and infrequent mature trees. Topography is gently undulating rising towards the central section of the study area and dropping away to the north into a shallow lowland meadow river valley containing the River Wensum and associated small lakes, which are remnants of former gravel extraction. To the south of the study area is the smaller river valley which contains the River Tud. There are infrequent belts of woodland, predominantly associated with farmsteads and isolated property or as screening to development, such as former gravel extraction, WWII Airfield, Roar!! Dinosaur Adventure Park and Weston Golf Course in the north.

5.5.19. Settlement is sparse throughout this landscape, often isolated property and farmsteads; the larger settlements are Lenwade in the north and Honingham in the south. The Old Airfield, now a solar farm, wind farm and turkey farm are notable developments in this landscape.

5.5.20. Traffic is perceptible along the A1067, A47 and to a lesser degree the B1535 that runs in a broadly north south direction and links the two A roads. In the north, development such as Roar!! Dinosaur Adventure Park, Weston Park Golf Club have altered and fragmented the landscape and have resulted in reduced tranquillity compared with the wider landscape, however woodland surrounding these developed sites reduce their impact on the wider landscape.

Route Option B West

5.5.21. The following landscape character areas are located within the study area and are described in a north to south orientation:

- 1.5km is within A1: River Wensum;
- 4km within D2: Weston Green; and
- The approach and junction with A47 is within the transition between D2: Weston Green, B6: Wensum and Tud Tributary Farmland and A5: Upper Tud Valley.

5.5.22. The landscape is gently undulating arable farmland, with a plateau to the south, located between two shallow lowland meadow river valleys. River Tud in the south and River Wensum in the north being the larger of the valleys with noticeable differences in character of wet meadow, a mosaic of lakes and drainage ditches. The fields are small to medium, regular in shape contained by trimmed hedgerow and infrequent mature trees; some fields have been turned over for pig rearing.

5.5.23. Mixed plantation woodland is a common feature through this landscape, reflecting the field pattern. The overhead power lines to the east and two wind turbines to the west on the former WWII airfield, along with the A47 and A1067, are noticeable human influences within this landscape, reducing the perception of tranquillity. Settlement within the study area of Route Option B West is sparse, mainly small farmsteads, with the biggest settlements being Ringland and Weston Longville located within the central part of this landscape and Honingham to the south. Roads are generally small lanes that link the two main road corridors to the north and south; these historic lanes follow the field boundaries and blocks of woodland within the landscape.

Route Option B East

5.5.24. The following landscape character areas are located within the study area and are described in a north to south orientation:

- From the north 1.5km is within A1: River Wensum;
- 4km within D2: Weston Green; and
- The approach and junction with A47 is within the transition between D2: Weston Green, B6: Wensum and Tud Tributary Farmland and A5: Upper Tud Valley.

5.5.25. The landscape is gently undulating arable farmland, flattening slightly to the south, and is located between two shallow lowland meadow river valleys. River Tud in the south and the River Wensum in the north are the larger of the two valleys with noticeable differences in character of wet meadow, mosaic of lakes and drainage ditches. Fields are small to medium, regular in shape and contained by trimmed hedgerow and infrequent mature trees, some fields have been turned over to pig rearing.

5.5.26. Mixed plantation woodland is a common feature through this part of the landscape, often reflecting the pattern of field boundaries. The overhead power lines to the east and two wind turbines to the west on the former WWII airfield, along with the A47 and A1067, are noticeable human influences within this landscape, reducing the perception of tranquillity. Settlement within the study area of Route Option B East is sparse, mainly small farmsteads, with the biggest settlements being Ringland and Weston Longville located within the central part of this landscape and Honingham to the south. Morton Hall is also a notable 17th century house, surrounded by mature woodland. Roads are generally small lanes that link the two main road corridors to the north and south; these historic lanes follow the field boundaries and blocks of woodland within the landscape.

Route Option C

5.5.27. The following landscape character areas are located within the study area and are described in a north to south orientation:

- From the north, 2km is within A1: River Wensum;
- 4km within D2: Weston Green; and
- The approach and junction with A47 is within the transition between D2: Weston Green, B6: Wensum and Tud Tributary Farmland and A5: Upper Tud Valley.

5.5.28. The landscape is gently undulating arable farmland, flattening to the south, located between two shallow lowland meadow river valleys. River Tud in the south, and River Wensum in the north are the larger of the valleys with noticeable differences in character of wet meadow, mosaic of lakes and drainage ditches. Fields are small to medium, regular in shape and contained by trimmed hedgerow and infrequent mature trees; some fields to the east have been turned over to pig rearing.

5.5.29. Mixed plantation woodland is a common feature through this landscape, often following the pattern of field boundaries. The overhead power line to the east, two wind turbines to the west of the former WWII airfield, and the A47 and A1067 are noticeable human influences within this landscape, reducing the perception of tranquillity. Settlement within the study area of Route Option C is sparse, mainly small farmsteads, with the biggest settlements being Ringland and Weston Longville located within the central part of this landscape and Honingham to the south. Morton Hall is also a notable 17th century house, surrounded by mature woodland. Roads are generally small lanes that link the two main road corridors to the north and south; these historic lanes follow the field boundaries and blocks of woodland within the landscape.

Route Option D West

5.5.30. The following landscape character areas are located within the study area and are described in a north – south orientation:

- The north 2km is within A1: River Wensum;
- 4.5 km is within D2: Weston Green; and
- The approach and junction with A47 is within the transition between the D2: Weston Green, A3: Tud Rural River Valley, and G1: Easton Fringe Farmland.

5.5.31. The landscape is gently undulating with small to medium arable fields which are regular in shape, rising to a flatter landform to the south, located between two shallow river valleys. River Tud in the south and River Wensum in the north are the larger of the valleys with noticeable differences in character of wet meadow and mosaic of lakes and drainage ditches. Fields are contained with mature hedgerows and infrequent mature trees; some fields have been turned over to pig rearing altering the texture of the landscape.

5.5.32. Irregular blocks of woodland are common through this landscape, disturbing the order and leading to a less extensive scale. There are scattered farmsteads and small settlements through this landscape, the most notable is Ringland to the east. Roads are generally small lanes that link the two main road corridors to the north and south; these historic lanes follow the field boundaries and blocks of woodland within the landscape. The overhead power line to the east and west of Route Option D, the two wind turbines to the west, and the A47 and A1067 are noticeable within the flatter landscape, reducing the perception of tranquillity in this landscape.

Route Option D East

5.5.33. The following landscape character areas are located within the study area and are described in a north – south orientation:

- The north 2km is within A1: River Wensum;
- 4.5 km is within D2: Weston Green; and
- The approach and junction with A47 is within the transition between the D2: Weston Green, A3: Tud Rural River Valley, and G1: Easton Fringe Farmland.

5.5.34. The study area and associated landscape is shared with Option D West and is described above in paragraphs 5.3.31 and 5.3.32.

LANDSCAPE EFFECTS

Route Option A

5.5.35. The following landscape impacts have been identified as likely to arise as a result of Route Option A:

- The western edge of Lenwade Plantation would be removed by this option, and woodland around Woodforde farm would be divided into two separate isolated woodlands and there would be further removal of part of the woodland at the B1535/ A47 junction.
- There would be truncating and removal of sections of approximately 14 hedgerows, and removal of approximately nine mature hedgerow trees.
- There would be the substantial removal of one field, approximately eight fields would be subdivided, and six fields would be reduced in size or have their boundaries modified.

5.5.36. Route Option A would lead to minor changes to the landscape at a local level, these being associated with the modification and straightening of the current B1535, particularly in the south where the route deviates more markedly from the current alignment.

5.5.37. The division of fields, particularly between Loke Farm and Wood Farm, and the loss of hedgerows and trees through this section would leave small irregular fields out of character with the wider landscape.

5.5.38. Route Option A, largely running at grade, would result in this option's influence on the wider landscape being less noticeable than other options, due to an absence of significant changes to the landform. The greatest effects would be the introduction of four pedestrian crossing bridges which would introduce taller visually intrusive elements into the landscape and reduce tranquillity locally.

5.5.39. There would likely be neutral effects on LCA A1 and A5 and slight adverse effects on LCA D2 and LCA B6.

Route Option B West

5.5.40. The following landscape impacts have been identified as likely to arise as a result of Route Option B West:

- There would be removal of and division of woodland at Scotchwood Hills, The Spinney, and woodland following The Broadway and Foxburrow Plantation.
- There would be truncating and removal of sections of approximately 19 hedgerows, and loss of approximately 14 mature hedgerow trees.
- There would be approximately 12 fields that would be subdivided, and 10 fields would be reduced in size and boundaries modified.
- Loss of existing vegetation along the existing A1067 as a result of upgrades to the existing road.

5.5.41. There would be noticeable changes to the landscape at a local level, with the proposed route option being dualled, creating a new substantial feature within the local landscape, particularly through the central section of the study area.

5.5.42. The division of fields would alter the landscape pattern along Route Option B West. The impact of the southern part of Route Option B West is lower as there are more frequent field boundaries and associated hedgerow trees in this location, limiting the influence of the change on the wider landscape. In contrast, the loss of hedgerows and trees in the north and centre would be conspicuous and lead to the open aspect of the landscape being furthered, framing views within the landscape.

5.5.43. This option, predominantly set on short sections of embankment in the north and the south, would result in the route being visually intrusive within the wider landscape to the north and south, particularly along the Wensum Valley. There is a substantial cutting in the central section and the tie in to A47. The road bridges over Ringland Lane, Weston Road, Breck Road and the tie-in at Attlebridge, would have the greatest impact. Furthermore, the introduction of one pedestrian crossing bridge in the south of the route option would introduce taller intrusive elements into the landscape and locally reduce tranquillity.

5.5.44. Vegetation removal as a result of the proposed upgrade to the A1067 would result in the existing corridor being marginally more apparent within the landscape as it runs parallel with the River Wensum to the north.

5.5.45. There would likely be a slight adverse effect on LCA A1, moderate adverse effects on LCA D2, and slight adverse effects on LCA B6 and LCA A5.

Route Option B East

5.5.46. The following landscape impacts have been identified as likely to arise as a result of Route Option B East:

- There would be loss of and division of the woodland west of Morton Hall, The Spinney, woodland following The Broadway and Foxburrow Plantation;
- There would be truncating and removal of sections of approximately 26 hedgerows, and loss of approximately 14 mature hedgerow trees; and
- There would be approximately 12 fields that would be subdivided, and 12 fields would be reduced in size and boundaries modified.
- Loss of existing vegetation along the existing A1067 as a result of upgrades to the existing road.

5.5.47. There would be noticeable changes to the landscape at a local level due to the dualling of the route creating a new substantial feature within the local landscape, particularly through the central section of the study area, the tie in with the A1067 and where the proposed viaduct crosses the River Wensum.

5.5.48. The division of fields would alter the pattern locally, however the impact is likely to be lower in the south of the study area where fields are typically smaller and less structured. In contrast, the loss of hedgerows and trees in the north and centre would further lead to the open aspect of the landscape becoming more apparent, framing views within the landscape.

5.5.49. Similarly, to Route Option B West, this route is predominantly set on embankment to the north and south, with cutting in the central section and would be visually intrusive in the wider landscape, particularly the viaduct in the north crossing the River Wensum Valley. The road bridge over Ringland Lane and the tie in at Attlebridge would have the greatest impact. Furthermore, the introduction of a pedestrian crossing bridge in the south and would introduce a taller intrusive element into the landscape and locally reduce tranquillity.

5.5.50. Vegetation removal as a result of the proposed upgrade to the A1067 would result in the existing corridor being marginally more apparent within the landscape as it runs parallel with the River Wensum to the north.

5.5.51. There would likely be moderate adverse effects on LCA A1 and on LCA D2, and slight adverse effects on LCA B6 and LCA A5.

Route Option C

5.5.52. The following landscape impacts have been identified as likely to arise as a result of Route Option C:

- There would be removal of and division of the woodland that forms Long Plantation, Rose Carr, and woodland following The Broadway and Foxburrow Plantation.
- There would be truncating and loss of sections of approximately 19 hedgerows, and removal of approximately 14 mature hedgerow trees.
- There would be approximately 11 fields that would be subdivided, and 10 fields would be reduced in size with modified boundaries.

5.5.53. There would be noticeable changes to the landscape at a local level, with the proposed route option comprising a dual-carriageway and creating a substantial new feature within the local landscape, particularly where the proposed viaduct crosses the River Wensum.

5.5.54. The division of fields would alter the pattern locally, however the impact is likely to be reduced in the south of the study area where fields are typically smaller and less structured. Therefore, the influence of Route C is relatively lower in this location as there are more frequent field boundaries and associated hedgerow trees that would reduce the impacts being perceived more broadly within the landscape. In contrast, the loss of hedgerows and trees in the north and centre would lead to the open aspect of the landscape being furthered, framing views within the landscape, particularly associated with the section proposed on a viaduct.

5.5.55. The route would be more visually intrusive to the wider landscape, due to more substantial height of embankments to accommodate the undulating landform that is more pronounced to the east. Where the road is in cutting, and in combination with the undulating landscape and belts of trees views to the wider landscape would be limited. However, the viaduct over the River Wensum and A1067 tie in, along with the three road bridges over Ringland Lane, Weston Road and Breck Road, along with the pedestrian crossing bridge in the south, would introduce taller intrusive elements into the landscape and locally reduce tranquillity.

5.5.56. There would likely be moderate adverse effects on LCA A1 and LCA D2, and slight adverse effects on LCA B6 and LCA A5.

Route Option D West

5.5.57. The following landscape impacts have been identified as likely to arise as a result of Route Option D West:

- There would be removal of and division of the woodland of Primrose Grove, Church Hill Plantation, Dryhill plantation, Aves Gap, and south of Harman's Grove.
- There would be truncating and loss of sections of approximately 19 hedgerows, and loss of approximately eight mature hedgerow trees.
- There would be approximately 13 fields that would be subdivided, and nine fields would be reduced in size with modified boundaries.

5.5.58. There would be noticeable changes to the landscape at a local level, with the route option comprising a dual-carriageway, creating a new feature within the local landscape, particularly the proposed viaduct crossing of the River Wensum in the north and bridge crossing of the River Tud to the south.

5.5.59. The division of fields would locally alter the landscape pattern, causing fragmentation and disruption to the existing field structures, particularly in the south. The removal of hedgerows and trees along the route would create framed views through the landscape.

5.5.60. The route, largely in shallow cutting with short sections on embankment in the central part and the approach to the A47 and viaduct, would be visually intrusive to the wider landscape. To some degree the undulating landscape and belts of trees would serve to limit some views to the wider landscape. However, the viaduct over the River Wensum and A1067 tie in, the bridge crossing of the River Tud, along with the local road bridges, particularly over Ringland Lane, and Honningham Lane would introduce taller, visually intrusive elements into the landscape and reduce tranquillity locally.

5.5.61. There would likely be moderate adverse effects on LCA A1 and LCA D2, and neutral effects on LCA A3 and LCA G1.

Route Option D East

5.5.62. The following landscape impacts have been identified as likely to arise as a result of Route Option D East:

- There would be removal of and division of the woodland of Primrose Grove, Church Hill Plantation, Dryhill plantation, Aves Gap, and south of Harman's Grove.
- There would be truncating and loss of sections of approximately 19 hedgerows, and loss of approximately eight mature hedgerow trees.
- There would be approximately 13 fields that would be subdivided, and nine fields would be reduced in size with modified boundaries.

5.5.63. There would be noticeable changes to the landscape at a local level, with the route option comprising a dual-carriageway, creating a new feature within the local landscape, particularly the proposed viaduct crossing of the River Wensum in the north and bridge crossing of the River Tor to the south.

5.5.64. The division of fields would locally alter the landscape pattern, causing fragmentation and disruption to the existing field structures, particularly in the south. The removal of hedgerows and trees along the route would create framed views through the landscape.

5.5.65. The route, a mix of embankment and cutting, would be visually intrusive to the wider landscape, particularly where it crosses over small valleys. To some degree the undulating landscape and belts of trees would limit some views to the wider landscape. However, the viaduct over the River Wensum and A1067 tie in, the bridge crossing of the River Tud, along with local road bridges, particularly over Ringland Lane, Honningham Lane, and Weston Road (east) would introduce taller visually intrusive elements into the landscape and reduce tranquillity locally.

5.5.66. There would likely result in moderate adverse effects on LCA A1 and LCA D2, and neutral effects on LCA A3 and LCA G1.

VISUAL EFFECTS

Route Option A

5.5.67. Route A will predominantly follow the existing road alignment. There would be minor alterations along the route, but where this change is perceptible it would be comparable to the baseline view of an existing road, albeit a less prominent element.

5.5.68. Where Route A departs from the B1535, north of The Old Airfield and crosses the field east of Woodforde Farm there would be a perceptible change, although heavily screened by mature vegetation in the view from Woodforde Farm, the road would be closer in the view, than the existing view for Leys Farm and Pond Farm. Where the road departs Sandy Lane towards Wood Lane, running at grade there would likely be a large change in the view from an agricultural field to users of PRoW East Tuddenham FP1 and Walnut Tree Farm.

5.5.69. There would likely be negligible to slight adverse effects to Woodforde Farm, Leys Farm and Pond Farm and moderate adverse effects to PRoW East Tuddenham FP1 and properties associated with Walnut Tree Farm, including an isolated dwelling to the east.

Route Option B West

5.5.70. Route B West runs predominantly on embankment from A1067, where it will be most visually prominent but limited due to mature belts of woodland limiting the influence. The route enters cutting south of Ringland Lane, partially screening the route from Field and Pump Farms, where it would be closer in the view than the existing road, and traffic would be perceptible.

5.5.71. The route is on embankment south of The Broadway, to the east of Wood Farm, where it would be visible to Wood Farm and to users of PRoW Honingham RB1 and be a noticeable addition into views.

5.5.72. There would likely be slight adverse effects to Field Farm, properties west of Pump Farm and Wood Farm. There would likely be moderate adverse effects to PRoW Honingham RB1, and Pump Farm.

Route Option B East

5.5.73. The viaduct over River Wensum would result in a large change in the view to Ivy Cottages, and to a lesser degree The Bungalow. The route would be perceptible to properties in Weston Longville. The route enters cutting south of Ringland Lane, helping to screen it from views from Field Farm, and properties west of Pump Farm. The route is on embankment south of The Broadway, where it would be a noticeable addition to views from PRoW Honingham RB1 and Wood Farm.

5.5.74. There would likely be slight adverse effects to views from Weston Longville, Field Farm, properties west of Pump Farm, and Wood Farm. There would likely be moderate adverse effects to views from The Bungalow, Pump Farm, and PRoW Honingham RB1. Large adverse effects are anticipated to views from Ivy Cottages.

Route Option C

5.5.75. The viaduct over the River Wensum would result in a large change in views with the introduction of a new prominent element within views from Old Hall Farm and PRoW Attlebridge FP5. The route is broadly at grade south of Ringland Road, raising onto embankment over Weston Road resulting in a noticeable addition in views from Field Farm, Pump Farm and properties south of Pump Farm. The route enters cutting, raising into embankment east of wood farm which would be noticeable change in the views from Wood Farm, before entering cutting on the approach to the A47 tie in, resulting in a noticeable change to views from Honingham RB1.

5.5.76. There would likely be slight adverse effect on views from Field Farm, and Wood Farm and moderate adverse effects on views from , PRoW Honingham RB1, and large adverse for properties adjacent to Old Hall Farm and PRoW Attlebridge FP5.

Route Option D West

5.5.77. The viaduct over the River Wensum would result in a large change in views with the introduction of the new prominent element within views from Old Hall Farm, PRoW Attlebridge FP5, Ringland FP1 and FP2. The road enters cutting through Primrose Grove, raising into embankment over Ringland Lane, where it would be a noticeable addition into views from properties on the western edge of Ringland. The road is predominantly in cutting to the south, reducing the roads visibility in views from Breck Barn. There are small sections on embankment, particularly the tie in to the A47 where it would be visually prominent, particularly to views from the western edge of Ringland and also the viaduct over River Tud which would be a large change in views experienced from properties adjacent to Church Farm.

5.5.78. There would likely be slight adverse effects on views from properties on the western edge of Ringland and Breck Barn. There would be moderate adverse effects on views from PRoW Attlebridge FP5, Ringland FP1 and FP2, and large adverse for properties adjacent to Church Farm, Old Hall Farm, Low Farm and PRoW Attlebridge FP5.

Route Option D East

5.5.79. The viaduct over the River Wensum would result in a large change in views with the introduction of the new prominent element within views from Old Hall Farm, PRoW Attlebridge FP5, Ringland FP1 and FP2. The road enters cutting through Primrose Grove, raising into embankment over Ringland Lane, where it would be a noticeable addition into views from properties on the western edge of Ringland. The road is predominantly in cutting to the south, reducing the roads visibility in views from Breck Barn. There are small sections on embankment, where it would be visually prominent, particularly to views from the western edge of Ringland and also the viaduct over River Tud which would be a large change, but less impactful than Route Option D West in views experienced from properties adjacent to Church Farm as a result of greater intervening distance.

5.5.80. There would likely be slight adverse effects on views from properties on the western edge of Ringland, Breck Barn, and properties adjacent to Church Farm. There would be moderate adverse effects on views from Ringland FP1 and FP2, and large adverse for Old Hall Farm, Low Farm, and PRoW Attlebridge FP5.

5.5.81.

MITIGATION

5.5.82. At this stage in the landscape assessment, the mitigation for all route options is broadly similar and therefore it has been combined in this report. The assumption for the inclusion of appropriate mitigation is outlined below.

5.5.83. For all the route options, new and replacement hedgerows along the route would contribute to the restoration of the landscape pattern. Woodland planting to screen views or connect with existing blocks would also contribute to the restoration of landscape features. Woodlands, hedgerows and hedgerow trees would contribute towards screening and/or filtering views where the route would be a new feature in the view.

5.5.84. Opportunities would also exist to incorporate remnant field corners or former boundaries into woodland blocks and/or new blocks of woodland to reduce the impact of the loss of associated woodland, provide specific screening to visual receptors, and reduce the effect of the scheme on the perception of landscape character.

5.5.85. For Route Options B East, C and D, which include a viaduct over the River Wensum, the design of the viaduct and supporting pillars should be designed to reduce vertical elevation. Furthermore, appropriate finishes and style to reflect the local vernacular would assist in reducing the structure's overall prominence.

CONSULTATION

5.5.86. No statutory consultation has been undertaken, specific to landscape, at this stage for any of the route options.

CONCLUSION

5.5.87. Option A would likely result in neutral effects on LCA A1 and A5 and slight adverse effects on LCA D2 and LCA B6. There would likely be negligible to slight adverse effects to Woodforde Farm, Leys Farm and Pond Farm and moderate adverse effects to PRoW East Tuddenham FP1 and properties associated with Walnut Tree Farm.

5.5.88. Option B West would likely result in slight adverse effects on LCA A1, moderate adverse effects on LCA D2, and slight adverse effects on LCA B6 and LCA A5. There would likely be slight adverse effects to Field Farm, properties west of Pump Farm, and Wood Farm. There would likely be moderate adverse effects to PRoW Honingham RB1, and Pump Farm.

5.5.89. Option B East would likely result in moderate adverse effects on LCA A1 and on LCA D2, and slight adverse effects on LCA B6 and LCA A5. There would likely be slight adverse effects to views from Weston Longville, Field Farm, properties west of Pump Farm, and Wood Farm. There would likely be moderate adverse effects to views from The Bungalow, Pump Farm and PRoW Honingham RB1. Large adverse effects are anticipated to views from Ivy Cottages.

5.5.90. Option C would likely result in moderate adverse effects on LCA A1 and LCA D2, and slight adverse effects on LCA B6 and LCA A5. There would likely be slight adverse effect on views from Field Farm, and Wood Farm, and moderate adverse effects on views from PRoW Honingham RB1, and large adverse for properties adjacent to Old Hall Farm and PRoW Attlebridge FP5.

5.5.91. Option D West would likely result in moderate adverse effects on LCA A1 and LCA D2, and neutral effects on LCA A3 and LCA G1. There would be likely slight adverse effects on views from properties on the western edge of Ringland and Breck Barn. There would be moderate adverse effects on views from Ringland FP1 and FP2, and large adverse for properties adjacent to Church Farm, Old Hall Farm, Low Farm and PRoW Attlebridge FP5.

5.5.92. Option D East would likely result in moderate adverse effects on LCA A1 and LCA D2, and neutral effects on LCA A3 and LCA G1. There would likely be slight adverse effects on views from properties on the western edge of Ringland and Breck Barn and properties adjacent to Church Farm. There would be moderate adverse effects on views from Ringland FP1 and FP2, and large adverse for Old Hall Farm, Low Farm, and PRoW Attlebridge FP5.

5.5.93. Options that avoid a crossing of the River Wensum on a viaduct (Options A and B West) would be less impactful on the perception of landscape character, in particular the horizontal alignment of Option A broadly reflects the alignment of existing local roads within the landscape and would require less significant changes to the landform associated with its vertical alignment. Of those options that include a crossing of the River Wensum on a viaduct Options D West and East alignments would result in moderate adverse effects, however within the context of the landscape they are likely to provide opportunities for mitigation to tie into existing woodland within the landscape. In contrast Option C crosses the open landscape, with a reduced capacity to incorporate existing woodland blocks into the mitigation design. Option C also includes a longer viaduct crossing of the River Wensum.

5.6. TOWNSCAPE

5.6.1. Townscape is defined in the Guidelines for Landscape and Visual Impact Assessment (3rd Edition) as ‘areas where the built form is dominant’. The study area comprises a largely rural landscape with small clusters of properties or isolated dwellings that do not readily combine to form a discernible area of townscape.

5.6.2. The nearest substantial settlements are Taverham and Queens Hill between 1.5 and 2km from the most easterly option and forming the outlying suburbs to Norwich. Neither of these areas would be materially impacted by the proposed options, therefore potential impacts on townscape have been scoped out of the appraisal and no further reporting will be carried out.

5.7. HISTORIC ENVIRONMENT

5.7.1. Within the study area there are a number of statutorily designated and non-statutorily designated heritage assets. The assessment has been informed by the proximity of these assets and through an identification of their value. To reflect to rural location of the route options a 500m buffer for the identification of heritage assets has been applied, due to the longer views (and hence the potential impacts upon the setting of these assets). The 500m buffer is based on professional judgement and the characterisation of the area and any potential impacts on the setting of listed buildings. The historical designations assessed will include Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Local Planning Authority (LPA) Conservation Areas. Within the study area there are a total of 32 listed buildings, of which two are Grade I, three are Grade II* and 27 are Grade II. There are also two Scheduled Monuments in the study area: a round barrow south-east of the Lodges and a Tumulus in the warren.

5.7.2. The River Wensum Valley geology includes areas of natural sand and gravel which, along with the riverine topography, provide an indication of suitability for early settlement due to the preference for well-drained gravels close to predictable resources provided by rivers. The study area therefore has high potential for archaeological deposits, the value and integrity of which are not likely to be understood sufficiently to inform an assessment at this stage of the process.

5.7.3. This assessment uses information derived from the National Heritage List for England, the Norfolk Historic Environment Record and a Heritage Constraints Report for the Norwich Western Link which was produced by WSP in November 2018. WebTAG sheets have been produced for each option in accordance to DMRB guidance.

5.7.4. A site visit was undertaken on 6th June 2019. This was a rapid visual assessment of designated heritage assets potentially impacted by the scheme.

ROUTE OPTION A

Baseline Conditions

5.7.5. Within the Route Option A study area there are a total of 20 listed buildings, one of which is Grade II* and 19 are Grade II.

5.7.6. The route passes close to two Scheduled Monuments, the round barrow south-east of the Lodges which is 25m to the south-west of the A1067, and the Tumulus in the warren which is 120m to the north-east of the A1067.

5.7.7. The proposed route passes through the following non-designated heritage assets, as recorded on the Norfolk Historic Environment Record (HER):

- An area where metal detecting found a Roman brooch.
- An area where metal detecting found a prehistoric flint flake, part of an Early Bronze Age copper alloy flat axehead.
- An area where metal detecting found prehistoric flint flakes and Roman pottery.
- A moderate to high potential for previously unrecorded remains from these periods.
- A moderate potential for palaeoenvironmental remains in the Wensum and Tud Valleys.
- Weston Park, a post-medieval landscape park.
- Attlebridge World War Two Airfield.
- The later medieval settlement of Hungate Common.
- Honingham Park a post-medieval landscape park.

5.7.8. The archaeological sensitivity of the route, based on the distribution of known buried heritage assets and perceived potential for previously unrecorded remains, is considered medium.

Environmental Effects

5.7.9. There is the potential for physical impact from a drainage feature along Route Option A, south of Lenwade, on the Grade II listed building, Gates and Railings to Lenwade Lodge to Weston House due to its close proximity to the gatepiers of this listed building.

5.7.10. Route Option A will retain the route of the existing A1067 which goes through Attlebridge. Any infrastructure changes or increase in traffic noise would affect the setting of assets within the village including the Grade II* listed Church of St Andrew. This option is unlikely to impact on six of the Grade II listed assets in Lenwade due to intervening built structures and vegetation.

5.7.11. In addition to the potential for the drainage feature to produce a physical impact on the Grade II listed Gates and Railings to Lenwade Lodge to Weston House, it would also be subject to a visual impact of the new road and impacts by increased traffic noise. The route is likely to be prominent in views out towards the route from the Grade II listed Lenwade Mills, impacting on its wider rural setting through new road infrastructure, and traffic noise.

5.7.12. The wider setting of Route Option A would also be impacted by an increase in traffic noise and road infrastructure, which will impact on its significance. Three Grade II listed buildings at Weston Hall (Weston Hall, Garden House and Barn) would also be impacted as the assets are located in proximity to the route. Impacts on the settings of these assets would be from views of the route, traffic noise. Although not in close proximity to the route, long views out towards the new road will be likely from the Grade II listed Willows Farmhouse and the Grade II listed Green Farm House. Traffic noise would also likely impact on the setting of these assets.

5.7.13. Route Option A has a moderate to high potential to impact areas from which isolated prehistoric and Roman findings have been made. Furthermore, the route has a moderate potential for possible palaeoenvironmental remains in the Wensum and Tud valleys and a high potential for unrecorded remains, which could also be impacted. This route would potentially impact two post-medieval landscape parks, Attlebridge World War 2 airfield and the area of a later medieval settlement. There would be no direct impact on the two Scheduled Monuments.

ROUTE OPTION B WEST

Baseline Conditions

5.7.14. Within the Route Option B West study area there are a total of nine listed buildings, one of which is Grade I, one is Grade II* and seven are Grade II.

5.7.15. The proposed route passes through the following non-designated heritage assets, as recorded on the Norfolk Historic Environment Record (HER):

- Cropmarks of possible Roman field boundaries.
- The findspot of a Roman brooch.
- An area of metal detecting which found a Roman ring.
- An area of metal detecting which found Neolithic flint blade and Roman pottery.
- An area of metal detecting which found a medieval strap fitting and a post-medieval coin weigh.
- An area where a metal detecting has discovered a range of finds, including a Neolithic flint blade, a Late Saxon strap end, and Roman, Late Saxon, medieval and post medieval pottery.

- The earthworks and cropmarks of a series of medieval to post medieval boundaries and drains.
- Cropmarks of undated field boundaries.
- Cropmarks of undated field boundaries.
- Cropmarks of undated field boundaries.
- The possible course of an old road.
- Attlebridge World War 2 Airfield.
- Honingham Park, a post-medieval landscape park.

5.7.16. The archaeological sensitivity of the route, based on the distribution of known buried heritage assets and perceived potential for previously unrecorded remains, is considered medium.

Environmental Effects

5.7.17. There would be a potential physical impact on the Grade II listed The Lodge (formerly Morton Lodge) through dualling of the A1067 road.

5.7.18. Route Option B West will retain part of the existing A1067 route through Attlebridge, leaving the current route just to the west of the village. Any infrastructure changes or increase in traffic noise would affect the setting of assets within the village including the Grade II* listed Church of St Andrew. The settings of a group of five heritage assets around Morton Hall, including Grade II* Church of St Margaret and the Grade II listed Morton Hall, to the south of the route are likely to be impacted by traffic noise. However, this route is unlikely to be visually prominent in views out from these assets towards the road due to intervening woodland.

5.7.19. This option is likely to impact on the group of assets at Weston Longville including the Grade I listed Church of All Saints and boundary wall. It is unlikely that the route would be visually prominent in views out from assets towards the road due to intervening woodland. However, the agricultural land to the south-east of Weston Longville is historically part of the wider rural landscape which forms part of the setting for these assets. There would also be the potential for traffic noise impacts on the assets in the village.

5.7.20. Route Option B West has moderate to high potential to impact an area of possible Roman field boundaries and areas where isolated prehistoric and Roman finds have been made. It would also potentially impact a post-medieval landscape park, a World War 2 airfield, the course of and old road, field boundaries and areas where isolate finds of medieval and post-medieval have been made. There is a moderate potential for possible palaeoenvironmental remains in the Wensum and Tud valleys and high potential for previously unrecorded remains, which could also be impacted.

ROUTE OPTION B EAST

Baseline Conditions

5.7.21. Within the Option B East study area there are a total of nine listed buildings, one of which is Grade I, one is Grade II* and seven are Grade II.

5.7.22. The proposed route passes through the following non-designated heritage assets, as recorded on the Norfolk Historic Environment Record (HER):

- Cropmarks of possible Roman field boundaries.
- The findspot of a Roman brooch.
- An area of metal detecting which found a medieval strap fitting and a post-medieval coin weight.
- Cropmarks of undated field boundaries.

- Cropmarks of undated field boundaries.
- Cropmarks of undated field boundaries.
- The possible course of an old road.
- Attlebridge World War 2 Airfield.
- Honingham Park, a post-medieval landscape park.

5.7.23. The archaeological sensitivity of the route, based on the distribution of known buried heritage assets and perceived potential for previously unrecorded remains, is considered medium.

Environmental Effects

5.7.24. There would be no direct impacts on designated heritage assets.

5.7.25. Route Option B East will retain part of the route of the existing A1067 to the east of Attlebridge. This option includes the viaduct across the River Wensum, which would make the route prominent in views out from The Lodge, Grade II listed building, looking towards the south-east. The option would also impact on The Lodge's relationship to the group of five heritage assets located around Morton Hall, which includes the Grade II* listed Church of St Margaret and the Grade II listed Morton Hall. The setting of the assets around Morton Hall to the south of the route is likely to be impacted by traffic noise. However, the route is unlikely to be visually prominent in views out from this group of assets towards the road due to intervening woodland.

5.7.26. This option would impact on the group of assets at Weston Longville including the Grade I listed Church of All Saints and boundary wall. It is unlikely that the route would be visually prominent in views out from the assets in the village towards the road due to intervening woodland. However, the agricultural land to the south-east of Weston Longville is historically part of the wider rural landscape which forms part of the setting for these assets. There would also be the potential for traffic noise impacts on the heritage assets in the village.

5.7.27. Route Option B East could potentially impact an area of possible Roman field boundaries and where isolated Roman finds have been made, as there is a moderate to high potential for previously unrecorded remains from the prehistoric and Roman periods. There is a moderate potential for possible palaeoenvironmental remains in the Wensum and Tud valleys, which could be impacted by the route. The proposed route would potentially impact a post-medieval landscape park, a World War 2 airfield, the course of an old road and field boundaries.

ROUTE OPTION C

Baseline Conditions

5.7.28. Within the Route Option C study area there are a total of two Grade II listed buildings, Low Farm House and Berry Hall (unlikely to be impacted by the route).

5.7.29. The proposed route passes through the following non-designated heritage assets, as recorded on the Norfolk Historic Environment Record (HER):

- Cropmarks of a possible Roman field system.
- The findspot of prehistoric flint flakes.
- Cropmarks of possible Iron Age/Roman field boundaries.
- Cropmarks of a possible later medieval/post-medieval field system.
- Cropmarks of field boundaries and trackways of probable post medieval date.

- Cropmarks of a linear boundary or trackway of unknown, but possibly later medieval to post medieval date.
- Attlebridge World War Two Airfield.
- A World War One to World War Two military training site.
- Honingham Park, a post-medieval landscape park.

5.7.30. The archaeological sensitivity of the route, based on the distribution of known buried heritage assets and perceived potential for previously unrecorded remains, is considered low to medium.

Environmental Effects

5.7.31. There would be no direct impacts on designated heritage assets.

5.7.32. Route Option C is in close proximity to the Grade II listed Barn, 50m north west of Low Farm House, and would therefore impact on the setting of the with the loss of surrounding rural and agricultural land. The proposed viaduct across the River Wensum would be prominent in views out from the asset towards the north-east. Traffic noise would also be prominent in the asset's setting.

5.7.33. The Grade II listed Berry Hall is located approximately 350m south west of the southern end of the route, therefore there is unlikely to be a visual impact on this asset. Traffic noise from A47 is prominent in the setting of this asset and therefore, Route Option C is unlikely to significantly increase traffic noise.

5.7.34. The proposed route has a moderate to high potential for previously unrecorded remains from prehistoric and Roman periods and could therefore potentially impact a possible Roman field system and possible Iron Age/Roman field boundaries. There is a moderate potential for possible palaeoenvironmental remains in the Wensum valley, which could be impacted by the route. The proposed route would potentially impact later medieval/post-medieval field systems; field boundaries/trackways; Attlebridge Airfield; a military training site; and Honingham Park.

ROUTE OPTION D

5.7.35. Where there are differences between Route Options D West and east, these are noted within the text below.

Baseline Conditions

5.7.36. Within the Route Option D study area there are a total of five listed buildings, one of which is Grade I, one is Grade II* and three are Grade II. All listed buildings are within 500m of Route Option D West, two listed buildings are within 500m of Route Option D East.

5.7.37. The proposed route passes through the following non-designated heritage assets, as recorded on the Norfolk Historic Environment Record (HER):

- Cropmarks of a possible Roman or later medieval/post-medieval field system.
- Cropmarks of undated linear ditches likely to be former field boundaries of Roman or post-medieval date.
- The findspot of an Upper Palaeolithic flint blade.
- The findspot of Neolithic flint artefacts.
- The findspot of Neolithic flint artefacts.
- An area of fieldwalking which recovered Mesolithic and Neolithic worked flints and Iron Age pottery.

- The cropmarks of an area of enclosures and fields of probable Roman date (Route Option D East only).
- Cropmarks of a possible Roman or later medieval/post-medieval field system.
- Cropmarks of undated linear ditches likely to be former field boundaries of Roman or post-medieval date.
- Cropmarks of fragmentary field boundaries and trackways of unknown date.
- The site of World War Two practice trenches and pits and possible gun emplacements.
- The site of probable World War Two weapon pits.
- An area of fieldwalking which recovered medieval and post-medieval pottery sherds.
- The earthworks of a series of platforms and ditched enclosures relating to former medieval tofts (small farms) (Route Option D West only).
- The findspot of a foot from a late medieval copper alloy vessel (Route Option D East only).

5.7.38. The archaeological sensitivity of the route, based on the distribution of known buried heritage assets and perceived potential for previously unrecorded remains, is considered medium to high.

Environmental Effects

5.7.39. The proximity of the Grade II listed Barn 50m from Low Farm House means that views out from the asset towards Route Option D are likely which will affect its rural setting. The viaduct is also likely to be prominent in views out from this asset and impacts from traffic noise are also likely to affect it.

5.7.40. Increases in traffic noise could also potentially impact on heritage assets in Ringland, including the Grade I listed Church of St Peter. Intervening vegetation means that views of the route are unlikely, although there would be an impact to setting through traffic noise. The Grade II listed buildings, Church Farm House and Barn at Church Farm, are located 150m to the west of the route and views of the route are likely as are impacts from traffic noise. Therefore, the setting of the assets would be impacted.

5.7.41. The Grade II* listed Church of St Andrew is located off the A47, 500m to the west of the southern end of the route whereby views of the route are unlikely. Traffic noise is already prominent in the setting of this asset and therefore any traffic noise from the route is unlikely to impact on the asset's setting.

5.7.42. Route Option D East would take the route further to the east of the Grade II listed Church Farm House and Barn at Church Farm reducing the impact of the option on these assets.

5.7.43. Route Option D has a moderate to high potential for previously unrecorded remains from the prehistoric and Roman periods and could potentially impact possible Roman field systems and field boundaries. Route Option D East could impact and area of Roman enclosures. The route passes through an area where relatively rare Mesolithic flint tools have been recovered. There is a moderate potential for possible palaeoenvironmental remains in the Wensum and Tud valleys and a high potential for previously unrecorded remains from these periods, which could also be impacted.

5.7.44. The proposed route would potentially impact later medieval field systems, field boundaries, ditches and trackways. The site of World War 2 practice trenches and weapons facilities could be impacted. Route Option D West could impact an area of earthworks of medieval tofts (small farms).

MITIGATION

5.7.45. An Historic Environment Desk-Based Assessment (HEDBA) would be necessary to provide a detailed assessment of the impacts of the option on the historic environment, based on a more comprehensive baseline, including a site walkover inspection. Considering the nature of the scheme and the uncertainties regarding the nature, date, extent and significance of any buried heritage assets, preliminary site-based archaeological investigation is also likely to be required, such as geophysical survey and subsequent archaeological trial trench evaluation. This should be carried out prior to planning submission or prior to the determination of the granting of planning consent.

5.7.46. The proposed scheme potentially impacts on the setting of a number of listed buildings within the study area. Mitigation measures in the form of screening should be considered to reduce the impacts on these heritage assets.

5.7.47. The bridges are designed to be built high enough to clear the floodplains and minimise the impact on the environment. Mitigation measures are proposed to avoid the bridges dominating the wider landscape by their being built in low-lying ground and through planting and landscaping.

5.7.48. This site based investigative work would clarify the potential and the likely impact of the proposed scheme and would enable an informed decision regarding an appropriate mitigation strategy for significance archaeological remains. Mitigation might comprise of targeted archaeological excavation prior to construction and/or an archaeological watching brief during topsoil removal or preliminary works. Whilst rare, it cannot be ruled out that nationally significant remains could be identified which would require preservation in situ (i.e. through design adjustments, avoidance etc.).

5.7.49. The HEDBA would include a detailed assessment of possible impacts on designated heritage assets through changes to their setting. In line with Historic England guidance, it would consider which designated above ground heritage assets should be scoped into a settings assessment, based on a zone of theoretical visibility model. The extent to which setting contributes to the heritage significance of each asset would be considered through desk-based research and a site visit, along with how each heritage asset might be affected by the proposed scheme due to changes to its setting.

CONSULTATION

5.7.50. Consultation regarding built heritage would be with Historic England and the District Council's Conservation Officer. Consultation regarding archaeological field investigation and mitigation would be with Historic England and with Norfolk County Council's Historic Environment Service.

CONCLUSION

5.7.51. In terms of options with the least and highest impact in respect of adverse effects on known buried heritage assets, and the potential for possible, previously unrecorded remains, this is as follows:

- The least impact option is Route Option C. This option passes through the fewest buried heritage assets. Assets affected comprise cropmarks of field boundaries and a post-medieval landscaped park.
- The highest impact option is Route Option D. At the southern terminus this option passes through an area in which prehistoric worked flints and Iron Age, medieval and post-medieval pottery sherds have been found; and the earthworks relating to former medieval field parcels (tofts). Within Option D the western leg has a higher impact as it passes through the medieval tofts, which the eastern leg avoids.

5.7.52. Any impacts on archaeological remains in any of the options can be successfully mitigated by a programme of archaeological works as outlined above.

5.7.53. In terms of options with the least and highest impact in respect of adverse effects on designated heritage assets, is as follows:

- The least impact option is Route Option C. It was concluded that the potential impacts to assets along this route would be low. It only has the potential to affect the setting of one designated asset and is therefore likely to be the least harmful of the proposed options.
- The highest impact options are Route Options A and Option B West. These routes have the potential to physically impact on built heritage assets.

5.7.54. Any impacts on the setting of heritage assets could be mitigated through screening. The impacts of bridges to the setting of heritage assets will be mitigated through their being built in low-lying ground and through planting and landscaping.

5.8. BIODIVERSITY

5.8.1. This section considers the biodiversity features that may be affected by Route Options A to D with consideration given to, statutory and non-statutory wildlife sites, habitats of conservation importance, protected species and other ecological features.

5.8.2. This assessment has been undertaken in accordance with TAG Unit A.3. A Preliminary Ecological Appraisal (PEA) has also been produced covering the study area, which comprised habitat mapping (largely using freely available mapping) and a desk study. Bat surveys, focussing on the rare barbastelle bat, were undertaken in May 2019 and will be continuing until September 2019 (and potentially into 2020). Survey data collected from the early summer surveys has been used to help inform this assessment.

5.8.3. This section describes the existing biodiversity baseline condition, and the anticipated likely significant impacts of the proposed options on the biodiversity within the study area, using desk and field-based information.

BASELINE CONDITIONS

5.8.4. For each of the six route options ecological features are considered primarily within a 50m buffer around the line of the route. The study area extends to 10km from all of the six route options. Within the study area numerous ecological features exist that may be directly or indirectly affected by the proposed route options. These include designated sites of ecological interest as well as species and habitats that are protected by law or are otherwise of particular nature conservation importance.

5.8.5. Within the study area, the most significant ecological feature is the River Wensum Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). The River Wensum has been designated because it is a good example of a calcareous lowland river and due to the rare species it supports: White-clawed crayfish *Austropotamobius pallipes;* Desmoulin`s whorl snail *Vertigo moulinsiana; Brook* lamprey *Lampetra planeri;* and Bullhead *Cottus gobio.* The river is of importance at a national and European level.

5.8.6. There are four statutory SSSI which are located within 2km of the combined route options. Within 1km of the proposed routes there are also 37 non–statutory County Wildlife Sites (CWS) and two Roadside Nature Reserves (RNR). These sites include a wide range of habitat types of value to different species, including areas of Ancient Woodland and Veteran Trees and wetland and marsh associated with the River Wensum in the north and the River Tud in the south, mature woodland and grassland. Habitats of Principal Importance (HPI) are also present, including lowland deciduous woodland, floodplain grazing marsh, rivers, ponds and hedgerows.

5.8.7. To date, a PEA has been produced covering the study area. This comprised of habitat mapping (largely using freely available mapping) and a desk study. Bat hibernation and winter bird surveys have been completed within 500m of the route options. The results of these surveys indicate that there are no significant assemblages of wintering birds or hibernating bats in buildings which might be affected by the scheme. The results of these surveys are therefore not discussed further in this section.

5.8.8. Bat surveys primarily focussing on the rare barbastelle bat begun in May 2019 and will continue until September 2019. The results of these surveys have been used to help inform this assessment. The barbastelle bat receives European legal protection and is a significant ecological consideration for the scheme. Additional habitat and species surveys are currently being undertaken.

5.8.9. The desk study results indicated that within the study area a diversity of wildlife has been recorded including protected species: otter *Lutra lutra*, water vole *Arvicola amphibius*, great crested newt *Triturus cristatus*, Norfolk hawker dragonfly *Aeshna isoceles*, Desmoulin's, whorl snail *Vertigo moulinsiana*, brook lamprey *Lampetra planeri,* bullhead *Cottus gobio* and ten species of bat including barbastelle[18] *Barbastella barbastellus*. Also recorded are a number of rare plant species including: fen pondweed *Potamogeton coloratus*, opposite-leaved pondweed *Groenlandia densa*, large yellow-sedge *Carex flava* and tubular water-dropwort *Oenanthe fistulosa.*

5.8.10. Barbastelle bat was a key ecological feature considered during the planning and construction of the NDR and post development monitoring for this rare species of bat is ongoing. A known colony of barbastelle are present within the Dinosaur Park / Morton Hall area within the north-western section of the study area (in close proximity to Route Options A and B). Dedicated bat surveys are currently being carried out to investigate the potential impacts of NWL on barbastelle. Given the legal protection afforded to this species a separate paragraph is provided below considering impacts on barbastelle for each of the route options.

5.8.11. The different route options are expected to have direct impacts on habitats and species, such as those caused by the removal of habitat to facilitate construction, as well as indirect impacts such as those arising from habitat fragmentation and disturbance. The data collected from the methods outlined above was used to undertake a WebTAG assessment in accordance with TAG Unit A.3.

5.8.12. In addition to the WebTAG a matrix was used to further asses and compare the impacts of the route options. The below table provides a comparison of the potential impacts of each route on the key ecological features identified at this stage. This comparison is based on information from online resources, baseline data available to date and professional judgement. The evaluation considers potential impacts in the absence of mitigation but with consideration for mitigation currently designed into the proposals i.e. a viaduct is proposed to cross the River Wensum on route B west, C and D to reduce the impact on the SAC. However, it is important to note that surveys, assessment and design

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[18] The barbastelle *Barbastella barbastellus* is one of the UK's rarest mammals. Few maternity roost sites are known in the UK. The great majority of other records come from caves or abandoned mines, which are important hibernation sites for a range of bat species. The barbastelle is widely distributed across southern England and across Wales but is likely to have been significantly under-recorded within its range (JNCC).

work for the viaduct is ongoing. Until this is complete and the data indicates that there will be no likely significant effect on the River Wensum SAC, we have classified the potential impact on the SAC as Moderate for routes B East, C and D. It is considered that once the survey and assessment work has been completed this impact could be revised down from Moderate to Minor or not applicable if no impacts are anticipated.

Table 5.32 – Route Comparison Key

Key	Likely Impacts
Red	Major
Orange	Moderate
Blue	Minor
Grey	Not applicable

Table 5.33 – Route Impact Matrix

Impact[19]	Routes					
Ecological Feature	**A**	**B (Western variant)**	**B (Eastern variant)**	**C**	**D Both variants**	**Route with biggest impact**
River Wensum SAC						B (Western variant)
Barbastelle bats						A and B
Site of Special Scientific Interest (SSSI)						B (Western variant)
Ancient woodland – direct and indirect – approx. within 200m						D
Habitat of Principle Importance (HPI)						C and D
Woodland						C and D
County Wildlife Sites						D
Watercourses (excluding the River Wensum)						D
Habitat fragmentation						D
Pond loss						A
Reduction in HPI quality						D
Number of hedgerows dissected						B (Western variant)

[19] In order of significance in relation to legislation and policy.

ROUTE OPTION A

Environmental Effects

5.8.13. Two designated sites are located within the Route Option A 100m corridor. An additional two non-statutory designated sites located within 250m of the route may also be indirectly affected. Designated sites within proximity to the route may be subject to deterioration in air quality (particularly within 200m), and increased noise and vehicle lighting.

5.8.14. Impacts on the River Wensum may be reduced in comparison to the other options, as the route will use the existing A1067 single carriageway crossing by way of the existing bridge over the Wensum at Attlebridge. The only works expected to the A1067 will be a new junction to join the new road running southwards.

5.8.15. HPI, identified from MAGIC[20], that are present within the Route Option A corridor, which may be affected by construction, comprise lowland deciduous woodland, floodplain grazing marsh and traditional orchard. Other habitats that could meet HPI criteria may also be affected, including hedgerows, watercourses, arable field margins and ponds. This option would lead to the loss of a number of ponds which could support protected species and species of conservation significance.

5.8.16. The route will affect one section of broadleaved woodland and widen an existing road causing the loss of numerous trees. The route is likely to affect protected species that use these habitats to move through the wider landscape. The route is also likely to increase habitat fragmentation of woodland in the north of this route.

5.8.17. Barbastelle could be dependent on the woodland habitat along the route, as a known barbastelle maternity colony is located within 300m of the route near to Morton. Within the Dinosaur Park/ Morton area there are multiple known roosts of barbastelle and it is considered that this area is of particular importance to the colony and the area of highest conservation significance to barbastelle in the study area. Areas where maternity colonies are located are of high conservation significance and can be vulnerable to disturbance. At this very close distance the bats could be particularly vulnerable to lighting and noise impacts from Route A. The severance of woodland and hedgerows may have significant impacts on barbastelle commuting between roosts and foraging habitat.

5.8.18. Two box culverts (likely to carry ditches) are proposed in the northern section of the route. If water voles, which have been recorded previously along the River Wensum and River Tud (Norfolk Biodiversity Information Service 2018) are present, the construction of box culverts may have impacts on this species.

ROUTE OPTION B WEST

Environmental Effects

5.8.19. Three designated sites are located within 100m of Route Option B West, including the River Wensum SAC and SSSI.

5.8.20. This route option requires the replacement of the existing bridge over the A1067 at Attlebridge to allow for a wider bridge to support the additional traffic. This will require excavation works in the banks of

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[20] Multi Agency Geographic Information for the Countryside (https://magic.defra.gov.uk/)

the River Wensum SAC that may have effects of ecological features within the river which will increase the risk of pollution of the watercourse during the construction phase.

5.8.21. This route is likely to give rise to severance of one CWS which that forms part of a larger area of deciduous woodland. Such severance is likely to affect protected species that use these habitats to move through the wider landscape. Dualling of the A1067 is likely to result in the complete loss of a road side nature reserve and land take from another CWS. Designated sites within proximity to the route may also be subject to deterioration in air quality (within 200m) and increase in noise and vehicle lighting.

5.8.22. HPI within the route corridor, that are likely to be impacted, comprise lowland deciduous woodland and floodplain grazing marsh. Other habitat that could meet HPI criteria may also be impacted, including hedgerows, watercourses, arable field margins and ponds.

5.8.23. The route option is expected to sever three sections of woodland, which is likely to affect protected species that use these habitats to move through the wider landscape. Blocks of broadleaved woodland within 500m, as well as hedgerows, are likely to be fragmented, which will lead to direct impacts and indirect impacts on the habitats and species using the habitats.

5.8.24. The route is close to the known maternity roosts around Morton. As indicated above in Route A analysis, due to the multiple known roosts the barbastelle colony uses in the area it is considered that the area is of higher conservation value and importance to barbastelle bats. The barbastelle bats using the Morton area would be vulnerable to disturbance from Route B due to the very close proximity of the route to the known roost sites. In addition possible maternity roosts, of barbastelle bat have been recorded in woodlands the route impacts in the south from the May 2019 bat surveys. One of the woodlands that the route bisects comprises a thin strip running along the south side of The Broadway where one of the possible maternity roosts was recorded. This woodland is connected to another woodland: Foxburrow Plantation, running parallel to The Broadway and linking into Hall Hills woodland. Within Hall Hills another possible maternity roost of barbastelle was located. It has not been confirmed whether these roosts are just gathering roosts or are part of a separate maternity colony within the study area. However the data collected to date does not indicate that The Broadway and Hall Hills woodland area are of the same conservation value as the Morton area. Given the surveys undertaken this May, recorded interchange between bats using these roosts and bats within the Morton area, it is possible that they form part of the Morton area maternity colony.

5.8.25. The May surveys also highlighted the importance of the woodlands in the northern and southern part of the route to foraging and commuting barbastelle. The habitat removal and disturbance within the woodlands is likely to have significant negative impacts for the barbastelle bat colony.

5.8.26. Furthermore, one box culvert is proposed along the route. If water voles, which have been recorded previously along the River Wensum and River Tud (Norfolk Biodiversity Information Service 2018) are present, the construction of box culverts may have impacts on this species.

ROUTE OPTION B EAST

Environmental Effects

5.8.27. Four designated sites are located along the Route of Option B East, including the River Wensum SAC and SSSI. Designated sites within proximity to the route will likely be subject to deterioration in air quality and an increase in noise and vehicle lighting.

5.8.28. This route is likely to give rise to severance of land adjoining a CWS, which is a site that forms part of a larger area of deciduous woodland. Such severance is likely to affect protected species that use these habitats to move through the wider landscape. Dualling of the A1067 is likely to result in the complete loss of a roadside nature reserve and land take from another CWS. The proposed viaduct across the Wensum will pass through two CWS and direct impacts upon this site may therefore arise during construction.

5.8.29. HPI within 100m of the route option that are likely to be impacted comprise lowland deciduous woodland and floodplain grazing marsh. The proposed viaduct across the River Wensum is likely to affect floodplain grazing marsh during construction. Other habitat that could meet HPI criteria may also be impacted, including hedgerows, watercourses, arable field margins and ponds.

5.8.30. The route option is expected to sever three sections of woodland, which is likely to affect protected species that use these habitats to move through the wider landscape. Blocks of broadleaved woodland within 500m, as well as hedgerows, are likely to be fragmented, which will lead to direct impacts and indirect impacts on the habitats and species using the habitats.

5.8.31. The route is close to the known maternity roost around Morton. As indicated above in Route A analysis, due to the multiple known roosts the barbastelle colony uses in the area it is considered that the area is of higher conservation value and importance to barbastelle bats. The barbastelle bats using the Morton area would be vulnerable to disturbance from Route B due to the very close proximity of the route to the known roost sites. In addition, two possible maternity roosts of barbastelle bat have been recorded in woodlands the route impacts in the south from the May 2019 bat surveys. One of the woodlands which the route bisects comprises a thin strip running along the south side of The Broadway where one of the possible maternity roosts was recorded. This woodland is connected to another woodland: Foxburrow Plantation, running parallel to The Broadway and linking into Hall Hills woodland. Within Hall Hills another possible maternity roost of barbastelle was located. It has not been confirmed whether these roosts are just possible maternity roosts or are part of a separate maternity colony within the study area. However, the data collected to date does not indicate that The Broadway and Hall Hills woodland area are of the same conservation value as the Morton area. Given the surveys undertaken this May, recorded interchange between bats using these roosts and bats within the Morton area, it is possible that they form part of the Morton area maternity colony.

5.8.32. The May surveys also highlighted the importance of the woodlands in the northern and southern part of the route to foraging and commuting barbastelle. The habitat removal and disturbance within the woodlands is likely to have significant negative impacts for the barbastelle bat colony.

5.8.33. Furthermore, one box culvert is proposed along the route. If water voles, which have been recorded previously along the River Wensum and River Tud (Norfolk Biodiversity Information Service 2018) are present, the construction of box culverts may have impacts on this species.

ROUTE OPTION C

Environmental Effects

5.8.34. Route Option C passes through four designated sites including the River Wensum SAC and SSSI. An additional three non-statutory designated sites within 250m of the route may be indirectly impacted. Designated sites within proximity to the route will likely be subject to deterioration in air quality and an increase in noise and vehicle lighting.

5.8.35. This route is likely to give rise to severance of land adjoining Foxborough Plantation CWS, a site that forms part of a larger area of deciduous woodland. Such severance is likely to affect protected species that use these habitats to move through the wider landscape. The proposed viaduct across the Wensum will pass through River Wensum Pastures, Ringland Estate, and direct impacts upon this site may therefore arise during construction.

5.8.36. HPI within 100m of Route Option C that are likely to be impacted comprised lowland deciduous woodland and floodplain grazing marsh. The proposed viaduct across the River Wensum is likely to affect floodplain grazing marsh during construction. Other habitat that could meet HPI criteria may also be impacted, including hedgerows, watercourses, arable field margins and ponds.

5.8.37. The route option is expected to sever five sections of woodland, which is likely to affect protected species that use these habitats to move through the wider landscape. Blocks of broadleaved woodland within 500m, as well as hedgerows, are likely to be fragmented, which will lead to direct impacts and indirect impacts on the habitats and species using the habitats.

5.8.38. Two possible maternity roosts of barbastelle bat have been recorded in woodlands, which the route will impact in the south, from the May 2019 bat surveys. One of the woodlands which the route bisects comprises a thin strip running along the south side of The Broadway where one of the roosts was recorded. This woodland is connected to another woodland: Foxburrow Plantation, running parallel to The Broadway and linking into Hall Hills woodland. Within Hall Hills another possible maternity roost of barbastelle was located. It has not been confirmed whether these roosts are just gathering roosts or are part of a separate maternity colony within the study area. However, the data collected to date does not indicate that The Broadway and Hall Hills woodland area are of the same conservation value as the Morton area. Given the surveys undertaken this May recorded interchange between bats using these roosts and bats within the Morton area it is possible that they form part of the Morton area maternity colony.

5.8.39. The May surveys also highlighted the importance of the woodlands in the southern part of the route to foraging and commuting barbastelle. Without mitigation the habitat removal and disturbance within the woodlands is likely to have significant negative impacts for the barbastelle bat colony.

5.8.40. Furthermore, one box culvert is proposed immediately south of Land adjoining Foxborough Plantation CWS. If water voles, which have been recorded previously along the River Wensum and River Tud (Norfolk Biodiversity Information Service 2018) are present, the construction of box culverts may have impacts on this species.

ROUTE OPTION D (WEST AND EAST)

Environmental Effects

5.8.41. Option D Eastern and Western variants are expected to have very similar impacts and so have been assessed together.

5.8.42. Route Option D passes through six designated sites including the River Wensum SAC and SSSI and four CWS. An additional six non-statutory designated sites within 250m of the route may be indirectly impacted. Designated sites within proximity to the route will likely be subject to deterioration in air quality and an increase in noise and vehicle lighting.

5.8.43. Severance of three woodland CWS, including two which form part of larger areas of deciduous woodland would occur. Such severance is likely to affect protected species that use these habitats to move through the wider landscape. The proposed viaduct across the Wensum will pass through two other CWS and direct impacts upon this site may therefore arise during construction.

5.8.44. The route is also expected to sever three sections of woodland, which is likely to affect protected species that use these habitats to move through the wider landscape. Multiple blocks of broadleaved woodland within 500m as well as hedgerows, are likely to be fragmented, which will lead to direct impacts and indirect impacts on the habitats and species using the habitats. This route will cause the greatest level of isolation of habitats.

5.8.45. The May 2019 bat surveys confirmed bats using areas in the northern and southern sections of the route for commuting and potentially foraging. New possible maternity roosts were also recorded within 1.2km of the new route. Given the proximity of the possible maternity roosts it is considered likely that the bats use woodlands around the route for commuting and foraging.

5.8.46. The bat activity's surveys conducted this year indicate that there is a higher level of bat activity on Route D compared to the other routes that were surveyed.

5.8.47. HPI within 100m of the route option that are likely to be impacted comprise lowland deciduous woodland and floodplain grazing marsh. The proposed viaduct across the River Wensum is likely to affect floodplain grazing marsh during construction. The southern section of the route will cross the River Tud, a chalk stream listed as HPI, although a proposed viaduct crossing the River Tud is likely to minimise direct impacts to the watercourse. Other habitat that could meet HPI criteria may also be impacted, including hedgerows, watercourses, arable field margins and ponds.

MITIGATION

5.8.48. The above assessment is based on our current understanding of the ecological features within the study area (to middle of June 2019). It should be noted that additional survey information will be collected over the next two years and will help to inform impact assessment and mitigation and compensation strategies.

5.8.49. This section provides an overview of mitigation measures which may be considered for each route. This does not include the design mitigation e.g. route options B eastern variant, C and D which would cross the River Wensum by way of a viaduct so as to minimise risk of affecting the Wensum SAC.

5.8.50. Route Option A doesn't involve new crossings of the Wensum however Route B western variant involves the upgrade of the existing road bridge at Attlebridge. This has the potential to cause significant impacts onto the River Wensum and on the species for which the SAC is designated for, as the river channel would be directly impacted by the works. Mitigation strategies can be adopted to reduce impacts to the river, however potentially expensive compensation measures are likely to be required.

5.8.51. All potential impacts on the River Wensum will be fully considered and assessed and appropriate measures will be included within a site wide Construction Environmental Management Plan (CEMP). This will include measures to avoid unnecessary impacts such as specific work timings and construction methods, reducing impacts to vegetation within the river corridor and avoiding and controlling for pollution incidents during the construction phase.

5.8.52. The CEMP will also include avoidance and reduction of impacts on other sites of conservation importance and habitats and species of conservation importance identified along the preferred route corridor. Good practice mitigation guidelines will be followed such as avoiding vegetation clearance during the breeding bird season and if necessary creating alternative habitats for great crested newts and reptiles.

5.8.53. Where loss of habitat is identified, the mitigation hierarchy will be applied as stated in the NPPF and consideration to avoid and minimise direct impacts on HPI will be taken into account. Translocation of mature habitat features will also be considered, for example for lost hedgerow, where habitat loss is unavoidable. Land will be acquired specifically for mitigation, and measures implemented, in accordance with a long-term management plan.

5.8.54. Green bridges and underpasses are a proven technique in mitigating for the impact on bats of the severance of woodland and linear habitats such as hedgerows. Work is currently ongoing to assess the requirement for green bridges and underpasses as these mitigation techniques are expensive and, for the methods to be successful they need careful consideration.

5.8.55. Given the nature of the landscape in the north-western corner of the study area i.e. lots of fragmented woodland and the proximity of the Morton barbastelle colony roost area containing multiple barbastelle roosts, mitigating for the impact of route options A and both B options will be difficult and potentially very expensive. Multiple bat crossing areas would be required to ensure safe passage of foraging and commuting bats in this area.

5.8.56. Route Option C is located further away from the identified maternity roost area however Route Option C and B (East and West)bisects a woodland known to contain a possible maternity roost of barbastelle bats along The Broadway. The route crosses perpendicular to The Broadway woodland through a strip of woodland less than 40 m wide. Mitigation for foraging and commuting bats using The Broadway woodland and Foxburrow Plantation could comprises two green bridges or underpasses. Given the linear nature of these woodlands mitigation in this area is considered likely to be successful as bats are effectively 'channelled' to follow the linear woodlands.

5.8.57. Route Option D also has the potential to impact barbastelle bats however due to land access constraints the bat data along this route is more limited than the other routes. Where access was possible barbastelle bats have been recorded along the route during the May surveys. Route option D causes the highest level of fragmentation of the landscape as it severs multiple woodlands and also passes in between more blocks of woodland compared to all other routes. Therefore, mitigation along this route has the potential to be very expensive as potentially multiple green bridges and/or underpasses would be required to ensure ecological linkages existed once the route was constructed.

5.8.58. The use of green bridges and/or underpasses will be further considered following further habitat and associated protected species assessment. It is important that all options are considered to retain habitat connectivity post development to reduce impacts on barbastelle bats. The green bridges and/or underpasses are likely to provide connectivity post road construction which will benefit a range of species of conservation importance.

5.8.59. The scheme will look to achieve biodiversity net gain. Once the preferred route has been announced a biodiversity net gain assessment will be undertaken to assess the requirement for biodiversity provision to help compensate and offset the loss of habitats as a result of the scheme. It is likely that the compensatory habitats will include woodland and wetland features.

5.8.60. Other measures will be installed where appropriate, comprising bird and bat boxes, kingfisher or sand martin banks, invertebrate mounds and hibernacula. Ponds that are created will be designed to enhance habitat for aquatic invertebrates and amphibians. Opportunities for enhancements to be made to existing habitat will be considered and informed by further survey work.

CONSULTATION

5.8.61. The EA and Natural England (NE) have been consulted as part of the optioneering process. A meeting was held in October 2018, and again in March 2019 where the five options were discussed in further detail. All comments have been considered in the biodiversity section although it is acknowledged that further consultation will likely be required as the baseline develops.

CONCLUSION

5.8.62. The following conclusions have been made from the best available baseline data to date and professional judgement.

Based on the conclusion from the WebTAG, it is concluded that Option A, B West and East will have a very large adverse impact on ecological features. Option C and Option D both variants will have a large adverse impact.

The very large adverse impact categorisation for routes A and B West and East are due to these routes impacting the ecological features in the study area (recorded so far) that receive the highest legal and policy protection; namely the River Wensum (SAC and SSSI) and barbastelle bat.

5.8.63. Through further assessment it is hoped that all likely significant impacts on the Wensum can be avoided on the routes which use a viaduct to cross the Wensum through careful viaduct design.

5.8.64. From the matrix that was put together to help further guide the assessment, Route D is the route that impacts the highest number of ecological features at a moderate or major level compared to the other routes. Route A impacts the least number of features at a moderate or major level followed by routes B West and C. A summary of each route is provided below.

5.8.65. Route Option D is likely to have the greatest ecological impact on the most ecological features, as it would affect seven of the 11 key ecological features identified. Route D would be likely to cause the greatest amount of severance and fragmentation of habitats of conservation importance and is therefore likely to give rise to the most direct and indirect impacts on species of conservation importance using these habitats, in particular barbastelle bat.

5.8.66. Route Option B (western variant) also has the potential to affect ecological features of particular importance namely the River Wensum SAC and the barbastelle bat. Route B (western variant) has the potential to give rise to significant effects on the Wensum because of the requirement for a new bridge crossing which is likely to give rise to loss of river habitat. Both variants for Route B are close to the Morton area barbastelle maternity colony and the possible maternity roost recorded along The Broadway. The routes also bisect core barbastelle bat foraging areas and commuting habitat. The habitats in the northern part of route B include multiple small blocks of woodland which would make mitigation options difficult and potentially very expensive as multiple new crossing points would be required.

5.8.67. Although Route Option C would cause severance of areas of woodlands it would not result in as much habitat fragmentation as Route Option D. Route C and Route B (East and West) have the potential to have an impact on the possible maternity roosts recorded in The Broadway and Hall Hills woodlands however due to the linear form of these woodlands, bat mitigation measures (green bridges or underpasses) would potentially be easier, cheaper (as fewer crossing points would be required) and more successful than mitigation required for Route Option B. Route B (East and West) has the potential to impact the Morton area barbastelle colony, which is spread across multiple woodland blocks, and the possible maternity roost along The Broadway.

5.8.68. Route Option A was considered to have least impact across the 11 key ecological features identified (including for the Wensum). The route is largely located within a more arable landscape than the other route options and so fragmentation impacts are considered to be minimal. However, this route has the potential to have a significant impact on the Morton barbastelle colony due to the very close proximity of the roosts to the route. As outlined above this would be difficult to mitigate for and so adverse impacts on bats as a result of this route are considered possible.

5.9. WATER ENVIRONMENT

5.9.1. This section considers the water environment features that may be affected by Route Options A to D with consideration given to water quality, aquatic and riparian biodiversity, recreation, hydromorphology and flood risk.

5.9.2. This assessment has been undertaken in accordance with TAG Unit A.3 and comprises a qualitative assessment. A desk study of the hydrological and hydrogeological features associated with the proposed options has been undertaken.

5.9.3. This chapter describes the existing water environment baseline condition and the anticipated likely significant impacts of the proposed options on the water environment within the study area.

5.9.4. This appraisal has been prepared with reference to TAG Unit A.3 Chapter 5 and 10. A five step approach to appraising potential impacts has been adopted:

1. Scoping and identification of the study area;
2. Identify key environmental resources and consider in terms of features or services that the resources provide (including supporting water supply, biodiversity, recreational value and flood flow conveyance);
3. Consider indicators such as quality, scale, rarity and substitutability to judge the importance of a feature based upon the criteria in TAG Unit A3 Chapter 10, Table 14;
4. Assess the potential adverse or beneficial direct and indirect impacts of the proposed options on identified water features; and
5. Combine the appraisal of the importance of the water environment features with the appraisal of the magnitude of the impacts, to determine the overall significance of those impacts in accordance with Table 16 and Table 17 of TAG Unit A3, Chapter 10. The significant impacts on the water environment are summarised in the Water Environment Worksheets for inclusion in the Appraisal Summary Table (AST).

5.9.5. The desk study undertaken to inform the appraisal of the proposed options for the SOBC used the following sources of information:

- OS mapping;
- Environment Agency (EA) Flood Map for Planning;
- EA Flood Risk from Surface Water mapping;
- EA Catchment Data Explorer;
- The Defra MAGIC geographical information portal; and
- The British Geological Survey viewer (BGS).

5.9.6. The study area has been defined as the physical area of the proposed options and a buffer of 500m either side of the option.

BASELINE CONDITIONS

Main Rivers

5.9.7. The River Wensum flows broadly parallel to the A1067 Fakenham Road, crossing the road twice within the study area at Lenwade and Attlebridge. The watercourse flows in an easterly direction through the centre of Norwich. The watercourse overlies chalk bedrock geology and flow within the river will be groundwater fed.

5.9.8. The River Wensum at Attlebridge has a catchment area of approximately 500km^2. The watercourse is classified as a Main River and is therefore under the jurisdiction of the Environment Agency. Throughout the study area the River Wensum has statutory designation as a Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). The watercourse supports coarse fishing upstream, within, and downstream of the study area. The watercourse also supports several private abstractions and has local amenity value.

5.9.9. The River Wensum is monitored against the objectives of the Water Framework Directive (WFD). Within the study area the watercourse is assessed to have Moderate overall status, with Moderate ecological quality and Good chemical quality. The watercourse is classified as Heavily Modified. Reasons stated as to why the River Wensum has not achieved Good overall status include:

- Groundwater abstraction from water industry and agriculture impacting hydrological regime;
- Surface water abstraction from water industry and agriculture impacting hydrological regime;
- Poor nutrient management from agriculture and rural lands contributing to point source pollution, impacting macrophytes and phytobenthos;
- Sewage discharge causing point source pollution, impacting macrophytes and phytobenthos; and
- Livestock causing diffuse source pollution impacting macrophytes and phytobenthos.

5.9.10. A review of historic maps indicates that the River Wensum has largely remained in its current alignment over the last century and is therefore considered to be relatively stable with little risk of lateral migration. However, some lateral movement of the River Wensum is noted to the east of Attlebridge, with maps dated 1908 and 1957 showing straightening of the River Wensum, and mapping since 1957 showing scour on the right bank of the watercourse as if the river is returning to its original sinuous shape. A review of OS mapping confirms there are three crossings of the River Wensum within the study area located at Ringland. The first Ringland (TG14121373), south of Taverham (TG15951349) and Drayton (TG17651271).

5.9.11. The River Tud flows broadly parallel to the A47, crossing the road within the study area at Honingham. The watercourse flows in an easterly direction and confluences with the River Wensum to the west of Norwich, approximately 8km downstream of the study area. The watercourse overlies chalk bedrock geology and is likely to have a strong connection with underlying groundwater resources. There are five road bridge crossings of the River Tud within the study area at Berrys Lane (TG09721182), Taverham Road (TG11801125), Ringland Road (TG13351145), Sir Alfred Munnings Road (TG15331159) and Longwater Lane (TG16951127). Easton Estates appear to have a private road crossing to the east of Ringland Road at (TG14031161).

5.9.12. The River Tud has a catchment area in the vicinity of the proposed options of approximately 65km^2. The watercourse is a Main River and is under the jurisdiction of the Environment Agency. The watercourse holds no statutory designations within the study area although does support several private abstractions and receives several consented discharges mainly for private wastewater treatment.

5.9.13. The River Tud is monitored against the objectives of the WFD. Within the study area the watercourse is assessed to have Moderate overall status, with 'Moderate' ecological quality and 'Good' chemical quality. The watercourse is classified as 'Heavily Modified'. Reasons stated as to why the River Tud has not achieved 'Good' overall status include:

- Poor nutrient management from agriculture and rural lands contributing to point source pollution impacting phosphates;
- Sewage discharge causing point source pollution impacting phosphates;
- Livestock causing diffuse source pollution impacting phosphates; and
- Transport drainage causing diffuse source pollution impacting phosphates.

5.9.14. A review of historic maps indicates that the River Tud has largely remained in its current alignment over the last century and is therefore considered to be relatively stable with little risk of lateral migration. However, some lateral movement of the River Tud is noted to the west of Easton (in the vicinity of Route Option D) with meanders becoming more pronounced.

5.9.15. The EA has recently completed consultation regarding the proposed reclassification of the River Tud from its current status as a Main River to an amended status of ordinary watercourse. This proposed reclassification is not expected to change the findings of the assessment presented below.

Ordinary Watercourses

5.9.16. Weston Fisheries is located within the west of the study area, flowing in a north-easterly direction to confluence with the River Wensum at Lenwade. The watercourse has been heavily modified for (assumed) agriculture and aquaculture use with several sluices controlling flow through this watercourse. The downstream extents of the watercourse flow adjacent to and beneath the B1535 Weston Hall Road. The watercourse is considered to provide suitable habitat for otter and water vole.

5.9.17. Several unnamed watercourses flow through the study area and are tributaries of the River Wensum and River Tud. The watercourses have no known amenity value but may have local biodiversity value.

5.9.18. The River Wensum and, to a slightly lesser extent, the River Tud are flanked by a complex network of land drains to the north and south of the watercourses that fall within the management area of the Norfolk Rivers Internal Drainage Board (IDB). These land drains broadly define the floodplain of the two rivers. The watercourses have no known amenity value but are likely to have local biodiversity value.

5.9.19. Ordinary watercourses are under the jurisdiction of Norfolk County Council as the relevant Lead Local Flood Authority (LLFA), although this responsibility can be delegated to the IDB in those areas managed by the IDB.

5.9.20. The quality of these watercourses is not monitored against the objectives of the WFD.

Groundwater

5.9.21. Bedrock geology within the study area comprises Lewes Nodular Chalk Formation, designated as Principal aquifer. The aquifer is designated as a Source Protection Zone for public water supply, with all proposed options located within the outer Zone 3 - Total Catchment. This zone is defined as the total area needed to support the abstraction from the protected groundwater source.

5.9.22. Superficial deposits comprise a mixture of Sheringham Cliffs Formation (Sand and Gravel) beneath Route Options B, C, D and the northern half of Route Option A; and Lowestoft Formation (Diamicton) beneath the southern half of A. The Sheringham Cliffs Formation is likely to have high permeability and infiltration potential, with the Lowestoft Formation likely to have lower permeability and infiltration potential (noting that infiltration testing has not yet been undertaken in the study area). Based on the available historic boreholes there are no recorded cohesive strata along the northern edge of the floodplain. No historic borehole information exists immediately along the River Wensum banks, though the ground is likely to contain Alluvium, some of which could be cohesive (as derived from the Geological Maps). Further south of the river more cohesive glacial deposits is likely to be present.

5.9.23. The quality of groundwater resources is monitored against the objectives of the WFD. The study area lies within the Broadland Rivers Chalk & Crag groundwater body. The groundwater body is assessed to have 'Poor' overall status, with Poor quantitative quality and 'Poor' chemical quality. Groundwater abstraction is stated as the reason for not achieving Good quantitative status.

5.9.24. Groundwater levels within the study area are currently unknown although review of available BGS borehole logs in the study area indicates groundwater may range between 5.10m below ground level (BGL) and 34.13mBgL. As discussed above the River Wensum receives groundwater flow and the water table is likely to be close to the ground surface near the River Wensum.

Flood risk

5.9.25. The most significant flood risk within the study area is associated with fluvial flooding from the River Wensum and the River Tud.

5.9.26. The floodplain of the River Wensum is well defined by the network of land drains that flank the north and south of the river, with this land indicated to comprise functional floodplain Flood Zone 3b defined as land that typically has a greater than 1 in 20 (5%) annual probability of flooding.

5.9.27. The floodplain of the River Tud is less well defined and comprises a mixture of Flood Zone 2 (between 0.1% (1 in 1000) and 1% (1 in 100) annual probability of flooding), Flood Zone 3 (greater than 1% (1 in 100) annual probability of flooding) and the functional floodplain Flood Zone 3b.

5.9.28. A more detailed review of flood risk is provided within the Outline Flood Risk Appraisals for each option.

ROUTE OPTION A

Environmental Effects

5.9.29. Route Option A comprises a new single carriageway two-way road between Honingham and Lenwade, continuing east along the existing alignment of the A1067 Fakenham Road towards Norwich.

5.9.30. New works will be required at the junction with the A1067 that will be partially located within the floodplain of the River Wensum. The loss of floodplain is likely to cause localised increase in flood risk that will require compensation. It is likely that this can be provided within the local area and not pose risk to flood flow conveyance associated with the River Wensum. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined.

5.9.31. The new junction with the A1067 will require realignment and/or culverting of the Weston Fisheries. Further realignment and culverting of Weston Fisheries is also likely to be required to the south of the new junction work between the A1067 and Sandy Lane. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined.

5.9.32. Weston Fisheries already flows beneath the existing B1535 and has experienced significant modification, therefore the long-term impacts to aquatic ecology and hydromorphology are not likely to be significant. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.33. It is likely that surface water runoff from the northern extent of the proposed scheme will be discharged to the River Wensum as groundwater levels in this area are likely to be too shallow to support infiltration. Consequently, there is potential pollution impact to the River Wensum from routine runoff and accidental spillage. However, a suitable treatment train has been included in the drainage strategy and the residual impact is considered negligible.

5.9.34. In areas where the water table is sufficiently low (more than 1m below the base of the infiltration basin) infiltration of runoff to ground will be promoted. Again, a suitable treatment train has been included in the drainage strategy and the residual impact to groundwater quality is considered negligible.

5.9.35. Works within close proximity of the River Wensum and Weston Fisheries may pose pollution risk during construction. It is likely that risks to water quality can be adequately mitigated through the implementation of a Construction Environmental Management Plan (CEMP) with negligible long-term effects.

5.9.36. No works are proposed within the vicinity of the River Tud therefore Route Option A is predicted to have negligible impact to the River Tud.

5.9.37. The overall summary assessment score for Route Option A is minor adverse.

ROUTE OPTION B WEST

Environmental Effects

5.9.38. Route Option B West comprises a new dual carriageway between Honingham and Attlebridge, joining the existing alignment of the A1067 Fakenham Road to the west of the existing crossing of the River Wensum. Route Option B also includes upgrading the existing A1067 to dual carriageway between the new road junction and the existing roundabout with the A1270 in the east, including widening or replacement of the existing bridge across the River Wensum.

5.9.39. The existing bridge across the River Wensum does not have bridge piers in the watercourse, however the bridge abutments are located close to the channel and in riparian habitat. Widening these abutments may cause minor adverse impacts to water quality during construction, although long term impacts are likely to be negligible.

5.9.40. If the bridge abutments of the widened bridge are located along the same alignment as the existing bridge and the vertical alignment is also maintained, the proposed works are not considered to have notable effect to flow conveyance within the River Wensum. It is likely that impacts to flow conveyance and storage in the floodplain associated with widening the existing bridge will be minimal and can be managed via provision of compensation in the local area, however an impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined.

5.9.41. Initial visual inspection of the existing bridge and indicative flood mapping indicates that the soffit of the existing bridge is unlikely to provide the standard design freeboard of 600m above the 1% (1 in 100) annual probability event flood level. The existing bridge and proposed widened bridge (if full replacement is not progressed) may therefore be at risk of flooding during extreme events particularly when the potential effects of climate change are considered. The provision of a new bridge may offer opportunity to improve the flood resilience of the bridge to flooding, although this may also require raising of the approaches to the bridge.

5.9.42. The provision of a new bridge across the River Wensum or an extension of the existing bridge is likely to pose risk to water quality during construction although long term impacts are likely to be negligible. If a new bridge is proposed this will however offer opportunity to locate the bridge abutments further back from the watercourse channel which could assist with reinstating riparian habitat, improving flood flow conveyance and potentially reducing flood risk to adjacent properties. This has not yet been considered in detail and at this stage of the assessment the impacts to flood risk could range between minor beneficial to minor adverse.

5.9.43. Neither the existing bridge or new bridge proposes piers within the watercourse channel, and piers for a new bridge will be located back from the channel edge to maintain riparian habitat. The watercourse is considered to be stable therefore lateral movement of the channel is unlikely and can be mitigated through appropriate design. Long term impacts to hydromorphological condition are considered negligible.

5.9.44. The proposed road alignment passes through land identified to be within Flood Zone 3 immediately south of the proposed junction with the A1067 Fakenham Road. The loss of floodplain is likely to cause localised increase in flood risk that will require compensation, although only arable land is likely to be affected. It is likely that compensation can be provided within the local area and not pose wider risk to flood flow conveyance. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined. The floodplain is considered to have biodiversity value. The relatively minimal loss of floodplain in this area is not considered to pose significant impact and can be compensated alongside the provision of floodplain compensation, although as per above an impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.45. Route Option B crosses an unnamed ordinary watercourse between Honingham and Weston Green. The provision of an appropriately sized box culvert and, if required, floodplain compensation is likely to adequately manage risks to flood flow conveyance and loss of fluvial floodplain. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined. Similarly, the culverting of the watercourse will cause loss of natural channel habitat and hydromorphological conditions. It is likely that connectivity and flow dynamics can be managed through the provision of a natural bed and structures such as baffles if required, although an impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.46. It is likely that surface water runoff from the northern extent of the proposed scheme will be discharged to the River Wensum as groundwater levels in this area are likely to be too shallow to support infiltration. Consequently, there is potential pollution impact to the River Wensum from routine runoff and accidental spillage. However, a suitable treatment train has been included in the drainage strategy and the residual impact is considered negligible.

5.9.47. In areas where the water table is sufficiently low (more than 1m below the base of the infiltration basin) infiltration of runoff to ground will be promoted. Again, a suitable treatment train has been included in the drainage strategy and the residual impact to groundwater quality is considered negligible.

5.9.48. No works are proposed within the vicinity of the River Tud therefore Route Option B is predicted to have negligible impact to the River Tud.

5.9.49. The overall summary assessment score for Route Option B West is minor adverse.

ROUTE OPTION B EAST

Environmental Effects

5.9.50. Route Option B East comprises a new dual carriageway between Honingham and Attlebridge, joining the A1067 Fakenham Road to the east of Attlebridge and crossing the River Wensum and its associated floodplain. Route Option B East also includes upgrading the existing road to dual carriageway between the new junction and the existing roundabout with the A1270 in the east.

5.9.51. The new viaduct is proposed to cross the River Wensum and its associated floodplain. Piers will not be located within the channel of the River Wensum or IDB drains located in the floodplain. The proposed structure will have no effect to flow conveyance in the River Wensum and is likely to have relatively minimal effect to flood flow conveyance or storage within the floodplain. However, an impact magnitude of moderate adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined. Similarly, the floodplain is considered to have biodiversity value. It is likely that this loss could be partly compensated for within the provision of floodplain storage compensation, although the new structures could change local flow dynamics through the floodplain. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.52. The construction of the new viaduct may cause localised minor adverse impacts to water quality and hydromorphological conditions, although this is expected to be mitigated through inclusion of a CEMP to limit the risk of pollutants entering surface water features or discharging to ground. Long term impacts are not likely to be significant if structures are located an appropriate distance from the watercourse channels. That said, review of historic mapping indicates some lateral movement of the River Wensum at the approximate location of the proposed viaduct crossing. Further movement could pose risk to the viaduct and the viaduct could prevent natural morphology of the watercourse. A precautionary approach is therefore recommended until a more detailed geomorphological assessment can be undertaken with an impact magnitude of minor adverse.

5.9.53. Route Option B crosses an unnamed ordinary watercourse between Honingham and Weston Green. The provision of an appropriately sized box culvert and, if required, floodplain compensation is likely to adequately manage risks to flood flow conveyance and loss of fluvial floodplain. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined. Similarly, the culverting of the watercourse will cause loss of natural channel habitat and hydromorphological conditions. It is likely that connectivity and flow dynamics can be managed through the provision of a natural bed and structures such as baffles if required, although an impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.54. It is likely that surface water runoff from the northern extent of the proposed scheme will be discharged to the River Wensum as groundwater levels in this area are likely to be too shallow to support infiltration. Consequently, there is potential pollution impact to the River Wensum from routine runoff and accidental spillage. However, a suitable treatment train has been included in the drainage strategy and the residual impact is considered negligible.

5.9.55. In areas where the water table is sufficiently low (more than 1m below the base of the infiltration basin) infiltration of runoff to ground will be promoted. Again, a suitable treatment train has been included in the drainage strategy and the residual impact to groundwater quality is considered negligible.

5.9.56. No works are proposed within the vicinity of the River Tud therefore Route Option B is predicted to have negligible impact to the River Tud.

5.9.57. The overall summary assessment score for Route Option B East is moderate adverse.

ROUTE OPTION C

Environmental Effects

5.9.58. Route Option C comprises a new dual carriageway from Honingham to the A1067 Fakenham Road, joining the A1067 approximately 600m west of the existing roundabout with the A1270. The new road will cross the River Wensum and its associated floodplain. The A1067 will be realigned at the location of the new junction and upgraded to a dual carriageway between the new junction and the existing roundabout with the A1270 in the east.

5.9.59. The new viaduct is proposed to cross the River Wensum and its associated floodplain. Piers will not be located within the channel of the River Wensum or IDB drains located in the floodplain. The proposed structure will have no effect to flow conveyance in the River Wensum and is likely to have relatively minimal effect to flood flow conveyance or storage within the floodplain. However, an impact magnitude of moderate adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined. Similarly, the floodplain is considered to have biodiversity value. It is likely that this loss could be partly compensated for within the provision of floodplain storage compensation, although the new structures could change local flow dynamics through the floodplain. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.60. The construction of the new viaduct may cause localised minor adverse impacts to water quality and hydromorphological conditions to the River Wensum during construction, although this is expected to be mitigated through inclusion of a CEMP to limit the risk of pollutants entering surface water features or discharging to ground. Long term impacts are not likely to be significant if structures are located an appropriate distance from the watercourse channels. The River Wensum is not considered to be at significant risk of lateral movement at the location of the proposed crossing, however a precautionary approach is recommended until a more detailed geomorphological assessment can be undertaken. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.61. Route Option C crosses an unnamed ordinary watercourse between Honingham and Weston Green. The provision of an appropriately sized box culvert and, if required, floodplain compensation is likely to adequately manage risks to flood flow conveyance and loss of fluvial floodplain. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined. Similarly, the culverting of the watercourse will cause loss of natural channel habitat and hydromorphological conditions. It is likely that connectivity and flow dynamics can be managed through the provision of a natural bed and structures such as baffles if required, although an impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.62. It is likely that surface water runoff from the northern extent of the proposed scheme will be discharged to the River Wensum as groundwater levels in this area are likely to be too shallow to support infiltration. Consequently, there is potential pollution impact to the River Wensum from routine runoff and accidental spillage. However, a suitable treatment train has been included in the drainage strategy and the residual impact is considered negligible.

5.9.63. In areas where the water table is sufficiently low (more than 1m below the base of the infiltration basin) infiltration of runoff to ground will be promoted. Again, a suitable treatment train has been included in the drainage strategy and the residual impact to groundwater quality is considered negligible.

5.9.64. No works are proposed within the vicinity of the River Tud therefore Option C is predicted to have negligible impact to the River Tud.

5.9.65. The overall summary assessment score for Route Option C is moderate adverse.

ROUTE OPTION D (WEST AND EAST)

Environmental Effects

5.9.66. Route Option D comprises a new dual carriageway from the A47 to the west of Easton to the A1067 Fakenham Road, joining the A1067 approximately 600m west of the existing roundabout with the A1270. Two options are being considered for the proposed alignment north of the A47 (eastern and west) although both options pose similar risks to the water environment at this stage of the assessment therefore the assessment of these two options has been combined.

5.9.67. The A1067 will be upgraded to a dual carriageway between the new junction and the existing roundabout with the A1270 in the east. The new road will cross both the River Wensum in the north and River Tud in the south and their associated floodplains.

5.9.68. A new viaduct is proposed to cross the River Wensum and its associated floodplain, as well as the River Tud. Piers will not be located within the channel of the River Wensum, River Tud or IDB drains located in the floodplain. The proposed structures will have no effect to flow conveyance in the River Wensum or River Tud and are likely to have relatively minimal effect to flood flow conveyance or storage within the floodplain. However, an impact magnitude of moderate adverse for the River Wensum and minor adverse for the River Tud is considered appropriate at this stage of the assessment as quantitative analysis and the requirement for floodplain compensation has not yet been determined.

5.9.69. The floodplain of the River Wensum is considered to have biodiversity value which supports the statutory designations. It is likely that any loss of floodplain could be partly compensated for within the provision of floodplain storage compensation, although the new structures could change local flow dynamics through the floodplain. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment.

5.9.70. The construction of the new viaduct may cause localised minor adverse impacts to water quality and hydromorphological conditions to the River Wensum during construction, although this is expected to be mitigated through inclusion of a CEMP to limit the risk of pollutants entering surface water features or discharging to ground Long term impacts are not likely to be significant if structures are located an appropriate distance from the watercourse channels. The River Wensum is not considered to be at significant risk of lateral movement at the location of the proposed crossing, however a precautionary approach is recommended until a more detailed geomorphological assessment can be undertaken. An impact magnitude of minor adverse is considered appropriate at this stage of the assessment. Similarly, the River Tud is also not likely to experience significant lateral movement, although review of historic mapping does indicate some movement within the vicinity of the eastern leg of Route Option

D with meanders becoming more pronounced. Further movement could pose risk to the viaduct and the viaduct could prevent natural morphology of the watercourse. A precautionary approach is therefore recommended until a more detailed geomorphological assessment can be undertaken with an impact magnitude of minor adverse.

5.9.71. It is likely that surface water runoff from the northern extent of the proposed scheme will be discharged to the River Wensum and that surface water runoff from the southern extent of the proposed scheme will be discharged to the River Tud as groundwater levels in these areas are likely to be too shallow to support infiltration. Consequently, there is potential pollution impact to the River Wensum and River Tud from routine runoff and accidental spillage. However, a suitable treatment train has been included in the drainage strategy and the residual impact is considered negligible.

5.9.72. In areas where the water table is sufficiently low (more than 1m below the base of the infiltration basin) infiltration of runoff to ground will be promoted. Again, a suitable treatment train has been included in the drainage strategy and the residual impact to groundwater quality is considered negligible.

5.9.73. The overall summary assessment score for Route Option D is moderate adverse.

MITIGATION

5.9.74. Mitigation measures for the management of identified impacts of all the route options are likely to comprise:

- Suitable treatment train for highway runoff to minimise impact to surface water and groundwater quality;
- Compensatory flood storage for loss of floodplain and provision of appropriately sized culverts to manage flood flow conveyance;
- Restriction of highway discharge rates to watercourses to mimic Greenfield runoff rates and volumes;
- Minimising additional length of abutments/piers required for existing bridge widening with no additional structures provided within channel or in closer proximity to watercourse;
- Minimising footprint of abutment/piers required for new bridge with no structures within channel and locating structures away from channel edge;
- Avoiding structures within the channel of the River Wensum, River Tud and adjacent land drains, and maximising the span between piers / distance from the banks of the River Wensum and River Tud;
- Adoption of a suitable CEMP to manage pollution risks during construction. A non-exhaustive list of construction practices to include:
  - Site-specific method statements for works adjacent to the River Wensum;
  - Management of sediment laden runoff and bunding of stockpiles to prevent loose sediment washing into watercourses;
  - Safe containment of chemicals, use of drip trays and provision of emergency spill kits; and
  - Site compounds located outside the flood plain and away from watercourses.

5.9.75. All options would need mitigation. Risks during construction likely to be similar and pose negligible permanent impact, although short-term impacts may be slightly greater for Options B (East), C and D. Options A & B (West) may have less impact on flood risk during operation, and Option B (West) may offer opportunity to improve flood risk at the existing crossing of the Wensum

CONSULTATION

5.9.76. The EA and Natural England (NE) have been consulted as part of the optioneering process. A meeting was held in October 2018, and again in March 2019 where the preferred options were discussed.

5.10. GEOLOGY AND SOILS

SCOPE OF THE ASSESSMENT

5.10.1. The assessment has been carried out on the basis of the following information:

- Geological maps and memoirs for the area;
- Available historic geotechnical logs and reports;
- Search of relevant maps, records and other data (Envirocheck search)

BASELINE ENVIRONMENT

5.10.2. The site lies across two British Geological Survey (BGS) maps, Sheet 147 to the north and Sheet 161 to the south.

5.10.3. The BGS 1:50,000 Geological Maps Sheets for the Norwich area and the existing ground investigation information indicate that the proposed scheme Options are underlain by the following sequence of geologies (starting from the top);

- Made Ground
- Alluvium
- Colluvium
- River Terrace Gravel
- Crag Deposits
- Glaciofluvial sands and gravels (Sheringham Cliff Formation)
- Till Members (Sheringham Cliff Formation)
- Lowestoft Formation
- Cretaceous Upper Chalk.

5.10.4. Descriptions of the geology within the scheme extents, based on the available geological mapping and memoir information, are presented below.

Made Ground

5.10.5. Made Ground is shown to be present within the area of study, predominantly between the villages of Lenwade and Morton on the Hill, which is in the proximity of the junction between Option A and the A1067. It is described in the Envirocheck data as either Made Ground (undivided) or Worked Ground (Undivided). The material descriptions of both the Made and Worked ground are not provided in the Envirocheck data.

Alluvium

5.10.6. Alluvium is shown on the BGS maps to be present within both the River Wensum and River Tud valleys. This deposit is fluvial in origin and normally consists of soft to firm normally consolidated, compressible silty clay. The BGS memoir states that the Alluvium may also contain layers of silt, sand, peat and basal gravel. Within the area of the Study the Alluvium is commonly underlain by the gravels of the River Terrace Deposits. All four options extend to areas where Alluvial Deposits are expected, however only Options B, C and D include a new river crossing.

Colluvium

5.10.7. Colluvium (typically referred to as Head) is shown on the BGS maps to be present within the area of study. The Colluvium generally comprises gravelly and clayey sand and sandy clay, depending on the upslope source and its distance from it. These deposits are formed by solifluction and/or hillwash and are normally poorly sorted and stratified.

River Terrace Deposits

5.10.8. River terrace gravels outcrop along the River Wensum valley to the north of the scheme extent. The superficial deposit of the river terrace gravels overlie the solid bedrock of the Upper Chalk, as indicated on the Geological Maps. The River Terrace Deposits are typically described as Sand and Gravels with local lenses of silts, clay or peat.

Glaciofluvial sand and gravel (Sheringham Cliff Formation)

5.10.9. The Glaciofluvial sands and gravels are outwash deposits derived from the local Tills and Glacial Moraines and generally comprise fine to coarse sands with flint gravel and occasional shell fragments. The Glaciofluvial Deposits are undifferentiated, often post-date the Lowestoft Till or fall between the Weybourne Town and Bacton Green Tills Members (of the Sheringham Cliffs Formation), or are encountered as layers within these deposits or as a boundary layer separating them. Within the site extents the Glaciofluvial deposits are included as the lower layers of the Sheringham Cliffs Formation that overlies the Lowestoft Formation.

Till Members (Sheringham Cliff Formation)

5.10.10. Two Till Members, the Weybourne Town and Bacton Green tills, are described as being part of the Sheringham Cliff Formation. The two tills are noted as being separate from the underlying Lowestoft Till and are typically encountered as sandy gravels of chalk and flint in a clay matrix that are interlayered with the sand and gravel Glaciofluvial deposits. The Geological Maps describe the layering is locally contorted and typically chaotic.

Lowestoft Formation (Chalky Boulder Clay)

5.10.11. The Lowestoft Formation (previously the Lowestoft Till & Chalky Boulder Clay) is shown on the BGS map to be mostly present west of the area of the study. BGS memoir quotes that this formation varies from a deeply weathered sandy, reddish brown flinty clay in which chalk fragments occur only below the main zone of weathering, to a slightly weathered, stiff, brownish, grey flinty clay, with chalk fragments extending almost to the top of the layer. The till is characterised by its chalk and flint content, where the chalk and flint are of various colours. It is described to be tenacious and poorly permeable.

Crag Deposits

5.10.12. The Crag Group may be encountered within the area of study. The BGS map shows that the Wroxham Crag Formation outcrops just to the north of the river Wensum and east of Lenwade, immediately overlaying the Upper Chalk formation. It comprises a variable series of sands, laminated clays and pebbly gravels.

White Chalk Subgroup

5.10.13. Chalk underlies the whole area of study. Within the river valleys the Chalk is shown on the BGS Geological maps to outcrop on the slopes and along the base of the valleys, in the north and south of the scheme. The BGS memoir of the Norwich area describes the Chalk as a soft, white, friable limestone. The upper chalk formation is rich in flints, which occur in bands as irregular nodules and commonly incorporate fossil remains. The top surface of the Chalk stratum is generally planar with an elevation between 10mOD and 20mOD.

EVALUATION OF ROUTE OPTIONS

Route Option A

Geology

5.10.14. The site is generally underlain by a sequence of Glacial-Fluvial deposits and Boulder Clay over Chalk.

5.10.15. River Terrace Deposits and Alluvium are expected along the northern portion of the route near the ground level, potentially directly underlain by Chalk.

Past Opencast Mines (Backfilled or Flooded)

5.10.16. The following past opencast mineral sites are located in a vicinity of the Option A route:

5.10.17. Old Covert Marl Pit, Honingham Pit, Sandy Lane Marl Pit, Hungate Common Pit, Well Grove Gravel Pit, Lenwade Bridge Gravel Pit, Lenwade Plantation Marl Pit, Weston Hall Marl Pit, Old Hall Farm Marl Pit.

5.10.18. Full list of mineral sites and details are provided in the Desk Study Report Ref No 70041922-WSP-GE- 001.

Solution Features

5.10.19. High risk of chalk solution features affecting this route.

Unexploded Ordnance (UXO)

5.10.20. A detailed study is required due to the route proximity to the past RAF Attlebridge airfield.

Route Option B (East and West)

Geology

5.10.21. The site is generally underlain by a sequence of Glacial-Fluvial deposits and Boulder Clay over Chalk. Locally Cragg may be encountered between the Glacial Deposits and Chalk.

5.10.22. River Terrace Deposits and Alluvium are expected along the northern portion of the route near the ground level, mostly overlying the Glacial Deposits.

Past Opencast Mines (Backfilled or Flooded)

5.10.23. The following past opencast mineral sites are located in a vicinity of the Option B route:

5.10.24. Honingham Pit, Old Covert Marl Pit, Mousewood Farm Clay Pit, High House Pit, Old Hall Farm Marl Pit, Scotchwood Hills Marl Pit, Morton Hall Marl Pit.

5.10.25. Full list of mineral sites and details are provided in the Desk Study Report Ref No 70041922-WSP-GE- 001.

Solution Features

5.10.26. High risk of chalk solution features affecting this route.

Unexploded Ordnance (UXO)

5.10.27. A detailed study is required due to the route proximity to the past RAF Attlebridge airfield.

Route Option C

Geology

5.10.28. The site is generally underlain by a sequence of Glacial-Fluvial deposits and Boulder Clay over Chalk.

5.10.29. River Terrace Deposits and Alluvium are expected along the northern portion of the route near the ground level, potentially directly underlain by Chalk.

5.10.30. Locally Cragg may be encountered between at the ground level at the northern end of the route.

Past Opencast Mines (Backfilled or Flooded)

5.10.31. The following past opencast mineral sites are located in a vicinity of the Option C route:

5.10.32. Honingham Pit, Old Covert Marl Pit, Mousewood Farm Clay Pit, Rose Carr Marl Pit, Old Hall Farm Marl Pit.

5.10.33. Full list of mineral sites and details are provided in the Desk Study Report Ref No 70041922-WSP-GE- 001.

Solution Features

5.10.34. High risk of chalk solution features affecting this route.

Unexploded Ordnance (UXO)

5.10.35. A detailed study is required due to the route proximity to the past RAF Attlebridge airfield.

Route Options D WEST and east

Geology

5.10.36. The site is generally underlain by a sequence of Glacial-Fluvial deposits and Boulder Clay over Chalk.

5.10.37. River Terrace Deposits and Alluvium are likely to be present along the northern portion of the route near the ground level, potentially directly underlain by Chalk.

5.10.38. Locally Cragg may be encountered between at the ground level at the northern end of the route.

Major Utilities

5.10.39. National Grid Pipeline is crossing this route.

Past Opencast Mines (Backfilled or Flooded)

5.10.40. The following past opencast mineral sites are located in a vicinity of the Option D route:

5.10.41. Brickkiln Plantation Pit, Langrow Lane Marl Pit, Old Hall Farm Marl Pit, Church Farm Pit, Blind Lane Pit, Harman’s Grove Pit.

5.10.42. Full list of mineral sites and details are provided in the Desk Study Report Ref No 70041922-WSP-GE- 001.

Solution Features

5.10.43. High risk of chalk solution features affecting this route.

Unexploded Ordnance (UXO)

5.10.44. No detailed UXO study is required.

MITIGATION

- All bridges are likely to have to be piled;
- The Wensum viaduct potentially has to be built of large bored piles, to allow for long bridge spans;
- Minor structures may be piled or built on shallow foundation or using ground replacement; depending on the location and the imposed loads; and
- The areas of past opencast will have to be subject to ground improvement.

RECOMMENDATIONS

5.10.45. A detailed ground investigation survey should be carried out after the preferred route is selected. This will assist in determining possible site-specific ground conditions and potential presence of contaminants along the preferred route corridor.

5.10.46. Ground investigation would also assist in determining suitability of soils, which would assist in determining earthworks balances for a more accurate costing of the preferred route.

6. TRAFFIC AND ECONOMIC ASSESSMENT

6.1. MODELLING

6.1.1. The existing Norwich Area Transport Strategy (NATS) model consists of a highway assignment model developed in Simulation and Assignment of Traffic to Urban Road Networks (SATURN) modelling software, which is endorsed by the DfT and approved by central government.

6.1.2. Highways England updated the NATS SATURN model for the assessment of proposed A47 schemes with the aim to maintain consistency with the existing NATS model. Where possible, the same approach was adopted as for the 2012 rebase. Highways England refined and adjusted the NATS model to represent a more current base year situation (2015) and achieve better functionality for representing the likely operation and impacts of the proposed A47 schemes. The Local Model Validation Report (LMVR) details the development of the updated NATS model.

MODELLED PERIODS

6.1.3. The NATS model has the following time periods:

- Morning peak hour (AM) 08:00-09:00;
- Average inter-peak hour (IP) 10:00-16:00;
- Evening peak hour (PM) 17:00-18:00.

6.1.4. The highway assignment model groups traffic into ‘user classes’. These segmentations differentiate between the characteristics of road users, both in terms of their use and their physical attributes. HGVs, for example, are physically larger than cars, and therefore take up more road space per vehicle. The user classes are summarised as follows:

- User Class 1: Cars used for Employers Business;
- User Class 2: Cars used for Commuting;
- User Class 3: Cars used for Other purposes;
- User Class 4: Light Goods Vehicles (LGVs); and
- User Class 5: HGVs.

MODELLED NETWORK

6.1.5. In order to reflect more recent traffic patterns within the study area, the updated Highways England NATS model has been used as the starting point. As part of the assessment of the A47 Road Investment Strategy schemes (RIS), Highways England updated the 2012 NATS model by:

- Refining the zoning detail in the west of the NATS model area;
- Including additional road network where missing links or junctions could potentially distort model access on the A47;
- Combine model update information from multiple sources to derive a 2015 base year model.

6.1.6. The model was also rebased using more detailed data including the use of mobile data sets to further develop demand assumptions within the model and zone disaggregation to better reflect the loading of trips onto the local road network. Network auditing around the study area and improved link validation in the study area should further improve the forecasting accuracy of the model.

6.1.7. For the NWL assessment the 2015 Highways England NATS model was updated as follows:

- Refining the zoning detail in the west of the NATS model area;

- Including additional road network to provide greater accuracy of local roads between the A47 and A1067 to better inform traffic patterns in the Norwich Western Link study area;
- Using localised 2015 ATC data the 2015 NATS model has been recalibrated to better reflect 2015 flows on those minor roads linking the A47 and A1067.
- Revalidation and Calibration of the model in the study area in order to reflect the observed conditions.

Network enhancements

6.1.8. The existing NATS model had some limitations in the western area that made the model less suitable for immediate appraisal of the NWL. The majority of the secondary (local) road junctions had not been specifically coded into the model; this means that demand flows are considered unrestricted in these areas, and that any results for these areas will be less realistic. This includes all the junctions within the study area for the NWL, as well as any junctions along the A47 to the west of the A47/Dereham Road junction, and any junctions along the A1067 to the west of the old Fakenham Road.

6.1.9. Given the limitations of the existing model, the existing simulation network was updated in order to better represent the existing local road network, as well as to take future growth and potential highway schemes into account.

Demand enhancements

6.1.10. As the study area is on the periphery on the NATS model it was necessary to add new zones. This would allow for better assignment of the traffic flows in the study area.

CALIBRATION AND VALIDATION

6.1.11. A localised model calibration and validation exercise was undertaken using the observed count information alongside an updated 2015 base year model (network and zoning).

6.1.12. Calibration of the NWL transport model involves ensuring the model represents the on-site observed conditions by adjusting model inputs and parameters. The process involves examination of the network, checking for errors, and improving the performance of the model in terms of comparisons with observed data. Calibration statistics are presented using the DfT's WebTAG criteria.

6.1.13. Calibration is undertaken for the four main components of the model:

Network	Route Choice	Trip Matrix	Assignment

6.1.14. Each of the tasks above is linked with each other and it is often a combination of all that are required to address each problem identified by the calibration process.

Network calibration

6.1.15. During the network building calibration process, the following activities are undertaken:

- Review of the network coding warnings produced by the SATURN network building program SATNET;
- Network distance and speed checks;
- Review of junction approaches and saturation flows;
- Detailed review of the coding of complex junctions; and
- Exclusion of neighbouring turning counts from the validation spreadsheet.

Route choice calibration

6.1.16. At various stages of model development, the minimum cost routes for a range of selected origin-destination pairs should be plotted and checked for plausibility. Modelled route choice depends on:

- Zone size;
- Network structure;
- Centroid connectors;
- Trip matrix accuracy;
- Representation of speeds and delays; and
- Junction coding accuracy.

6.1.17. Where routes are found to be implausible one or more of the above aspects have been adjusted.

Trip matrix calibration

6.1.18. As part of the trip matrix calibration it is essential to validate the trip matrices by comparing assigned flows with traffic counts with the Geoffrey E. Havers (GEH) statistic used to compare observed and assigned flow. The statistic uses the following formula to calculate a value for the difference between observed (M_E – survey data) and modelled (M_G – SATURN flow) traffic flow:

$$GEH\ Statistic = \sqrt{\frac{(M_E - M_G)^2}{0.5(M_E + M_G)}}$$

6.1.19. The GEH statistic takes account of the fact that when traffic flows are low, the percentage difference between observed and modelled flow may be high but the significance of this difference is small and conversely, a small percentage difference on a large base might be important. A GEH value greater than 10 indicates that closer attention is required, as the match between observed and modelled flows is poor, while a GEH less than five indicates a good fit. The aim is to achieve at least 85% links and turns with a GEH less than 5 as specified in Unit M3.1 of the DfT's WebTAG.

6.1.20. The following sections set out the comparison of the modelled flows and observed flows.

Assignment calibration

6.1.21. Unit M3.1 of the DfT's WebTAG also specifies the following flow validation criteria for links and turns:

- Individual flows within 100 vehicles per hour for flows less than 700 vehicles per hour in more than 85% of cases
- Individual flows within 15% for flows between 700 – 2,700 vehicles per hour in more than 85% of cases
- Individual flows within 400 vehicles per hour for flows greater than 2,700 vehicles per hour in more than 85% of cases

6.1.22. In updating the NATS model and to provide confidence in the robustness and accuracy of the forecast models, a full audit process was undertaken to calibrate and validate the 2015 base year model in line with current guidance Unit M3.1 of the DfT's WebTAG. The results of the calibration and validation are shown in **Figure 6.1.**

6.1.23. The results show that the model has achieved a high-level of calibration and validation across all time periods.

Figure 6.1 - Calibration and validation results

AM Peak

Criteria and Measure: Observed	Modelled	Acceptability Guideline	ALL Calibration Total Counts	ALL Calibration Meet Criteria	ALL Calibration %	ALL Validation Total Counts	ALL Validation Meet Criteria	ALL Validation %	CAR Calibration Total Counts	CAR Calibration Meet Criteria	CAR Calibration %	CAR Validation Total Counts	CAR Validation Meet Criteria	CAR Validation %
Flow Criteria														
< 700 vph	±100 vph	> 85 % of links	12	12	100%	22	22	100%	12	12	100%	22	21	95%
700 - 2,700 vph	±15%	> 85 % of links	4	4	100%	0	0	0%	4	4	100%	0	0	0%
> 2,700 vph	±400 vph	> 85 % of links	0	0	0%	0	0	0%	0	0	0%	0	0	0%
GEH Criteria														
GEH Statistic for individual links < 5		> 85 % of links	16	13	81%	22	20	91%	16	14	88%	22	18	82%

GEH Range	ALL Calibration		ALL Validation		ALL Combined		CAR Calibration		CAR Validation		CAR Combined	
GEH < 2	11	69%	0	0%	11	29%	11	69%	8	36%	19	50%
GEH < 4	12	75%	17	77%	29	76%	11	69%	17	77%	28	74%
GEH < 6	14	88%	21	95%	35	92%	14	88%	20	91%	34	89%
GEH < 8	15	94%	22	100%	37	97%	14	88%	22	100%	36	95%
GEH < 10	16	100%	22	100%	38	100%	16	100%	22	100%	38	100%
GEH <5	13	81%	20	91%	33	87%	14	88%	18	82%	32	84%

Interpeak

Criteria and Measure: Observed	Modelled	Acceptability Guideline	ALL Calibration Total Counts	ALL Calibration Meet Criteria	ALL Calibration %	ALL Validation Total Counts	ALL Validation Meet Criteria	ALL Validation %	CAR Calibration Total Counts	CAR Calibration Meet Criteria	CAR Calibration %	CAR Validation Total Counts	CAR Validation Meet Criteria	CAR Validation %
Flow Criteria														
< 700 vph	±100 vph	> 85 % of links	12	12	100%	22	22	100%	16	16	100%	22	22	100%
700 - 2,700 vph	±15%	> 85 % of links	4	4	100%	0	0	0%	0	0	0%	0	0	0%
> 2,700 vph	±400 vph	> 85 % of links	0	0	0%	0	0	0%	0	0	0%	0	0	0%
GEH Criteria														
GEH Statistic for individual links < 5		> 85 % of links	16	14	88%	22	22	100%	16	14	88%	22	21	95%

GEH Range	ALL Calibration		ALL Validation		ALL Combined		CAR Calibration		CAR Validation		CAR Combined	
GEH < 2	12	75%	0	0%	12	32%	12	75%	10	45%	22	58%
GEH < 4	14	88%	19	86%	33	87%	14	88%	21	95%	35	92%
GEH < 6	15	94%	22	100%	37	97%	15	94%	22	100%	37	97%
GEH < 8	16	100%	22	100%	38	100%	16	100%	22	100%	38	100%
GEH < 10	16	100%	22	100%	38	100%	16	100%	22	100%	38	100%
GEH <5	14	88%	22	100%	36	95%	14	88%	21	95%	35	92%

PM Peak

Criteria and Measure: Observed	Modelled	Acceptability Guideline	ALL Calibration Total Counts	ALL Calibration Meet Criteria	ALL Calibration %	ALL Validation Total Counts	ALL Validation Meet Criteria	ALL Validation %	CAR Calibration Total Counts	CAR Calibration Meet Criteria	CAR Calibration %	CAR Validation Total Counts	CAR Validation Meet Criteria	CAR Validation %
Flow Criteria														
< 700 vph	±100 vph	> 85 % of links	12	11	92%	22	22	100%	12	11	92%	22	20	91%
700 - 2,700 vph	±15%	> 85 % of links	4	4	100%	0	0	0%	4	4	100%	0	0	0%
> 2,700 vph	±400 vph	> 85 % of links	0	0	0%	0	0	0%	0	0	0%	0	0	0%
GEH Criteria														
GEH Statistic for individual links < 5		> 85 % of links	16	14	88%	22	20	91%	16	14	88%	22	17	77%

GEH Range	ALL Calibration		ALL Validation		ALL Combined		CAR Calibration		CAR Validation		CAR Combined	
GEH < 2	11	69%	0	0%	11	29%	11	69%	6	27%	17	45%
GEH < 4	13	81%	17	77%	30	79%	12	75%	15	68%	27	71%
GEH < 6	15	94%	21	95%	36	95%	14	88%	20	91%	34	89%
GEH < 8	15	94%	22	100%	37	97%	15	94%	22	100%	37	97%
GEH < 10	15	94%	22	100%	37	97%	15	94%	22	100%	37	97%
GEH <5	14	88%	20	91%	34	89%	14	88%	17	77%	31	82%

Base Year (2015) Annual Average Daily Traffic

6.1.24. Annual Average Daily Traffic (AADT) flows have been produced from the 2015 base year peak hour models (AM peak, inter-peak and PM peak). **Table 6.1** shows flows on certain points on the network rounded to the nearest 1,000 vehicles.

Table 6.1 - Base year AADT (2015)

Location	2015
A47 west of Sandy Lane (2-way)	25,000
A47 east of Wood Lane (2-way)	26,000
Former A47 west of Taverham Road	1,000
B1535 Wood Lane	6,000
Total on other existing North-south routes through study area (Taverham Road, Lyng Road, Honingham Road & Ringland Road)	7,000
A1067 Attlebridge to A1270	14,000

6.2. FORECASTING

METHODOLOGY

6.2.1. WSP produced an updated traffic model based on the existing 2006 Norwich Area Transport Strategy (NATS) SATURN highway model to test a future year Reference Forecast scenario comprising the proposed Norwich Western Link (NWL) and including the major developments most likely to be developed within the next 15-20 years.

6.2.2. This section reports on the methodology used to develop the NATS traffic model. Specifically, this section describes the impact of changes due to selected major developments most likely to be developed on the highway network in the various strategies and developments, in highway performance terms, both on the local network and on the wider transport network of Norwich.

6.2.3. The following forecast years have been identified:

- 2025: Opening year
- 2040: Design year
- 2050: Horizon year

Development growth

6.2.4. The updated traffic forecast models include local development and infrastructure which is classified as 'Near Certain' or 'More than Likely'. This includes developments and schemes which have planning permission or are going through the planning process.

6.2.5. For each of the modelled peak hours the base year validated matrix was used as a starting point.

6.2.6. Background traffic growth for cars has been obtained from the Trip End Model Presentation Program version 7.2 (TEMPro), a software tool that provides projections of growth over time based on outputs from the National Trip End Model (NTEM). NTEM takes into account changes in population, employment, car ownership and trip rates to forecast the growth in trip origins and destinations. NTEM version 7.2 datasets were published on 1 March 2017 and are the latest available set of forecasts at the time the forecast models were updated

6.2.7. Growth for LGVs and HGVs has been obtained from the National Road Traffic Forecasts (NRTF) published by the DfT (September 2018). These growth rates have been applied to each region depending on the NWL zone location.

6.2.8. At this stage a 'core' central growth scenario has been developed with District wide demographic growth constrained to the top totals within TEMPro version 7.2 and in the absence of an adopted Local Plan beyond 2026 as the new Local Plans applicable to the study area are still emerging. TEMPro and NRTF factors have been assigned to each base year model zone with the origin and destination totals for each base year zone increased appropriately. This is in accordance with WebTAG methodology where forecasting needs to consider time periods beyond adopted policy. Sensitivity testing will be carried out at the SOBC stage for a wider range of growth scenarios. However, at this stage a TEMPro-based approach is considered to be robust as the housing growth assumptions within TEMPro exceed those set out within the relevant Local Plans.

6.2.9. The forecast year origin and destination totals were then used to furness the base year matrix to generate a matrix for the forecast year peak hour which represented background growth in traffic. Furnessing is a process by which the matrix is balanced in order to meet targets totals for origins and destinations. Since both trip ends are factored, the process is referred to as being doubly-constrained.

6.2.10. As land use developments are a source of uncertainty, the total growth predicted by the forecast model is to reflect the total growth predicted by TEMPro in order to be consistent with national and regional planning policy. Unadjusted TEMPro factors at district level, have been effectively used as a constraint on the forecast matrix.

6.2.11. A summary of the percentage change in matrix totals by user class for each modelled year and time period compared to the 2015 base scenario is shown in Table 6.2.

Table 6.2 – Growth in matrices by user class 2015-2050

User class	2025			2040			2050		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Car Employers Business	8%	7%	8%	20%	18%	19%	29%	25%	27%
Car Commuting	7%	7%	6%	19%	21%	18%	28%	30%	25%
Cars Other	18%	17%	14%	41%	39%	34%	54%	52%	45%
LGV	15%	15%	15%	38%	38%	38%	50%	50%	50%
HGV	3%	3%	3%	11%	11%	11%	17%	17%	17%
TOTAL	**11%**	**13%**	**10%**	**28%**	**31%**	**26%**	**38%**	**42%**	**36%**

Forecasting scenarios

6.2.12. Updated forecast year 2025, 2040 and 2050 networks have been produced with the core growth demand matrices. These are the 'Do Nothing' scenarios for 2025, 2040 and 2050, that is without NWL infrastructure. The 2025, 2040 and 2050 forecast year models have been produced for the following 'Do Nothing' network scenarios:

- Highways England A47 North Tuddenham to Easton scheme assumed to include grade-separated junctions with the A47

6.2.13. **Figure 6.2** and **Figure 6.3** show the forecast year Average Annual Daily Traffic (AADT) flows for the Do Nothing scenario in 2025 (opening year) and 2040.

Figure 6.2 – 2025 Forecast year AADT Do Nothing

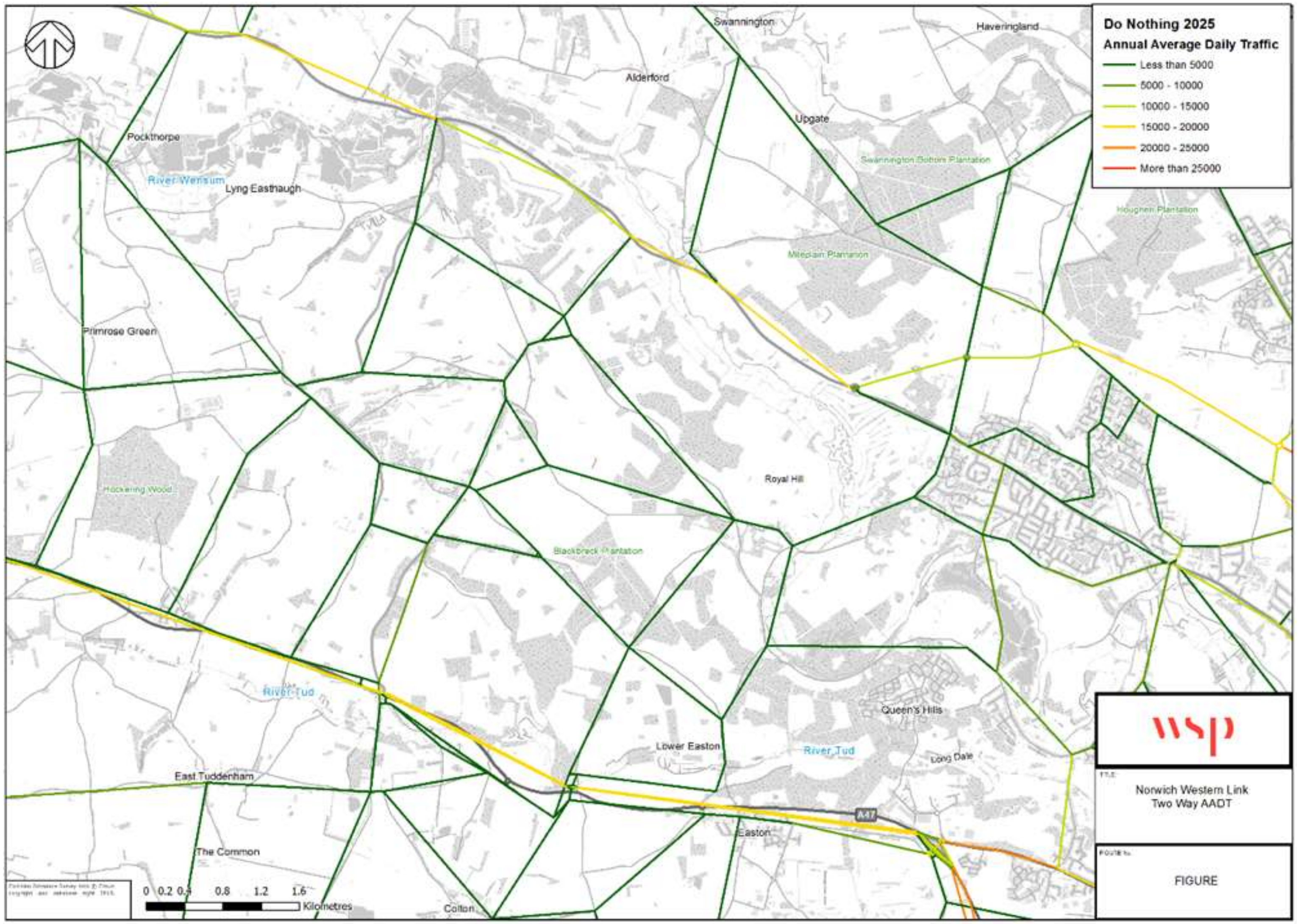
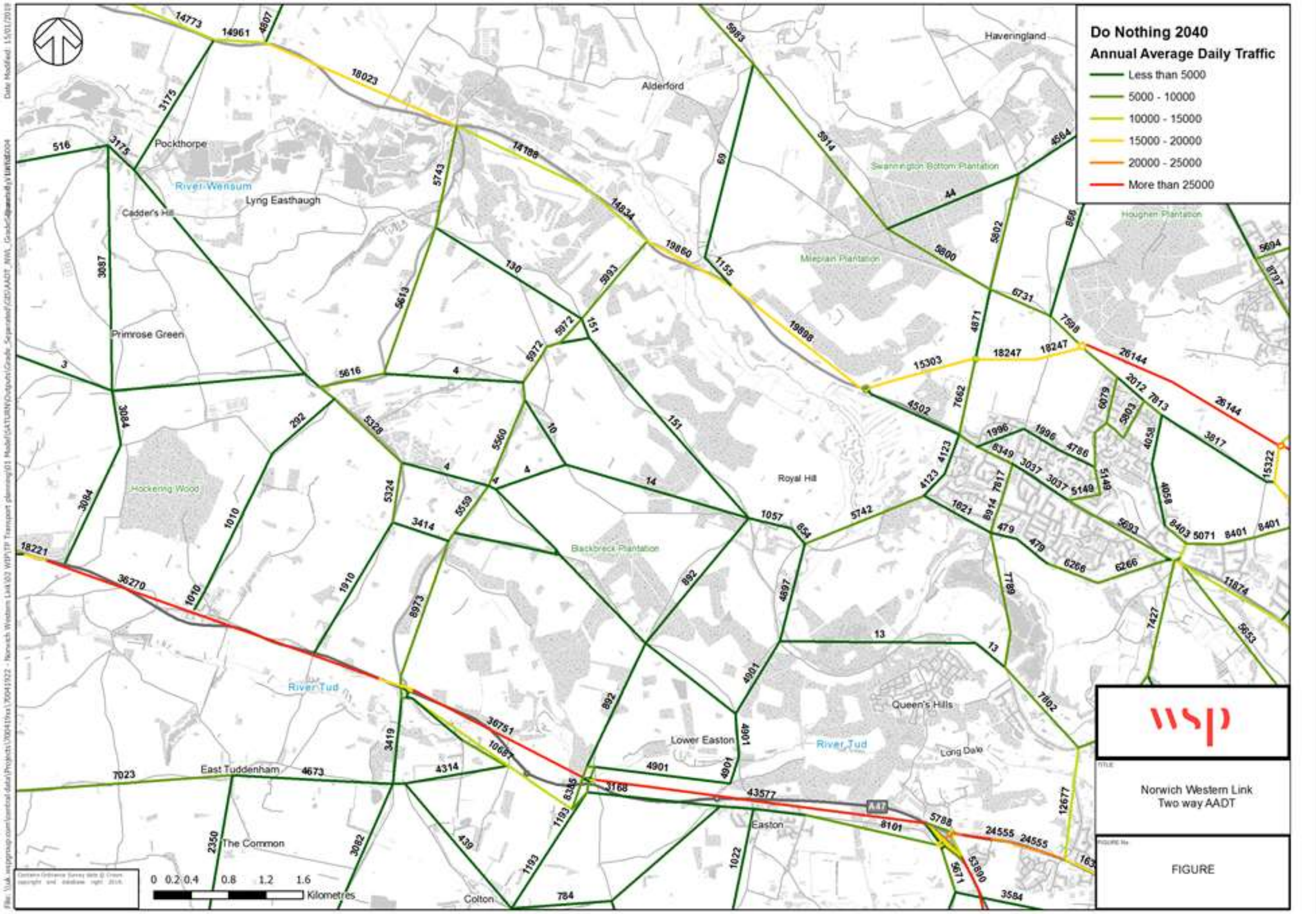


Figure 6.3 - 2040 Forecast year AADT Do Nothing



6.2.14. AADT flows have been produced from the 2025, 2040 and 2050 forecast year peak hour models (AM peak, inter-peak and PM peak) and **Table 6.3** shows flows at key locations on the network, rounded to the nearest 1,000 vehicles.

Table 6.3 – 'Do Nothing' AADT changes

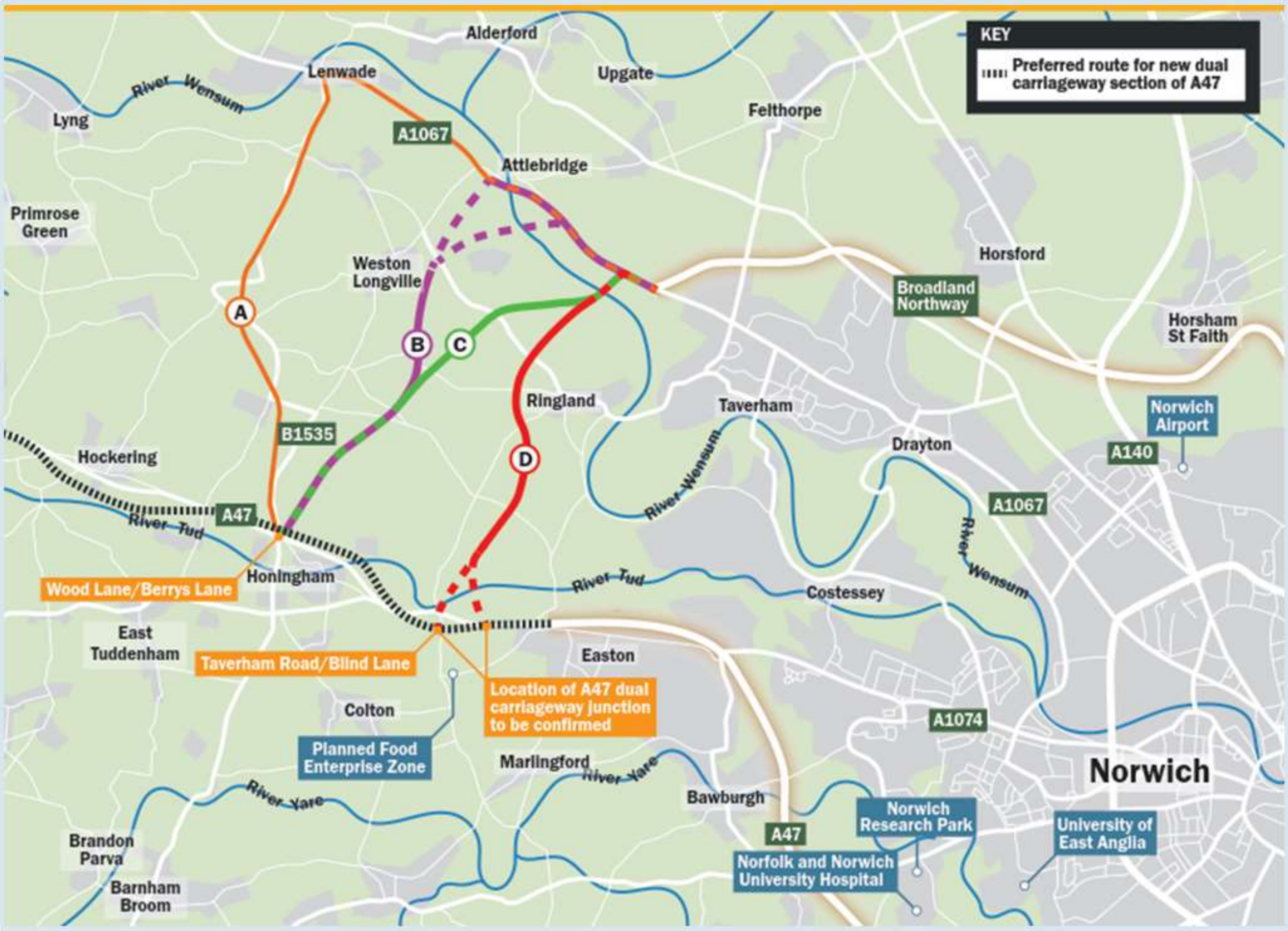
Location	2015-2025	2015-2040	2015-2050
A47 west of Sandy Lane (2 way)	+5,000	+12,000	+14,000
A47 east of Wood Lane (2 way)	+5,000	+11,000	+16,000
Former A47 west of Taverham Road	+1,000	+5,000	+13,000
B1535 Wood Lane	+2,000	+3,000	+6,000
Total on existing North-south routes through study area (Taverham Road, Lyng Road, Honingham Road & Ringland Road)	+4,000	+6,000	+9,000
A1067 Attlebridge to A1270	+3,000	+6,000	+7,000

6.2.15. The flows on the A47 (west of Sandy Lane) are forecast to increase by 12,000 vehicles per day by 2040. On the A47 (east of Wood Lane) modelled traffic are forecast to increase by 11,000 vehicles per day by 2040. The A1067 is forecast to increase by 6,000 vehicles per day by 2040 between Attlebridge and the A1270. The existing routes between the A47 and A1067 are also predicted to show increases in traffic of approximately 6,000 vehicles by 2040 (this includes Lyng Road, Ringland Road, Honingham Road and Taverham Road). This would be nearly double the existing total flow on these routes. The existing B1535 would experience an additional 3,000 vehicles per day by 2040. There is predicted to be a large increase in modelled flow on the A47 west of Taverham Road which is likely to be influenced by traffic from additional development in the A47 corridor.

Do-something networks

6.2.16. To undertake an assessment of the shortlisted options for NWL, the proposed schemes have been coded into the "Do nothing" network to create a "Do Something" network. This has been undertaken to understand the range of demand generated by the various options and to gauge the likely effects of an NWL. The route options are shown in Figure 6.4.

Figure 6.4 – Shortlisted Highway Options



6.2.17. The short-listed options are:

Option A:

- Single carriageway link from Wood Lane/Berry's Lane A47 proposed Highways England roundabout (extra arm added) which would replace the existing B1535 route
- WS2 standard
- No widening of A1067 to A1270

Option B East:

- Dual carriageway link from Wood Lane/Berry's Lane A47 proposed Highways England roundabout (extra arm added)
- D2AP standard
- A1067 also dualled to A1270
- On viaduct crossing River Wensum

Option B West:

- Dual carriageway link from Wood Lane/Berry's Lane A47 proposed Highways England roundabout (extra arm added) using the existing bridge at Attlebridge to join with the A1067
- D2AP standard
- A1067 also dualled to A1270

Option C:

- Dual carriageway link from Wood Lane/Berry's Lane A47 proposed Highways England roundabout (extra arm added)
- D2AP standard
- On viaduct crossing River Wensum short section of A1067 also dualled to A1270

Option D:

- Dual carriageway link from Taverham Road/Blind Lane A47 proposed Highways England roundabout (extra arm added)
- D2AP standard
- On viaduct crossing River Wensum and also bridges over the River Tud. Short section of A1067 also dualled to A1270.
- The southern section of this route has two options due to the uncertainty around the placement of the junction with the A47 which will be set by Highways England as part of the A47 dualling upgrade. At this stage identical traffic flows have been applied to both variations of Option D

6.3. EFFECTS OF SCHEME OPTIONS

PREDICTED TRAFFIC FLOW CHANGES

6.3.1. For an overview of the impact of flows on the network Table 6.4 presents the AADT for key points in 2025, 2040 and 2050 for the 'Do Nothing' scenario and the five options, to the nearest 1,000 vehicles.

Table 6.4 – 'Do Nothing' and NWL scheme options: AADT flow at key points

Location	Do Nothing	Option A	Option B East	Option B West	Option C	Option D
2025						
A47 east of Wood Lane	31,000	33,000	30,000	30,000	30,000	33,000
The Common, Lyng Road	2,000	2,000	2,000	2,000	2,000	2,000
Weston Hall Road	5,000	7,000	<500	<500	1,000	1,000
Ringland Road	2,000	2,000	<500	<500	<500	<500
A1067 east of Lenwade	12,000	11,000	16,000	17,000	14,000	15,000
Heath Road	1,000	<500	1,000	1,000	1,000	1,000
Wood Lane	8,000	5,000	1,000	1,000	1,000	1,000
Honingham Road	4,000	5,000	1,000	1,000	1,000	1,000
A1067 west of Broadland Northway	17,000	16,000	26,000	24,000	28,000	27,000
Broadland Northway	13,000	13,000	19,000	18,000	22,000	21,000
The Street	1,000	1,000	<500	<500	<500	<500

Location	Do Nothing	Option A	Option B East	Option B West	Option C	Option D
Taverham Lane	7,000	7,000	6,000	7,000	6,000	6,000
A47 west of Church Lane	34,000	36,000	33,000	33,000	33,000	37,000
Norwich Western Link		7,000	20,000	19,000	21,000	21,000
2040						
A47 east of Wood Lane	37,000	38,000	37,000	37,000	37,000	39,000
The Common, Lyng Road	3,000	3,000	2,000	2,000	2,000	2,000
Weston Hall Road	6,000	10,000	<500	<500	1,000	2,000
Ringland Road	6,000	5,000	<500	1,000	<500	<500
A1067 east of Lenwade	14,000	13,000	20,000	20,000	17,000	17,000
Heath Road	1,000	<500	1,000	1,000	1,000	1,000
Wood Lane	9,000	6,000	1,000	1,000	2,000	3,000
Honingham Road	6,000	6,000	1,000	1,000	1,000	1,000
A1067 west of Broadland Northway	20,000	20,000	36,000	34,000	38,000	37,000
Broadland Northway	15,000	16,000	28,000	27,000	30,000	30,000
The Street	1,000	1,000	1,000	1,000	1,000	1,000
Taverham Lane	8,000	7,000	7,000	7,000	7,000	6,000
A47 west of Church Lane	44,000	45,000	43,000	43,000	42,000	47,000
Norwich Western Link		10,000	30,000	29,000	32,000	31,000
2050						
A47 east of Wood Lane	42,000	43,000	40,000	40,000	40,000	45,000
The Common, Lyng Road	4,000	3,000	2,000	2,000	2,000	3,000
Weston Hall Road	7,000	13,000	1,000	1,000	2,000	4,000
Ringland Road	8,000	8,000	1,000	2,000	1,000	1,000
A1067 east of Lenwade	14,000	14,000	21,000	21,000	17,000	16,000
Heath Road	1,000	1,000	1,000	1,000	1,000	1,000
Wood Lane	12,000	9,000	2,000	2,000	3,000	5,000

Location	Do Nothing	Option A	Option B East	Option B West	Option C	Option D
Honingham Road	8,000	8,000	1,000	1,000	1,000	1,000
A1067 west of Broadland Northway	22,000	22,000	40,000	39,000	41,000	40,000
Broadland Northway	17,000	18,000	33,000	32,000	34,000	33,000
The Street	2,000	2,000	1,000	1,000	1,000	1,000
Taverham Lane	8,000	8,000	7,000	7,000	7,000	7,000
A47 west of Church Lane	52,000	53,000	51,000	52,000	51,000	55,000
Norwich Western Link		12,000	37,000	35,000	36,000	34,000

6.3.2. Analysis of the model outputs has shown that there will be a reduction of traffic flows on the local road network to the west of Norwich through areas such as Drayton and Costessey. The level of impact however differs with each option as would be expected. In 2040 Traffic flows on competing north-south routes through the study area were found to decrease significantly on Ringland Road, Weston Hall Road, Honingham Road and Wood Lane with the majority of options, with 4000-5000 vehicles per day although reductions with Option A were much less pronounced on these routes.

6.3.3. Significant reductions were also found on Costessey Lane where flows dropped by 700 vehicles per day with Option A and by 4800 vehicles with Options B, C and D. Similar results were also noted on Long Water Lane and the A1074. Reductions are more pronounced for options located further east.

PREDICTED JOURNEY TIME CHANGES

6.3.4. In order to understand the impact of the proposed option alignments average modelled journey times on key routes have been calculated for the 2040 AM Peak and are shown below directionally for each option. The Journey Times on four key routes are shown in **Table 6.5** below.

Table 6.5 - 2040 AM Journey Times (Key Routes)

Route	Time (minutes)					
	Do Nothing	Option A	Option B East	Option B West	Option C	Option D (both)
Taverham Road/Blind Lane A47 junction to western end of Broadland Northway	11	11	6	7	6	5
Between Wood Lane/Berry's Lane junction to western end of Broadland Northway	12	10	5	6	5	7
Between Taverham Road/Blind Lane A47 junction to B1535 junction with A1067 at Lenwade	11	7	8	8	9	8
Between Wood Lane/Berry's Lane junction to B1535 junction with A1067 at Lenwade	9	5	9	9	9	9

Taverham Road/Blind Lane A47 junction to western end of Broadland Northway

6.3.5. Option D produces an average 6 minute journey time saving - the largest journey time saving of the 5 options when compared with the Do Nothing scenario. This analysis covers both Option D West and option D East which have been modelled as single scenario at this stage.

6.3.6. Option B East and Option C both produce an average 5 minute journey time saving, while Option B West is forecast to provide a 4 minute journey time saving. Option A, the upgrade to the B1535, which is the Option aligned furthest to the west, produces no journey time saving on this key route.

Between Wood Lane/Berrys Lane junction to western end of Broadland Northway

6.3.7. Options C and B East were shown to offer the most significant journey time saving for this route reducing journey times by around 5 minutes.

6.3.8. Option B West offers on average a 6 minute reduction on this route and Options D (West and East) produce average journey time savings of around 5 minutes.

6.3.9. Option A results in a 2 minute average journey time saving and provides the least benefit on this route when compared with the Do Nothing scenario.

Between Taverham Road/Blind Lane A47 junction to B1535 junction with A1067 at Lenwade

6.3.10. Table 6.5 shows that Option A offers the greatest time saving on this route of about 4 minutes on average. Options B (West and East) and Options D (West and East) also offer reductions of about 3 minutes on average. Whilst Option C is forecast to produce an average journey time saving of about 2 minutes.

Between Wood Lane/Berrys Lane junction to B1535 junction with A1067 at Lenwade

6.3.11. Option A produces an average journey time saving of around 4 minutes, whilst the remaining options all offer no journey time saving on this route when compared with the Do Nothing scenario.

PREDICTED CHANGES IN ACCIDENTS

6.3.12. Highway schemes are generally assessed with both travel time savings and accident benefits. While accident benefits normally come from a change of junction or link type or a change in flow which impacts exiting conditions such as speed and merge or diverge rates, the scheme accidents benefits have not been directly assessed at this stage because the proposed scheme does not include sufficient detail at this stage. In order to assess the impact of the scheme in relation to accidents a qualitative exercise has been carried out at this stage. It is envisioned that a quantitative assessment will be carried out using Cobalt at a later stage.

6.3.13. An assessment of the impact that the proposed NWL scheme has on accidents has been undertaken.

6.3.14. Within the study area, there have been a number of recorded road traffic accidents, primarily along the main arterial routes to or from Norwich city centre. It should be noted that these records only represent injury accidents recorded by the police and do not take into account ‘damage only’ accidents.

6.3.15. In the five years from 2013 to 2017, there were 621 recorded collisions in the study area, involving 830 casualties:

Table 6.6 – NWL Study Area Accident Analysis

Severity	Collisions	Casualties
Slight	515	702
Serious	99	121
Fatal	7	7
Total	**621**	**830**

6.3.16. **Table 6.6** provides a summary of all accidents in the study area for the period 2013-2017. Of the 830 casualties, 64 (8%) were pedestrians and 115 (14%) were cyclists. 106 casualties (13%) arose from accidents involving motorcycles. Clusters (based on five-year accident plot 2013-2017) have been identified at the following locations:

- A47 Longwater junction
- Dereham Road (A1074), junction with Longwater Lane
- Dereham Road (A1074), roundabout junction with Wendene
- Dereham Road (A1074), junction with Norwich Road
- Drayton High Road (A1067) junction with Boundary Road
- A410 in the vicinity of the airport
- Middletons Lane

6.3.17. Currently the majority of traffic in the study area can be found on three roads, the A47, and its continuation the A1074 from Longwater Junction heading east into Norwich and the A1067 located to the north of the study area. As strategic routes within the study area these roads provide core linkages between the west and east and access to the main north to south routes. A summary of the number of accidents recorded on these roads is provided below.

- A1067 from Cadge Road to Longwater Junction - 46
- Longwater Junction - 19
- Longwater to Taverham Road -15
- Hospital Lane to NDR -38
- NDR to Attlebridge - 18
- Attlebridge to B1535 and Potters Lane - 11

6.3.18. The proposed link road will run between the A47 in the south and the A1067 in the north and is expected to have the most significant impacts on roads and routes which currently service this area. Analysis has shown that between 2013 and 2017 a total of 61 accidents were recorded, resulting in 82 slight injuries and 17 serious injuries. It was noted that in terms of non-motorised users a total of 5 pedestrians and 9 cyclists were injured equating to approximatley14% of all injuries, which is higher than the national average of 11%.

6.3.19. A review of the main five routes linking the A47 and A1067 in the study area was undertaken to allow an understanding of the potential direct impact on accidents. The routes are described below.

- Route 1 – Lyng Road, Heath Road, The Common
- Route 2 – Sandy Lane Weston Grange Road, Rectory Road, Weston Hall Road
- Route 3 - Wood Lane, Paddys Lane, Honingham Road, Church St, Marl Hill
- Route 4 - Taverham Road, Honingham Lane, The Street, Ringland Road, Beech Avenue
- Route 5 – Longwater Lane, West End, The Street, Costessy Lane

6.3.20. On these five routes during the five year 2013 to 2017 study period a total of 32 accidents occurred resulting in 36 slight injuries and 11 serious injuries with 13% of injured categorized as non-motorised users.

6.3.21. The proposed options will encourage a reassignment of traffic away from existing lower standard routes on to the new higher standard highway link proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.

6.4. PERFORMANCE AGAINST OBJECTIVES

6.4.1. An assessment of the route options against the High Level and Specific objectives was undertaken during the OAR phase in 2018. Options where considered in relation to their performance against both the high level and specific objectives.

6.4.2. Options B and D West and East and Option C generally performed well against both the high level and specific objectives however, option A was found to be the less successful in terms of performance against the specific objectives.

6.4.3. Where the route options are found to perform poorly against specific objectives, specific non-highways measures which address these objectives can be considered as part of an overall package in order to produce the most efficient result.

6.5. ECONOMIC PERFORMANCE OF OPTIONS

METHODOLOGY

6.5.1. The appraisal of the economic elements associated with the scheme has been undertaken in accordance with WebTAG Unit A1.1 Cost-Benefit Analysis (May 2018) using the DfT's standard appraisal software:

- Transport User Benefit Appraisal (TUBA) version 1.9.11 with TUBA Economics File (version 1.9.11) using TAG Data Book v1.10 (May 2018).

6.5.2. The following economic elements have been considered for this stage of the assessment of the proposed Norwich Western Link scheme options:

- Time Savings
- Vehicle Operating Costs
- Scheme Costs
- Indirect tax revenue.

6.5.3. TUBA was used to carry out the economic appraisal of the Norwich Western Link scheme options. All costs and benefits reported by TUBA are based on willingness to pay and expressed in the market price unit of account.

TUBA INPUTS

Economic parameters

6.5.4. The economic appraisal was undertaken in TUBA Version 1.9.11 with the TUBA input consisting of two files containing the economic data and scheme data.

6.5.5. The economic input file contains all of the economic data and parameters required by TUBA in the economic appraisal. The TUBA Economics File (version 1.9.11) has used TAG Data Book v1.8.10 (May 2018) which was the latest available at the time.

6.5.6. The scheme input file contains data regarding scheme costs, user classes, modelled years, annualisation factors and input matrices.

Modelled years

6.5.7. The economic appraisal was carried out over a 60-year period, from 2025 (opening year) to a horizon year of 2084 as this is the standard period over which travel time benefits are calculated.

6.5.8. Traffic flow information have been based on the SATURN forecast year transport models (2025, 2040 and 2050).

6.5.9. Annualisation factors have been applied to convert peak period flows into annual flows. Details are provided in the following sections.

Time scales / annualisation

6.5.10. TUBA makes a distinction between time slices and time periods. Standard time periods are defined in the economics file as:

- AM Peak (Weekday 07:00 – 10:00)
- PM Peak (Weekday 16:00 – 19:00)
- Inter-peak (Weekday 10:00 – 16:00)
- Off-peak (Weekday 19:00 – 07:00)
- Weekend.

6.5.11. The SATURN model does not include weekend and the off-peak periods as origin-destination data were not collected for these time periods, therefore it has not been possible to determine potential benefits for these periods.

6.5.12. The SATURN model has been assigned as an AM peak hour model, average Inter peak hour model and a PM peak hour period which enables the benefits for these peak periods to be used in TUBA.

6.5.13. In order to model the time slices in TUBA, an annualisation factor is required to convert to each time period. The annualisation factor is given by h x d where h is the number of this time slice in the time period and d is the number of days a year containing the time period. The annualisation factor is specified in the scheme input file.

6.5.14. From the information detailed above, the modelled time slices used to represent the weekday benefit are detailed below:

- AM peak period average hour time slice
- PM peak period average hour time slice
- Average Inter-peak period average hour time slice.

6.5.15. There are 253 peaked weekdays (excludes weekdays falling on bank holidays) meaning that the annualisation factors that have been used are:

- AM peak (07:00-10:00): 759
- PM peak (16:00-19:00): 759
- Inter-peak (10:00-16:00): 1,518.

6.5.16. These have been based on the recent observed count information collected within the study area by Norfolk County Council which looked at traffic flow volumes/patterns in the vicinity of the Norwich Western Link as part of the on-going monitoring of the impact of the Norwich Northern Distributor Road (NNDR).

6.5.17. The benefits produced in this assessment represent a conservative estimate of the total benefits produced from the scheme. This is due to two main reasons:

- No benefits were calculated for weekday off-peak periods (19:00 – 07:00)
- No benefits have been calculated for weekends or bank holidays.

Matrix input

6.5.18. Matrix inputs were required for the number of trips and journey time for each user class and also for trip distance. The trip distance and journey time matrices were taken from the SATURN model directly for the 2025, 2040 and 2050 forecast year models.

Journey purpose / user class

6.5.19. The trip matrices were split into the following vehicle types and journey purposes shown in **Table 6.7.** The correspondence between the SATURN matrix user classes and TUBA user classes is also shown.

6.5.20. In line with the production of the Norwich Area Transportation Strategy (NATS) model a Passenger Car Unit (PCU) value of '2.3' was used in converting HGV (vehicle units) to PCU whereas other vehicle classes remain constant i.e. 1 veh unit = 1 pcu for Car and LGV. For use within TUBA the HGV user class needs to be converted to vehicles therefore a factor of 0.43 i.e. 1/2.3 has been used.

6.5.21. All HGV were defined as Vehicle Type 4 (OGV1) in TUBA. As these have lower operating costs than OGV2, this is likely to have resulted in a conservative estimate of benefits attributable to HGV.

Table 6.7 - TUBA to SATURN matrix user class correspondence

Saturn User Class	Vehicle Type	Journey Purpose	Tuba User Class	Tuba Purpose	Pcu To Vehicle Factor
1	Car	Business	1	Business	1
2	Car	Commuting	2	Commuting	1
3	Car	Other	3	Other	1
4	LGV	LGV	4	LGV Personnel	1
4	LGV	LGV	5	LGV Freight	1
5	HGV	HGV	6	OGV1	0.43

Scheme costs

6.5.22. The scheme costs have been set out within **Table 6.8** showing the estimated risk and inflation costs associated with each of the scheme options, at Q1 2019 prices, with the base cost of each option shown as well.

Table 6.8 - Scheme costs with inflation and estimated risk

Cost £	Option A	Option B West	Option B East	Option C	Option D West	Option D East
Base cost	**45,686,557**	**99,598,036**	**120,279,642**	**114,780,854**	**134,854,823**	**125,523,543**
Risk	10,742,272	21,504,589	27,352,083	26,872,937	30,729,522	29,020,000
Inflation	4,218,618	9,254,385	10,485,666	11,030,579	12,580,924	11,892,958
TOTAL	**60,647,447**	**130,357,009**	**158,117,391**	**152,684,370**	**178,165,269**	**166,436,501**

6.5.23. **Table 6.9** sets out the level of Optimism Bias that has been applied to each of the base costs for each of the scheme options.

Table 6.9 - Scheme Cost Optimism bias

Cost £	Option A	Option B West	Option B East	Option C	Option D West	Option D East
Optimism Bias	£18,015,685	£43,187,585	£56,393,204	£55,144,211	£63,347,572	£59,087,917

Travel time changes calculation

6.5.24. Travel time savings are monetised as a perceived benefit, reflecting users' willingness to pay for a quicker journey. The value of those savings differs depending on the reason for the trip, of which three are defined in TAG; business users, commuters, and non-commuting consumers e.g. leisure trips.

6.5.25. The costs and benefits for travel time savings have been assessed using TUBA. The trip length, trip volume and journey time information needed for this has been taken from the relevant SATURN models.

6.5.26. The costs and benefits for travel time savings have been assessed using TUBA. The transport model, described in previous sections, has been used to extract time, distance and trip matrices from a Fixed Demand Model assessment for use within the TUBA assessment.

Vehicle operating cost changes

6.5.27. Vehicle operating cost savings accrue in two categories; fuel costs, a function of the speed of the vehicle through the network and fuel efficiency, and non-fuel costs such as oil, tyres, vehicle maintenance depreciation and business vehicle capital costs, largely a function of the distance travelled by the vehicle.

6.5.28. The costs and benefits for vehicle operating costs have been assessed using TUBA. The trip length, trip volume and journey time information needed for this has been skimmed from the relevant SATURN models.

ECONOMIC ASSESSMENT

Transport economic efficiency

6.5.29. The transport user benefits for the DS scenario relative to the DN scenario have been assessed using TUBA v1.9.11. The business user benefits as forecast by TUBA are shown in **Table 6.10**.

Table 6.10 - Transport User Benefits (TUBA Results)

Benefit	Option A	Option B West	Option B East	Option C	Option D
Greenhouse Gases	0,614	-0,383	-0,050	1,533	0,422
Economic Efficiency: Consumer Users Commuting	20,662	114,850	121,547	133,364	116,397
Economic Efficiency: Consumer Users Commuting	24,911	98,547	104,853	116,124	108,973
Economic Efficiency: Business Users and Providers	18,425	91,549	97,469	107,463	92,480
Present Value of Transport Economic Efficiency Benefits (TEE)	**64,612**	**304,563**	**323,819**	**358,484**	**318,272**

Results ('£000's, 2010 prices discounted to 2010)

6.5.30. The scheme is expected to provide a net benefit in terms of journey times to business users both within the study area and for those beyond and passing through the study area.

Initial BCR

6.5.31. The BCR considers the impact to the economy, society, the environment and the public accounts. It offers and estimate of the value of benefit generated for every £1 of public expenditure. Therefore, any BCR above one shows value for money for every £1 of invested cost. The BCR defines the Value for Money (VfM) category based on BCR categories, which are

- BCR < 1.0 Poor
- BCR between 1.0 and 1.5, Low
- BCR between 1.5 and 2.0 Medium
- BCR between 2.0 and 4.0, High
- BCR > 4.0, Very High.

6.5.32. The initial BCR includes the monetised impacts associated with Economy for business users and providers, Environment for Greenhouse Gases, Social for non-business users, and Public Accounts for the cost to the broad transport budget and indirect tax.

6.5.33. It must be stressed that the BCR has been based on using:

- Travel time benefits only through TUBA and does not include potential benefits from accidents, air quality, noise etc
- The SATURN model does not include weekend and the off-peak periods as origin-destination data were not collected for these time periods, therefore it has not been possible to determine potential benefits for these periods

6.5.34. Fixed Demand origin-destination matrix with no Variable Demand Model (VDM) assumed at this stage.

6.5.35. **Table 6.11** shows the Analysis of Monetised Costs and Benefits (AMCB) results and the Initial BCR associated with the scheme. Greenhouse gas emissions have been taken from environmental assessment as this provides an assessment for a full 24 hour period.

Table 6.11: Analysis of Monetised Costs and Benefits – Initial

	Route Options					
	Option A	Option B West	Option B East	Option C	Option D West	Option D East
Economic Efficiency: Consumer Users (Commuting)	20,662	114,850	121,547	133,364	116,397	116,397
Economic Efficiency: Consumer Users (Other)	24,911	98,547	104,853	116,124	108,973	108,973
Economic Efficiency: Business Users and Providers	18,425	91,549	97,469	107,463	92,480	92,480
Wider Public Finances	-1,109	1,144	520	-2,650	-305	-305
Greenhouse Gases (Environmental assessment)	8,623	-1,359	-4,900	-4,149	-10,576	-10,576
Air Quality	3,603	729	-548	-453	-3,029	-3,029
Present Value of Benefits (PVB)	75,115	305,460	318,941	349,699	303,940	303,940
Present Value of Costs (PVC)	54,351	119,584	147,782	142,858	166,523	155,251
Net Present Value (NPV)	20,764	185,876	171,159	206,841	137,417	148,689
Benefit Cost Ratio (BCR)	1.38	2.55	2.16	2.45	1.83	1.96

£000s deflated and discounted to 2010 prices and values

6.5.36. Therefore, based on the transport benefits the scheme has an initial VfM category in the range of Low to high, depending on the Option. Option A returns the lowest BCR placing it in the Low VfM range, while the other options are all in the Medium to High VfM range.

Adjusted BCR

6.5.37. The initial BCR can be adjusted to account for other monetised impacts which include:

- Reliability impact on business users(economy);
- Wider Impacts(economy);
- Landscape(environment);
- Reliability impact on commuting and other users(social); and
- Option and non-use values (social).

6.5.38. For the study the only additional impacts which have been monetised are Wider impacts. Table 6.12 shows the adjusted AMCB results and the adjusted BCR associated with the scheme.

Table 6.12: Analysis of Monetised Costs and Benefits – Adjusted

	Route Options					
	Option A	Option B West	Option B East	Option C	Option D West	Option D East
Economic Efficiency: Consumer Users (Commuting)	20,662	114,850	121,547	133,364	116,397	116,397
Economic Efficiency: Consumer Users (Other)	24,911	98,547	104,853	116,124	108,973	108,973
Economic Efficiency: Business Users and Providers	18,425	91,549	97,469	107,463	92,480	92,480
Wider Public Finances	-1,109	1,144	520	-2,650	-305	-305
Greenhouse Gases	8,623	-1,359	-4,900	-4,149	-10,576	-10,576
Air Quality	3,603	729	-548	-453	-3,029	-3,029
Wider Impacts	1,876	7,683	7,304	8,659	7,224	7,224
Present Value of Benefits (PVB)	76,991	313,143	326,245	358,358	311,164	311,164
Present Value of Costs (PVC)	54,351	119,584	147,782	142,858	166,523	155,251
Net Present Value (NPV)	22,640	193,559	178,463	215,500	144,641	155,913
Benefit Cost Ratio (BCR)	1.42	2.62	2.21	2.51	1.87	2.00

£000s 2010 prices and values

6.5.39. Based on the additional monetised impacts the scheme has an adjusted BCR in the range of 1.42 to 2.62, giving it an adjusted VfM category in the range of Low to High, depending on the Option. Option A returns the lowest BCR placing it in the Low VfM range, while the other options are all in the Medium and High VfM range.

OPTION A

6.5.40. Option A, the upgrade to the existing B1535, linking to the A47 at the Wood Lane junction north of Honingham is predicted to carry around 10,000 vehicles a day by 2040 and 12,000 by 2050.

6.5.41. It is proposed Option A will help to reduce accidents as 10,000 trips transverse the upgraded route by 2040 while an upgrade of the existing road will see further improvements in Carbon emissions. With a proposed Present Value of Benefits of £76m and an estimated cost of £54m, a TUBA run of Option A has produced a Net Present Value of £22m and a Benefit Cost Ratio of 1.42 which is regarded as Low.

OPTION B WEST

6.5.42. Option B West provides a new link to the east of Weston Longville, linking to the A47 at Wood Lane before heading south to a new junction near Attlebridge which would include widening or replacement of the existing River Wensum bridge at Attlebridge.

6.5.43. It is projected that that Option B West will result in the reassignment of 20,000 trips per day in the year of opening 2025 before increasing to 30,000 trips in 2040 and 37,000 trips by 2050. This will have a significant impact in the reduction of forecast road accidents and carbon emissions and with a proposed Present Value of Benefits £313m and an estimated cost of £120m a Net Present Value of £194m has been produced by TUBA resulting in a BCR of 2.62 which is regarded as High.

OPTION B EAST

6.5.44. Option B East which differs with a new viaduct crossing of the Wensum joining the A1067 further to the east is forecast to carry 19,000 tips in 2025, 29,000 in 2040 and 35,000 in 2050. The route if forecast to have a Present Value of Benefits £327m and an estimated cost of £148m and a Net Present Value of £179m resulting in the a BCR of 2.21 or high.

OPTION C

6.5.45. Option C provides a new route between the A1067 to the west of Ringland linking into the A47 at Wood Lane.

6.5.46. This option, which provides a crossing of the River Wensum via a new viaduct is forecast to produce a PVB of £359m while the PVC has been forecast at £143m, resulting in a Net Present Value £216m and a BCR of 2.51 or high.

OPTION D WEST

6.5.47. Option D West which provides a new route between the west of Ringland and the A1067 in the same location as Option C and connects at the approximate location of the existing A47/Taverham road junction.

6.5.48. It is predicted this route would carry around 31,000 vehicles a day by 2040. The estimated cost is £167 (PVC) and proposed benefit of £311(PVB) results in a total Net Present Value of £145M and a BCR of 1.87 which is regarded as Medium.

OPTION D EAST

6.5.49. Variant D East which has a connection further east just outside Easton to the A47 is predicted carry around 31,000 vehicles a day by 2040 with an estimated benefit of £311m (PVB) and a £155(PVC) with a resultant BCR of 2.00 or Medium.

7. PUBLIC CONSULTATION

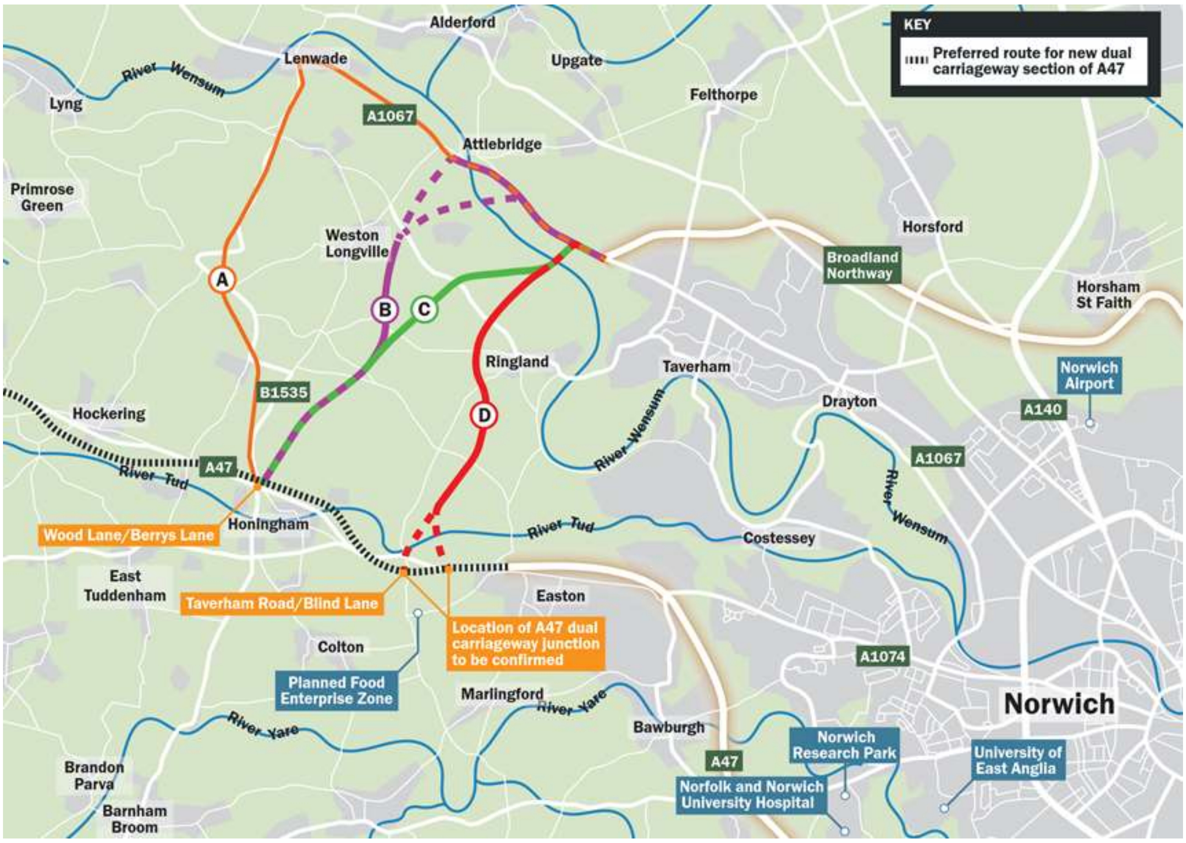
7.1. OVERVIEW OF CONSULTATION

7.1.1. In summer 2018, an initial consultation for a Norwich Western Link took place to seek feedback on the principle of creating a new link to the west of Norwich. More than 1,700 consultation responses were received which demonstrated very strong support for creating a link between A1270 Broadland Northway (formerly known as the Northern Distributor Road) and the A47, with 86% of respondents to the initial consultation in summer 2018 wanting Norfolk County Council to create a new road link between the A47 and A1270 Broadland Northway.

7.1.2. Some responses to the initial consultation suggested that improvements to public transport, cycling and walking routes, together with further traffic calming were options that should be explored, and a small number preferred taking no action. Many consultees set out in their responses that the existing roads are simply not able to cope with the levels of traffic that are now routinely using them.

7.1.3. Following this initial consultation, further work was undertaken to shortlist four road options for a Norwich Western Link as set out within the Options Assessment Report (OAR). Between Monday 26 November 2018 and Friday 18 January 2019, the Council held a second non-statutory public consultation on these proposals with the objective of informing the selection of a preferred option and providing evidence on public support for the proposed NWL scheme. **Figure 7.1** below shows the option routes as presented for consultation.

Figure 7.1 - Options Presented for Public Consultation (November 2018)



7.1.4. A Consultation report is provided in Appendix F with fuller explanation of the information provided to the public to inform them of the proposals and analysis of the responses received. Appendix F focusses on the qualitative responses to the consultation but a summary of the quantitative responses is also appended at Annex E.

7.1.5. It should be noted that Option B West was referred to in the consultation as 'Option B with Existing Bridge' and Option B East was referred to as 'Option B with New Viaduct'.

7.1.6. Option D west and east were also considered as a combined Option D, so any responses in relation to this option are assumed to apply equally to both variants, unless the respondent specifically stated otherwise. Option D was presented as one option due to Highways England's plans to dual the section of the A47 between North Tuddenham and Easton and the limited detail available on the new junction location near Easton. Until more detail is known, the Council has accounted for the possibility of the junction being located near Blind Lane and Taverham Road or closer to the current Easton roundabout junction. The location of the junction makes a small difference to the overall length of the route – 3.8 miles if the route connects near Blind Lane and Taverham Road and 3.7 miles if it connects near the current Easton roundabout.

7.2. PURPOSE AND OBJECTIVES OF THE CONSULTATION

7.2.1. The purpose of the consultation was to provide information on the options proposals, asking for views on them to help identify a preferred option. The objectives for the consultation were as follows:

- Understand the degree of public support for each of the four options.
- Understand how each option may rank against one another.
- Gauge support for each option from statutory and non-statutory organisations.
- Gain knowledge of potential scheme risks and local effects of each of the proposed options which may influence design or cost.
- Inform the development of the Strategic Outline Business Case, in particular seeking to identify additional potential social and economic scheme benefits and opportunities which may arise as a result of each option and any aspects requiring mitigation which may influence the scheme cost.
- Identify other potential complementary measures which could be delivered as part of the scheme.

7.3. WHO NORFOLK COUNTY COUNCIL CONSULTED

7.3.1. The consultation sought views from the public and stakeholders, including previous respondents to the initial consultation, local communities and businesses.

7.3.2. Key stakeholders that were consulted, included:

- Local authorities, businesses and organisations within the Norwich Western Link local area;
- Relevant public-sector bodies;
- Environmental groups;
- Walking and cycling groups; and
- Organisations who have previously expressed an interest in the project.

7.3.3. Work to identify any landowners affected by any of the proposed options was undertaken. As such, those identified were sent a letter containing tailored information prior to the start of the consultation period informing them of the latest proposals and the opportunity to provide comment.

7.4. WHAT NORFOLK COUNTY COUNCIL CONSULTED ON

7.4.1. Consultees were asked to provide their views on the four options, and to advise any options they preferred based on the information provided and the potential benefits and impacts of each option. People could also state a preference for 'none of them – do nothing' or 'none of them but something should be done'.

7.4.2. Respondents were asked to highlight any particular issues, interests or concerns in relation to each of the options put forward, as well as comparative views on the different options.

7.4.3. The questionnaire also asked respondents what other transport improvements they felt could complement the Norwich Western Link proposals.

7.4.4. A copy of the consultation questionnaire can be found in Appendix F. Further information about the questions and analysis of responses is set out in Chapter 4 of this report.

7.5. METHODS OF RESPONDING

7.5.1. Consultees were invited to respond to the consultation by completing an online questionnaire, available via the consultation website.

7.5.2. Written responses were also accepted by writing to: Norwich Western Link, Infrastructure Delivery Team, Norfolk County Council, County Hall, Floor 2, Martineau Lane, Norwich, NR1 2DH, or emailing norwichwesternlink@norfolk.gov.uk. Individuals, groups and organisations responding in a professional capacity were encouraged to respond in this way.

7.5.3. People were also able to respond in person by attending a consultation event.

7.6. CONSULTATION MATERIALS

7.6.1. The consultation was promoted using a range of different methods to encourage as many views as possible. The methods used are listed below.

Website

7.6.2. The online questionnaire was available via the County Council's website: www.norfolk.gov.uk/nwl

7.6.3. As part of the consultation questionnaire, people were asked where they had seen information about the consultation - the website was cited in nearly 400 responses and was viewed by 3,475 people.

Consultation brochure

7.6.4. A consultation brochure provided information on the background for the proposals and details of the proposed options. The brochure also included the consultation questionnaire, which could be completed and left at an exhibition, or posted to Norfolk County Council.

7.6.5. As part of the consultation questionnaire, people were asked where they had seen information about the consultation - the brochure was cited in more than 300 responses.

Public consultation events

7.6.6. Public Consultation events were held in locations which were informed by experience from the initial consultation and feedback and suggestions from members of the public, Local Liaison Group and councillors. The project team were available to answer questions and to talk to visitors about the proposals. A total of 1,245 people came to 17 consultation events.

7.6.7. Consultation events were held at:

- Ringland Village Hall (Wednesday 28 November 2018)
- Drayton Village Hall (Monday 3 December 2018)
- The Forum, Norwich (Tuesday 4 December 2018)
- Hockering Village Hall (Wednesday 5 December 2018)
- Easton Village Hall (Monday 10 December 2018)
- Taverham Village Hall (Tuesday 11 December 2018)
- Hall for All, Weston Longville (Wednesday 12 December 2018)
- Salvation Army Church, Fakenham (Friday 14 December 2018)
- Aylsham Town Hall (Tuesday 8 January 2019)
- Diamond Jubilee Lodge, Hellesdon (Thursday 10 January 2019)
- Great Witchingham Village Hall (Friday 11 January 2019)
- The Costessey Centre (Monday 14 January 2019)
- Dereham Memorial Hall (Tuesday 15 January 2019)
- Honingham Village Hall (Wednesday 16 January 2019) – also attended by Highways England staff

7.6.8. Additional consultation events were also held at the Norfolk and Norwich University Hospital on 27 November and at Norwich Research Park on 9 January and promoted to staff in advance. Staff from the project team also attended a public consultation event organised by Barnham Broom Parish Council on 5 January.

7.6.9. Exhibition boards provided information on the need for the Norwich Western Link, the project objectives, information on each of the proposed options, environmental considerations, traffic impacts for each of the options, and how people could respond to the consultation.

7.6.10. As part of the consultation questionnaire, people were asked where they had seen information about the consultation – attending a consultation event was cited in more than 250 responses.

7.7. PROMOTION AND PUBLICITY

7.7.1. Channels used for promoting the consultation included:

- Social Media – Publicity on Facebook & Twitter
- Media and Community Newsletters
- Promotional Materials
- Targeted Promotion to Key Stakeholders
- Emails and letters were sent in November to more than 2,000 stakeholders including MPs
- Email updates were also sent regularly to 900 people who had subscribed to news about the project – this number increased as the consultation continued and more people subscribed to be kept informed
- The Norwich Western Link Local Liaison Group, made up of representatives from 29 local parish councils, were kept informed about the consultation via a meeting before the consultation began on 6 November and during the consultation on 19 December. In addition, briefings were offered prior to each consultation event to each local parish council.

7.8. NUMBER OF RESPONSES

7.8.1. A total of 1,931 respondents provided feedback to the consultation. Responses were received either via the online questionnaire, or through letters and emails. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme).

Through the analysis of the 1,931 responses, over 12,000 comments regarding the proposals were identified.

7.8.2. The majority of responses were received via the online questionnaire, with 1,825 people providing a response in this manner. Some respondents only provided responses to the closed/quantitative questions, and therefore did not provide any written (qualitative) comments.

7.8.3. The options comparison section of the website also included a question asking respondents which statement best described the information they had seen about the scheme. The NWL consultation website was cited in nearly 400 responses and the brochure was identified in more than 300 responses. , More than 250 respondents stated that they had attended a consultation event, whilst a smaller number of respondents (150) had read the information on social media.

7.8.4. In addition to the online questionnaires, 74 stakeholder organisations, (including 13 with land interests) and 32 members of the public provided responses by letter or email. A list of the stakeholder organisations who responded can be found in **Appendix F** of this report.

Table 7.1 - Qualitative responses received to consultation

Response type	Number of qualitative responses
Questionnaire responses	1,711
Letters/emails from public	32
Letters/emails from stakeholder organisations This category includes those with land interests	74
Total	**1817**

Questionnaire Responses

7.8.5. The questionnaire consisted of:

- 14 closed questions (quantitative questions) whereby respondents were asked to select answers based on a selection of pre-determined responses;
- Eight open free-text questions (qualitative questions) whereby respondents could elaborate or provide further comment; and
- A series of demographic questions to help understand who has responded to the consultation.

The responses to each of the individual options are set out below for each option.

QUANTITATIVE ANALYSIS ACROSS ALL OPTIONS

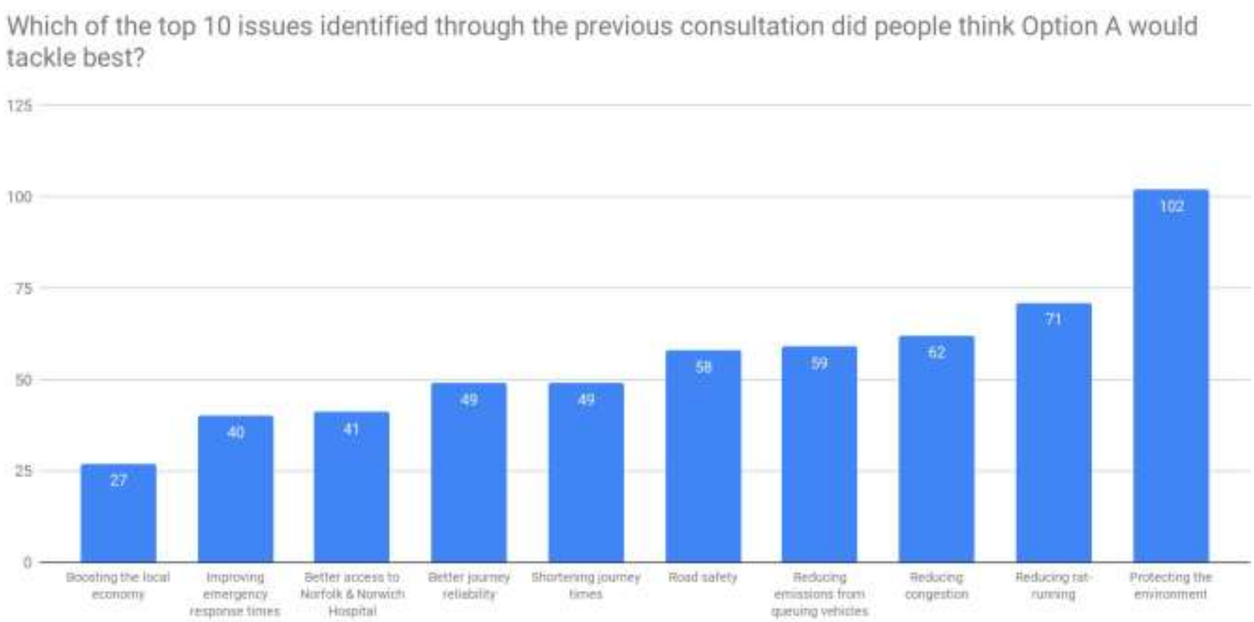
7.8.6. Quantitative analysis regarding the Norwich Western Link options was also produced by Commonplace for Norfolk County Council. This analysis focuses on the quantitative data gathered through the consultation responses to the Norwich Western Link Options website. In total, data was recorded from 1,825 respondents.

7.8.7. With regards to the options analysis, respondents were asked to provide feedback on each of the four options (including the two sub-options for Option B), and then to select which options they would support for a Norwich Western Link. For each option, respondents were asked how effective they thought the option would be as a Norwich Western Link, as well as to highlight which of the top ten transport issues raised in the previous phase of consultation they thought the option would help to tackle. The issues to consider were:

- boosting the local economy;
- improving emergency response times;
- better access to Norfolk and Norwich Hospital;
- better journey reliability;
- shortening journey times;
- road safety;
- reducing emissions from queuing vehicles;
- reducing congestion;
- reducing rat-running; and
- protecting the environment.

7.8.8. Regarding Option A, only 11.9% of respondents thought that it would provide a very effective or fairly effective Norwich Western Link, whereas 82.9% of respondents thought that it would be fairly ineffective or not very effective. The remaining proportion - 5.2% of respondents thought that Option A were neutral about this option.. Respondents identified ‘protecting the environment’ as the top issue Option A would tackle best. Reducing rat running and reducing congestion were also in the top three, whilst the responses indicate that people saw Option A as less effective for boosting the local economy, improving emergency response times and improving access to NNUH. The responses are summarised in **Figure 7.2** below.

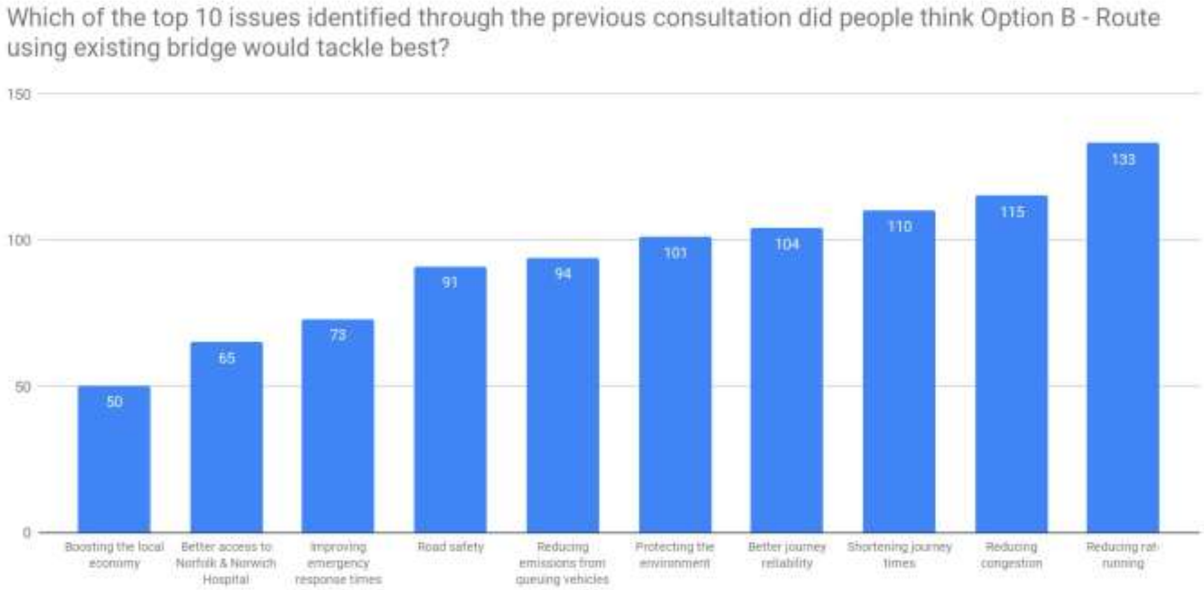
Figure 7.2 - Top 10 Issues that Option A Would Tackle



7.8.9. Regarding Option B WEST, 35.5% of respondents thought that it would provide a very effective or fairly effective Norwich Western Link. However 54.7% of respondents thought that it would either be fairly ineffective or not very effective. The remaining 9.8% of respondents remained neutral about the effectiveness of Option B WEST.. Respondents identified ‘reducing rat-running’ as the top issue

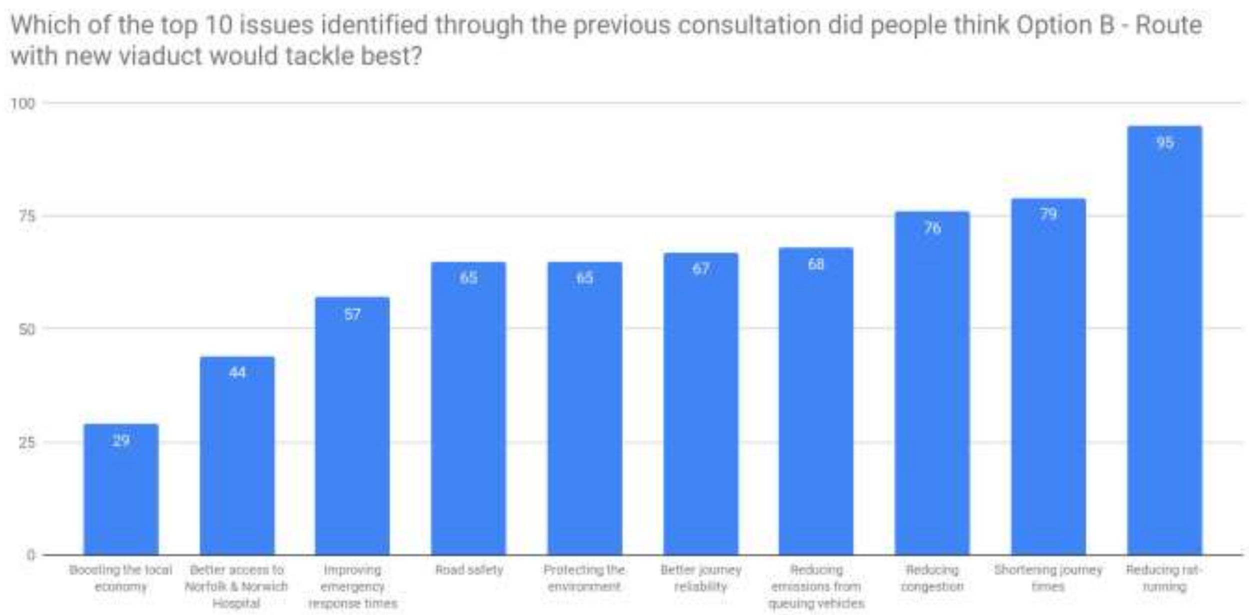
Option B WEST would tackle best. Reducing congestion and shortening journey times were also in the top three, whilst the responses indicate that people saw Option B WEST as less effective for boosting the local economy, improving access to NNUH and improving emergency response times. The responses are summarised in **Figure 7.3** below.

Figure 7.3 - Top 10 Issues that Option B WEST Would Tackle



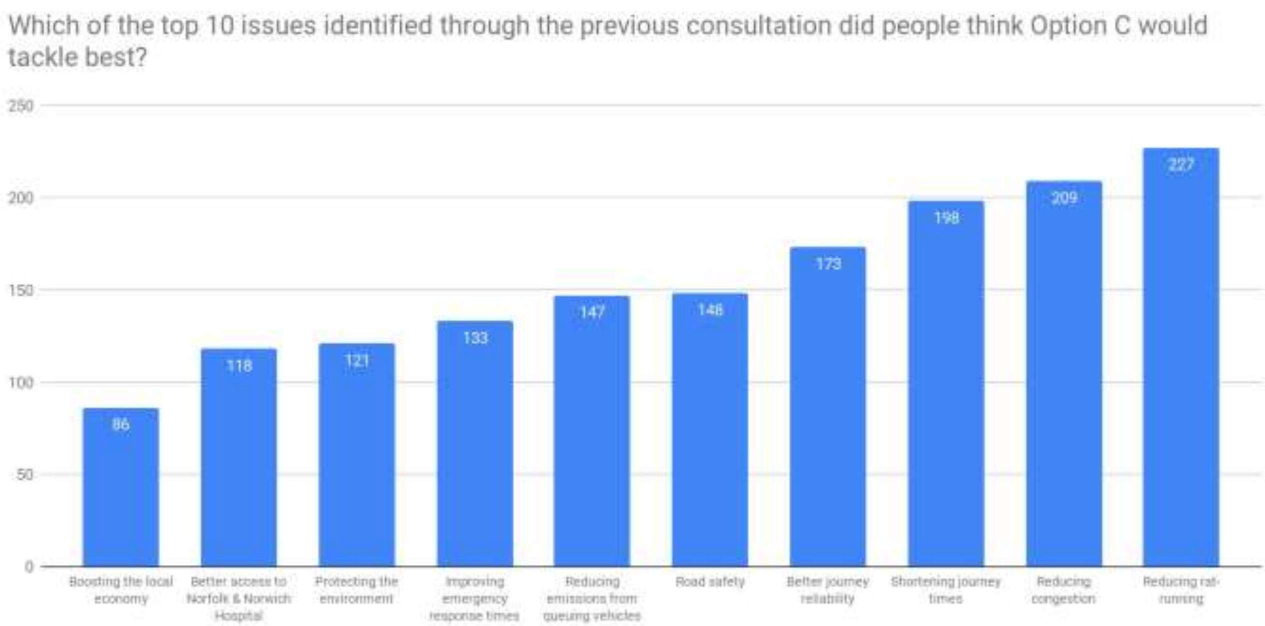
7.8.10. Regarding Option B EAST, 25.3% of respondents thought that it would provide a very effective or fairly effective Norwich Western Link, however 60% of respondents thought that it would be fairly ineffective or would not be very effective. The remaining 14.7% of respondents were neutral about the effectiveness of Option B EAST. Respondents identified ‘reducing rat-running’ as the top issue Option B EAST would tackle best. Reducing congestion and shortening journey times were also in the top three. However the responses indicated that people thought Option B EAST would be less effective at boosting the local economy and improving access to NNUH and improving emergency response times. The responses are summarised in **Figure 7.4** below.

Figure 7.4 - Top 10 Issues that Option B EAST Would Tackle



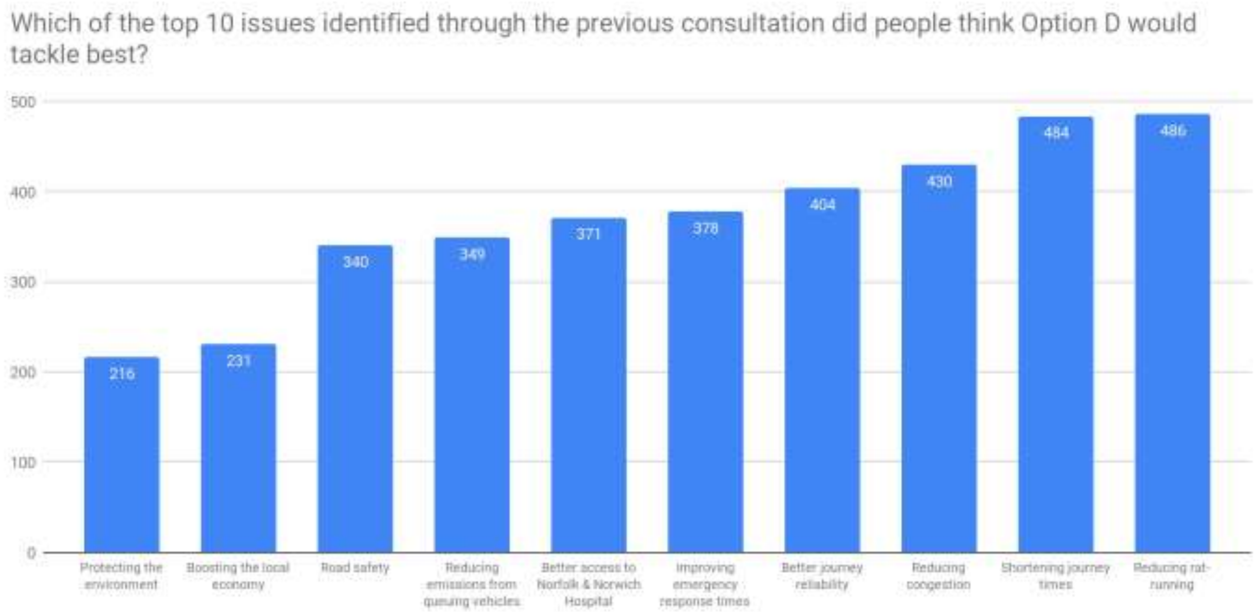
7.8.11. Regarding Option C, 62.2% of respondents thought that it would provide a very effective or fairly effective Norwich Western Link, however 29.7% of respondents thought that it would either be fairly ineffective or not very effective. The remaining proportion were neutral about Option C.. Respondents identified 'reducing rat-running' as the top issue Option C would tackle best. Reducing congestion and shortening journey times were also in the top three. However, responses indicate that people thought Option C would be less effective at boosting the local economy and improving access to NNUH and protecting the environment. The responses are summarised in **Figure 7.5** below.

Figure 7.5 - Top 10 Issues that Option C Would Tackle



7.8.12. Regarding Option D, 73.6% of respondents thought that it would provide a very effective or fairly effective Norwich Western Link, whilst 22.2% of respondents thought that it would be fairly ineffective or not very effective. The remaining 4.2% of respondents were neutral about the effectiveness of Option D. Respondents identified 'reducing rat-running' as the top issue Option D would tackle best. Reducing congestion and shortening journey times were also in the top three. Responses indicate that people thought Option D may be less effective for protecting the environment, boosting the local economy and tackling road safety issues. The responses for Option D are summarised in

Figure 7.6 - Top 10 Issues that Option D Would Tackle



7.8.13. The textual responses to Question 3 in relation to each of the individual proposed options are set out below. Question 3 asked the respondent to justify their response regarding the possible effectiveness of Option A as a Norwich Western Link. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme).

QUALITATIVE ANALYSIS OF OPTION A RESPONSES

7.8.14. There were 619 respondents who provided a response to Question 3 for Option A. In analysing the 619 responses, a total of 1,144 different textual comments regarding Option A were identified. **Table 7.2** lists the top 10 most frequently raised comments, including the number of times this comment was raised throughout the responses to Question 3 (Option A).

7.8.15. The table also shows the percentage breakdown in relation to the total number of comments raised for Question 3 (Option A), indicating how often this issue was noted by respondents in comparison to all other comments within this question.

Table 7.2 - Question 3 (Option A) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Rat-running	Does not solve rat-running/traffic will not divert from villages	200	17.5%
General opposition	Opposed to scheme/scheme not needed	151	13.2%
Design	Single carriageway is not fit for purpose/road capacity is insufficient	117	10.2
Design	Route is too long/no journey time improvement	93	8.1%
Cost	Not cost effective	86	7.5%
Design	Route will not be used/too much of a diversion	76	6.6%
Environment	Concern over impact on environment	69	6%
Environment	Option has lowest environmental impacts	45	3.9%
Design	Route is not effective/not fit for purpose	38	3.3%
Cost	Low cost/cheapest option	36	3.1%

7.8.16. **Table 7.2** shows that 200 comments (17.5%) were raised noting that Option A will not resolve rat-running and traffic will continue to go through local villages. Some respondents referred to particular concern over impacts on the local villages of Ringland, Weston Longville, Lyng and Taverham.

7.8.17. Several respondents also noted general opposition to the scheme (151 comments, 13.2%), noting that it will not be fit for purpose or that it is not needed. Some respondents also highlighted concerns regarding the designs, particularly that a single carriageway is not sufficient, that the option does not provide much improvements to journey times or that it is not cost effective.

7.8.18. Comments on Option A also highlighted concern over potential environmental impacts (69 comments, 6%), with reference to impacts on natural beauty, emissions from Wensum Valley, noise/ air pollution. This compared to 45 comments (3.9%) highlighting that respondents felt that this option had the lowest environmental impact.

QUALITATIVE ANALYSIS OF OPTION B WEST RESPONSES

7.8.19. There were 475 respondents who answered Question 3 for Option B WEST. In analysing the 475 responses, we identified a total of 1,138 different comments regarding Option B WEST. **Table 7.3** lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option B WEST). The table also shows for each comment its percentage in relation to the total number of comments raised for Question 3 (Option B WEST).

Table 7.3 - Question 3 (Option B WEST) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option is too far west	111	9.8%
General support	General support for Option B WEST	101	8.9%
Environment	Concern about environmental impacts	71	6.2%
Rat-running	Traffic will still use local roads / rat-run	68	6.0%
Environment	Option has fewer environmental impacts	61	5.4%
General opposition	Other options are better	51	4.5%
Cost	Option is most cost effective	43	3.8%
Connectivity	Concern over ineffective links	42	3.7%
General opposition	General opposition to this option	33	2.9%
General support	Positive comments regarding use of existing bridge	32	2.8%

7.8.20. **Table 7.3** shows that several respondents noted that Option B WEST is too far to the west of Norwich (111 comments, 9.8% of comments raised for this question), impacting on the effectiveness of the link road and creating a longer route.

7.8.21. There was also general support noted for this option, with 101 comments noting this as a preferred option. Several respondents also noted support for this option as it uses the existing bridge at Attlebridge.

7.8.22. Concern was raised regarding continued traffic using local roads as rat-runs, particularly as this option is considered too far away to be used effectively. Concern was also raised regarding environmental impacts of the options in general terms.

QUALITATIVE ANALYSIS OF OPTION B EAST RESPONSES

7.8.23. There were 294 respondents who answered Question 3 for Option B EAST. In analysing the 294 responses, we identified a total of 724 different comments regarding Option B EAST. **Table 7.4** lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option B EAST). The table also shows for each comment its percentage in relation to the total number of comments raised.

Table 7.4 - Question 3 (Option B EAST) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option is too far west	77	10.6%
Environment	Concern about environmental impacts	53	7.3%
Rat-running	Traffic will still use local roads/rat run	40	5.5%
Cost	Option is not cost effective/waste of money	32	4.4%
Environment	Option has fewer environmental impacts	26	3.6%
General opposition	Opposed to new bridge/viaduct	25	3.5%
General opposition	General opposition	25	3.5%
General support	Support for new bridge/viaduct	24	3.3%
Rat-running	Option has minimum impact on communities	24	3.3%
Connectivity	Concern over ineffective links	24	3.3%

7.8.24. As with Option B WEST, many respondents noted that Option B EAST is too far west of Norwich and therefore creates a longer, less effective route. 24 comments (3% of comments raised for this questions) were raised noting that this option does not provide an effective link and so would not be used.

7.8.25. Several respondents noted concern for the environmental impacts of this option (53 comments, 7.3%), with concern over ruining the countryside and damaging the environment.

7.8.26. Both opposition and support for the bridge / viaduct was highlighted. Concerns about the viaduct are rooted in cost, height and visual impact, as well as wider environmental impact over the Wensum Valley.

QUALITATIVE ANALYSIS OF OPTION C RESPONSES

7.8.27. There were 573 respondents who answered Question 3 for Option C. In analysing the 573 responses, we identified a total of 1,552 different comments regarding Option C. **Table 7.5** lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option C). The table also shows for each comment its percentage in relation to the total number of comments raised.

Table 7.5 Question 3 (Option C) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
General support	Option is the most viable/best solution	191	12.3%
Environment	Option has fewer environmental impacts	111	7.2%
Environment	Concern about environmental impacts	103	6.6%
Connectivity	Route is too far west/away from Norwich	69	4.4%
Cost	Option is most cost effective	68	4.4%
Traffic	Option is shortest/most direct route	65	4.2%
Rat-running	Option will discourage rat running	62	4%
General support	General support for Option C	56	3.6%
Connectivity	Option provides good links to Broadland Northway (NDR)	56	3.6%
Traffic	Option would reduce traffic/bottlenecks	54	3.5%

7.8.28. 191 comments were raised noting that Option C is the most viable option, with many respondents noting the shorter distance to travel compared to other options or often because it ‘ticks several boxes’.

7.8.29. Although a number of respondents felt this option has the least environmental impact (111 comments), a similar number of comments were raised (103) regarding concern regarding the environmental impact of the option, particularly with regards to impact on woodland and wildlife, and the impact on the County Wildlife Site.

7.8.30. Respondents have noted that, similarly to Options B WEST and B EAST, this option is too far west to be effective. Conversely, other comments note that this option provides good links to the Broadland Northway (often referred to in comments as the NDR).

7.8.31. Other frequently raised comments note that Option C is cost effective, that it is the most direct route of the options, that it would discourage rat running and reduce bottlenecks.

QUALITATIVE ANALYSIS OF OPTION D RESPONSES

7.8.32. There were 983 respondents who answered Question 3 for Option D. In analysing the 983 responses, we identified a total of 2,837 different comments regarding Option D. **Table 7.6** below lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option D).

Table 7.6 - Question 3 (Option D) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
General support	Option is most viable/best solution	338	11.9%
Traffic	Option is shortest/most direct route	214	7.5%
Rat-running	Option will discourage rat running	150	5.3%
Environment	Concern about environmental impacts	145	5.1%
Connectivity	Option is an effective link for A47 to north	141	5%
Connectivity	Option provides good links to Broadland Northway (NDR)	116	4.1%
Connectivity	Option provides good links to other major roads	111	3.9%
Cost	Option is not cost effective/waste of money	95	3.3%
Environment	Option has fewer environmental impacts then other options	90	3.2%
Traffic	Option would reduce traffic/bottlenecks	89	3.1%

7.8.33. Many respondents noted this option as being most viable or the most practical solution. 214 comments noted that this option is the shortest and most direct route, with respondents highlighting that this route is closest to link roads, such as the Southern Bypass or the Broadland Northway.

7.8.34. As with the other options, there is concern over the environmental impact of this option, with over 100 comments raised regarding concern over damage to the local area, to woodlands and to wildlife. Several respondents stated that this option is the most expensive, or that it is not cost effective.

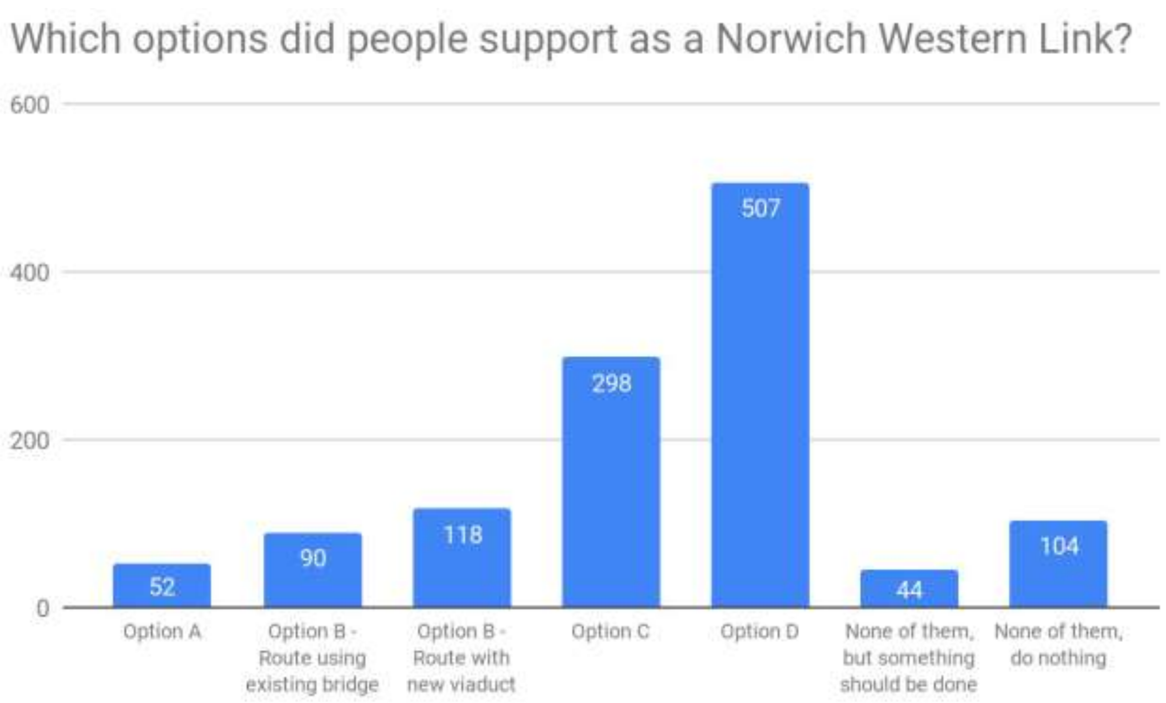
7.8.35. With regards to the two proposed alternatives links to the A47 (either at Taverham Road or closer to Easton), a small number of respondents noted their preferences. 10 comments suggested a preference for a link closer to Easton, and two comments indicated a preference to a link at Taverham Road / Blind Lane.

7.9. COMPARISON OF OPTIONS

7.9.1. The response to the Question 3 of the main questionnaire (which asked respondents to select any options that they would support as a Norwich Western Link) shows that many respondents would support Option D, in comparison with the other options. Option C is the second most supported option. Option A received the least amount of support. The quantitative feedback in response to Question 3 is shown in Figure 7.7 below.

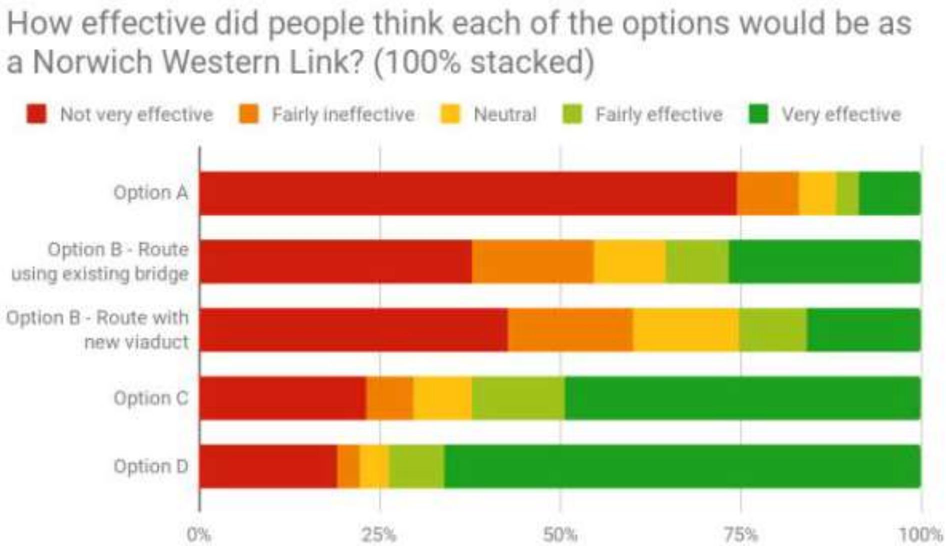
7.9.2. Figure 7.7 demonstrates that Options C and D were the most popular options overall, whilst the other potential route options A, B EAST and B WEST received significantly less support with response levels similar in magnitude to the Do-Nothing option or other alternative options.

Figure 7.7 - Level of Support for the Proposed Options



7.9.3. In relation to each individual option, respondents were asked to indicate the level of effectiveness of each option. **Figure 7.8** shows the level of effectiveness which respondents assigned to each of the options. Options C and D were considered to be the most effective, with over 60% of responses highlighting these options as either 'fairly effective' or 'very effective'. Option A is considered to be the least effective with over 80% of respondents highlighting this option as being 'fairly ineffective' or 'not very effective'.

Figure 7.8 – Effectiveness of Norwich Western Link Options



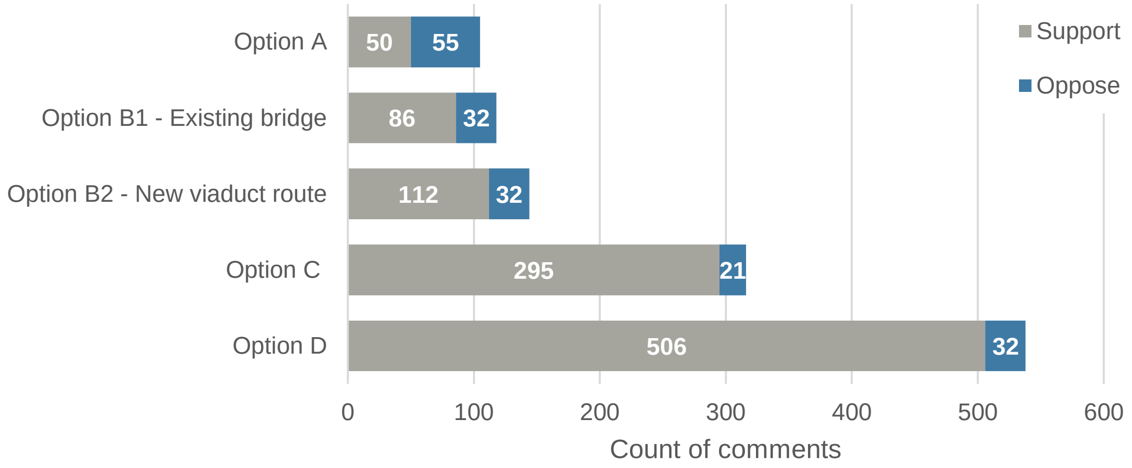
7.10. SUPPORT AND OPPOSITION FOR OPTIONS

7.10.1. Question 4 of the consultation questionnaire asked respondents to explain the reasons for their choice of preferred option(s) for a Norwich Western Link as cited in their responses to Question 3 (as shown in Figure 7.7 above).

7.10.2. There were 844 respondents who answered this question. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 844 responses, we identified a total of 3,270 different comments.

7.10.3. **Table 7.9** below outlines the number of comments which expressed support and opposition for each of the options.

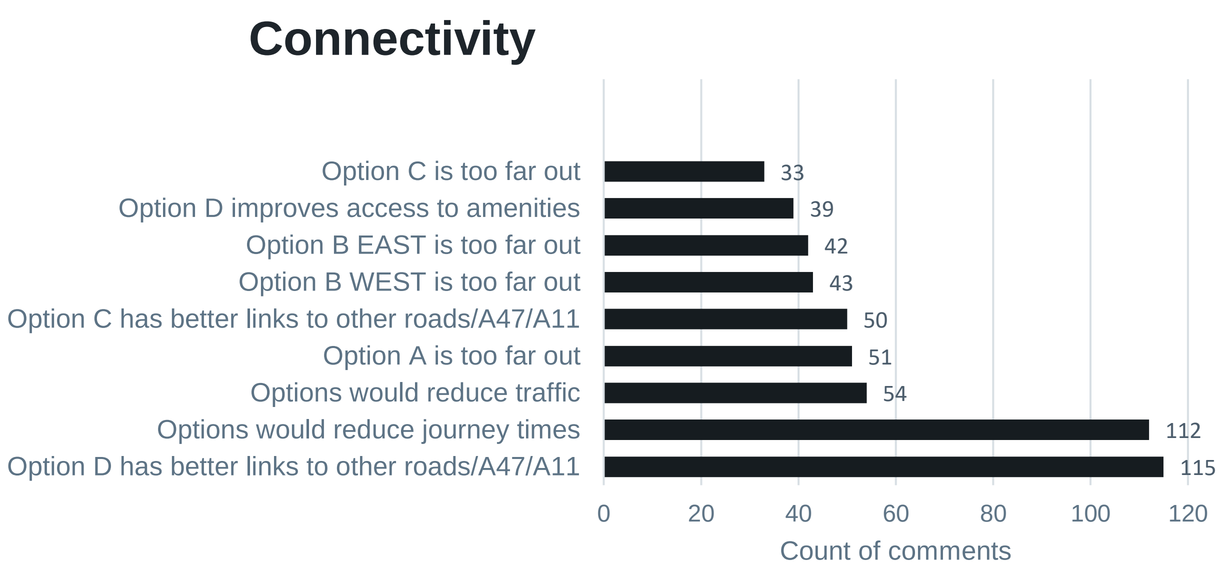
Figure 7.9 – Options Support and opposition



7.10.4. Several respondents also noted either general support or opposition to the scheme, not specific to any particular option. **Table 7.9** highlights the number of comments made around opposition or support for the scheme. Several comments were made suggesting that improvements are not required. Others noted that improvements are needed in the area but that these options are not the solution.

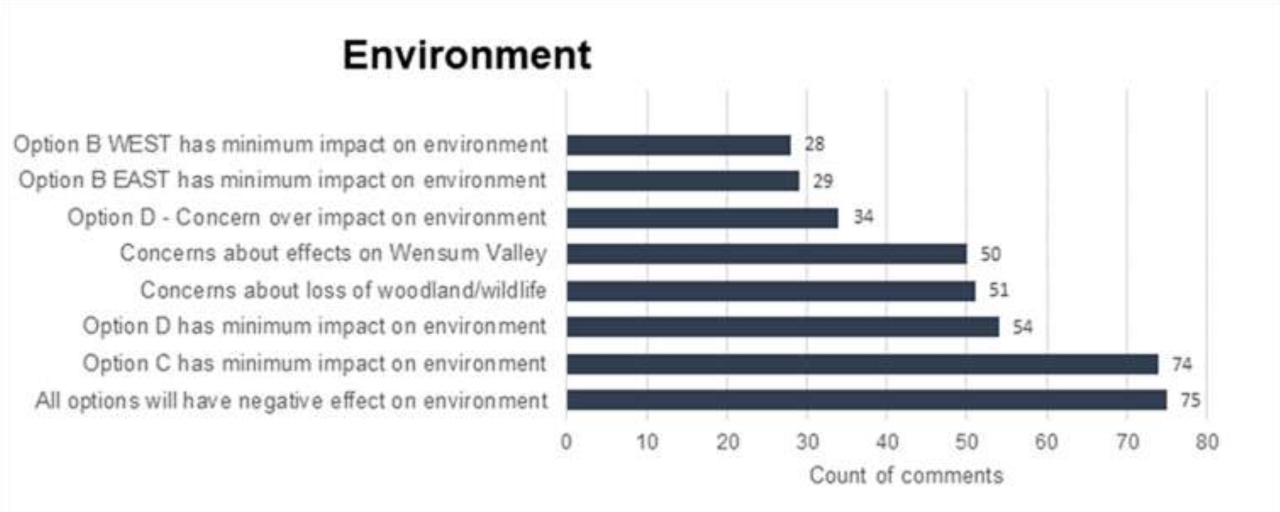
7.10.5. Of the comments received for question three, key themes have emerged which mirror the comments raised for each of the separate options: connectivity, environment, and rat running Figure 7.10 to Figure 7.12 indicate the main comments raised as part of this question.

Figure 7.10 – Options comparison - connectivity



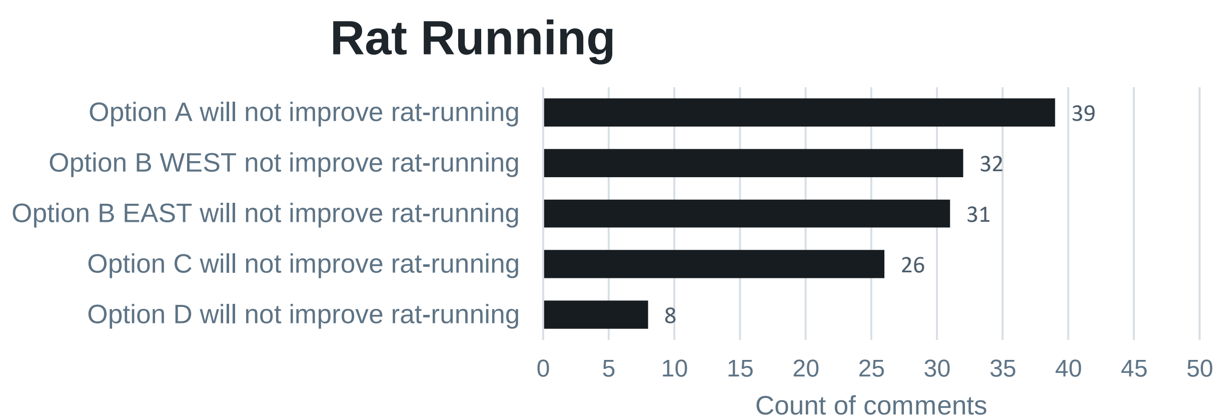
7.10.6. With regards to road network connectivity, Option D is highlighted as having better connections with other roads such as the A47 or A11. Option C is also noted to have good connections. Options A, B WEST, B EAST and C are noted as being too far away from Norwich to be effective.

Figure 7-11 – Options comparison – environment



7.10.7. With regards to environmental comments, all options are generally considered to have an environmental impact on the area. There is particular concern over the impact on woodland, wildlife, and the impacts on Wensum Valley. There are varying views on which option would have a minimal impact on the environment in comparison to the others; although the majority of comments in this respect state that Option C will have the least environmental impact (74 comments).

Figure 7.12 – Options comparison – rat running



7.10.8. With regards to rat-running, all options have been highlighted by respondents as not improving the rat-running situation, this is particularly the case for Option A.

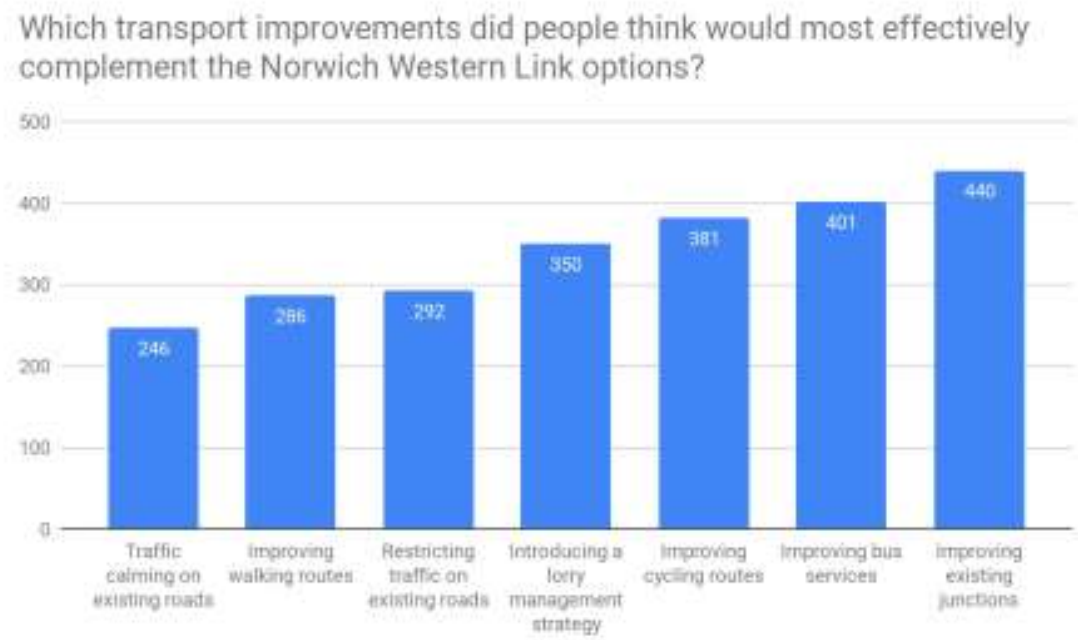
7.10.9. Based on the above it is likely that Options C and D would offer a solution that is publicly acceptable, whereas substantially less support was evident for Options A and B (both variants).

7.11. COMMENTS RECEIVED FOR OTHER TRANSPORT IMPROVEMENTS

7.11.1. Question 5 of the consultation questionnaire asked respondents whether there were any other transport improvements they felt could complement the Norwich Link. This question was optional but

84% of respondents elected to answer this question. As shown in **Figure 7.13** below, improving existing junctions was cited as the top response selected by 57% of those answering this question. Improving bus services and cycling routes were also in the top three responses to this question.

Figure 7.13 - Quantitative Feedback on Other Transport Improvements



7.11.2. A total of 724 comments were made for Question 6 which requested textual explanation of the reasons for selecting responses to Question 5. **Figure 7.14** below provides an outline of the main comments raised. A full list of comments received to this question can be seen in **Appendix F.**

7.11.3. Over 100 comments refer to the need for improved bus services. The need for improved facilities for cycling and walking are also highlighted by respondents. Roads and traffic improvements are suggested, including the avoidance of any new roundabouts as well as improved signage.

7.11.4. Traffic calming measures are commented upon in both a positive and negative context. Several respondents note the need to implement traffic calming measures, while others also note concern with these measures causing more congestion, noise and air pollution.

ANY OTHER COMMENTS

7.11.5. The final qualitative question in the questionnaire asked respondents if they have any further comments regarding the shortlisted options. 260 respondents provided a response to this question. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 260 responses, a total of 420 different comments were identified.

7.11.6. The comments raised in this section mirror the comments raised as part of responses to other questions in this questionnaire. A full list of comments received to this question can be seen in **Appendix F.**

Figure 7.14 - Comments received regarding other transport improvements

7.11.7. **Table 7.7** outlines the most frequently raised comments in this section, highlighting those comments that were raised over 10 times by respondents. Many of the comments stated that the scheme is needed (40 comments, 9.5%), whilst 38 comments (9%) noted opposition to all options or that improvements are not required (38 comments, 9%). Several respondents (10 comments, 2.4%) noted that there is a need for improvements, but opposed all options put forward.

7.11.8. Support for Option D is further expressed (31 comments, 7.4%), and support for Option C (11 comments, 2.6%) as well as opposition to Option A (12 comments, 2.9%)

7.11.9. Several comments re-iterated concern over environmental impacts of all options. Several respondents also provided alternatives or variations to the options proposed. This includes requests for single carriageway routes, amalgamations between different options (such as a route between B and C), and considering more direct or improved access to the A47 or the NDR. Other neutral comments included suggestions with regards to the scheme as a whole, including need for street lights, park and ride schemes, and national speed limit trials.

Table 7.7 - Any other comments – Most frequently raised

Theme	Comment	N° of times mentioned	% of comments
Support for Options	Support all options/Scheme is needed	40	9.5%
Oppose options	Oppose all options/do nothing / leave as is	38	9%
Support for Options	Support - Option D	31	7.4%
Neutral	Other comments (neutral)	29	6.9%
Environment	All options will have negative effect on environment	27	6.4%
Neutral	Alternative route suggestion given	21	5%
Cost	Too expensive/not cost effective	14	3.3%
Oppose options	Oppose - Option A	12	2.9%
Other negative comments	General comments (negative towards the scheme or the consultation)	12	2.9%
Neutral	Need better improvements in pedestrian/cycle facilities	11	2.6%
Support for Options	Support - Option C	11	2.6%
Oppose options	Oppose - all options but something needs to be done	10	2.4%

SUMMARY OF FEEDBACK FROM LETTERS AND EMAILS

7.11.10. A total of 41 responses were received from members of the public by letter or email, as opposed to the questionnaire. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 41 responses, a total of 174 different comments were identified.

7.11.11. **Table 7.8** summarises the level of support and opposition mentioned through the public letters and emails. The table indicates the number of comments which referred to support or opposition for each option, including its percentage in relation to the total number of comments raised throughout the letter and emails received from the public.

7.11.12. There is most support for Option D, with some support noted for Option C. There is more opposition to Option A, B WEST and B EAST. A small number of comments (1.6%) note opposition to all options put forward but that improvements are required.

Table 7.8 - Letters and emails from members of the public – Support and opposition

Theme	Comment	N° of times mentioned	% of comments
Support for options	Support - Option D	18	7.5%
	Support - Option C	7	2.9%
	Support - Option B WEST - Existing bridge	1	0.4%
	Support - Option B EAST - New viaduct route	1	0.4%
	Support - Option A	2	0.8%
Opposition to options	Oppose - Option A	8	3.3%
	Oppose - Option B WEST - Existing bridge	7	2.9%
	Oppose - Option B EAST - New viaduct route	7	2.9%
	Oppose - Option C	6	2.5%
	Oppose all options but something needs to be done	4	1.6%

Themes arising from stakeholder organisation responses

7.11.13. In total, 74 responses were received from stakeholder organisations (including those with land interests). As shown in Table 7.9 below, there is most support amongst stakeholder organisations for Option D, with some support noted for Option C. There is most opposition to Options A. Other comments received note opposition to Options B (both variants) and D (both variants).

Table 7.9 - Stakeholder Organisations – Support and Opposition

Theme	Comment	N° of times mentioned	% of comments
General	Overall support for scheme	18	6.23%
	Oppose – All options	6	2.08%
Support for options	Support - Option D	34	11.76%
	Support - Option C	17	5.88%
	Support - Option B WEST - Existing bridge	2	0.69%
	Support - Option A	1	0.35%
	Support - Option B (both)	2	0.69%
	Support - Option B EAST - New viaduct route	2	0.69%
Opposition to options	Oppose - Option A	11	3.81%
	Oppose - Option B (both)	10	3.46%
	Oppose - Option D (both)	3	1.04%
	Oppose - Option C	4	1.38%
	Oppose - Option B WEST - Existing bridge	3	1.04%
	Oppose - Option B EAST - New viaduct route	2	0.69%

7.11.14. A majority of comments from stakeholders related to environmental effects. There was general concern expressed that all of the options would have a significant negative impact on the environment. Whilst many of the stakeholders were of the opinion that Option D was a logical solution, several stakeholders felt that Option C would have less environmental impact but would still offer an acceptable route option. Despite the concerns from some organisations regarding potential environmental effects, responses from Natural England and Environment Agency did not oppose any of the options and Norfolk Wildlife Trust also highlighted the need for environmental mitigation to be included within the scheme design. The stakeholder responses are summarised in more detail in Appendix F.

7.12. LANDOWNER RESPONSES

7.12.1. The stakeholder responses above in Table 7.9 include 13 responses received from people and organisations who would potentially be affected by the proposals in terms of direct land take within their property ownership extents. There were varying degrees of support for the various options expressed, depending on which option most significantly affected their individual circumstances. In general, the landowners affected by one or more options, were in favour of the alternatives proposed. However, where more than one option would potentially affect their land, some had explained which of those options would be more acceptable to them.

7.12.2. Given the rural nature of the area, there were concerns expressed from landowners over impacts on farming and agricultural operations and severance of their land holdings, whilst a small number of others have operational businesses which may be commercially affected. Several landowners had concern over environmental effects and suggested avoiding impacts on woodland and wildlife in particular, whilst a small number of others were opposed in general as they would not want to see development attracted to the Wensum valley in response to a new road. However support and objections indicated in these representations is largely focused on specific route options rather than regarding the principle of an NWL.

7.13. RESPONSES TO COMMENTS RECEIVED

7.13.1. **Table 7.10** below lists general themes and comments raised in relation to any of the potential options and additional suggestions that could be taken into account or suggestions where further mitigation may be needed.

7.13.2. Responses are provided to the concerns raised, explaining how these ideas and suggestions have been considered within the work undertaken to date or how they will be addressed going forward.

Table 7.10 – Consultation Comments Received and Responses to Issues Raised

Options	Summary of issue	Response to issue
General		
General	Opposition to scheme/scheme is not needed	A wide range of 82 options were considered as part of the Option Assessment Report. These were compared against a Do Nothing option and only options that offered significant benefits over and above the do nothing scenario were taken forward. The options considered in the OAR included public transport and non-highway options but these were found to offer less opportunity to address key transport issues raised in the previous consultation and by local stakeholders. The four main route options proposed in the consultation were the best performing options across a range of criteria including transport benefits, environmental effects and value for money.
Option B WEST	General opposition to this option	This option was included as if offers a potential solution that may be feasible without a new viaduct crossing the River Wensum.

Options	Summary of issue	Response to issue
Option C Option D	Option is the most viable solution	These options offer improved choice of route closer to Norwich urban area and support orbital movement around Norwich.
Option B WEST Option C Option D	General support for this option.	Your comments are noted. These options cater well for the most direct/straight line routes from origins to destinations through the study area.
General	Alternative route suggestions provided/other options are better	A total of 82 options were considered and evaluated in the Option Assessment Report and the four options taken forward at this stage were shown to offer positive economic benefits and were seen to tackle the study objectives more effectively than various other options, whilst seeking to minimise impacts on environmental constraints.
General	Alternative route between Option B and C	Route options between B and C were considered previously. These were found to have increased impacts on strategic utilities and listed properties as well as increased effects on residential properties.
General	Alternative route between Option C and D	Route options between C and D were considered previously. These were found to have increased impacts on strategic utilities and listed properties as well as increased effects on residential properties.
General	Use of Option C as a single carriageway	Single Carriageway and Dual carriageway options were modelled for the shortlisted routes and all but Option A were shown to require the additional capacity offered by dualling in the 2040 forecast year.
General	An option which links directly to the A47 dual carriageway	All of the proposed options link directly to the A47 where dualling is proposed by Highways England. This should be in place prior to the completion of the NWL with new grade separated junctions to alleviate existing queues and delays at Honingham and Easton.
General	Reference to original plans which offered a western route through Queens Hills, and routes passing through Costessey emerging via Longwater. An Option D which starts at Longwater.	Connectivity with Longwater interchange and access through the Queens Hill development has been considered in the OAR but is unlikely to offer a significant benefit as the Longwater junction already suffers from peak hour congestion. However the traffic modelling suggests that the current proposed options would assist with reducing pressure on this junction (to varying degrees depending on which option is selected). Due to the design of the housing development at Queens Hill there are limited opportunities for connecting through the site in a way that would be acceptable to local residents and this would potentially detract from residential amenity. The provision of a new inner route

Options	Summary of issue	Response to issue
		would also potentially increase noise and vehicle emissions close to a high concentration of residential receptors.
General	Trialling of national speed limit to 80 or 90 mph	By definition, the local highway authority Norfolk County Council are unable to amend the national speed limit as this would need to be carried out on a National level by the UK Government. This idea has recently been considered but rejected by DfT.
General	Provision of Park and Ride for Option D	There are already Park and Ride sites at the Airport and Costessey which are close to the two ends of the Option D route. However, the NWL scheme may improve access to these sites and provide traffic relief to existing bus routes which would help to enhance bus service reliability and make these sites more attractive for users.
General	Consideration as to how the Norwich Western Link joins the existing road network.	We are working with Highways England in relation to junction strategy and connectivity with the proposed A47 new junctions which form part of the dualling scheme. At the north end of the route the NWL will join A1067 via a new junction. At this stage, it has been assumed to be a new roundabout for all options but more detailed modelling will be undertaken to find the most appropriate design of a new junction at the north of the NWL route.
Traffic		
Option A Option B WEST Option B EAST	Option will not solve the issue of rat-running and traffic will still use local roads, with particular mention of rat-running through Ringland, Weston Longville, Attlebridge, Taverham, Honingham and Costessey.	These options are further from Norwich urban edge but offer potentially reduced environmental effects during construction. Options B WEST and B EAST would still accommodate similar volumes of traffic to options C and D. However, route option A and both route options for B are relatively indirect routes (B WEST to a lesser extent than B EAST), so may be less effective than Option C and D at reducing rat -running through the villages.
Option A	A single carriageway is not fit for purpose/proposed road capacity is insufficient	This option was included in response to comments from the earlier round of consultation seeking to demonstrate that upgrading of existing routes had been considered. The Route A option has been tested within the model as both a single and dual carriageway variant and was found to be underutilised in the dual carriageway variant with only slightly higher traffic flows than the single carriageway option. This coupled with the longer length of A1067 widening required to connect a Dual carriageway route from A47 to A1270 makes a dualled option less cost

Options	Summary of issue	Response to issue
		effective and was considered to offer poor value for money. Hence only a single carriageway option was expected to have a viable Benefit Cost Ratio on this route alignment.
Option A	Option will not provide any journey time improvements	Traffic modelling indicates that there would be some journey time savings for Option A in comparison with the do nothing option in 2040. The table shown in the consultation brochure indicates that this would be 2-4 minutes per journey on some routes. In particular this route option makes journeys between Fakenham and destinations to the south of Norwich more efficient.
Option B EAST	Option has minimal traffic impact on local communities	This option does increase traffic on A1067 through Lenwade but offers similar levels of reduction through Ringland and Weston Longville as Options C and D and more reduction through Hockering than options D and C but less than option A.
Option C Option D	Option will discourage rat-running	These options offer substantial reductions in traffic through the villages of Ringland (44-45%), Weston Longville (84-85%) and Taverham (93%). These are expected to be more effective than Options A and B at reducing rat-running through villages closer to Norwich.
Option C Option D	Option will reduce traffic/congestion	These routes are expected to offer relief to routes through Taverham and Costessey and Longwater Lane which suffer from congestion at peak times.
Connectivity		
Option A Option B WEST Option B EAST Option C	Concern that the option is too much of a diversion for drivers to use/route is too far west/the route is not effective	This needs to be considered in the context of the Highways England proposals for dualling the A47 from North Tuddenham to Easton, which would include removal of existing at grade roundabouts at Easton and Honingham which are known to cause delays. With grade separated junctions and dual carriageway between Easton and Honingham, journey times on this section are expected to substantially reduce to around 2mins.
Option B WEST Option B EAST	Concern over ineffective links to road network, including that: - Flow of routes are ineffective disruptive flow - The options link too far onto the A47 - Does not link close enough to NDR	These routes are acknowledged to offer a longer distance than options C and D but still offer journey time savings over Option A and the Do nothing option. However a section of A1067 is proposed to be dualled for both Options B EAST and B WEST to provide a continuous dual carriageway from A47 to A1270. With A47 dualling in place and grade separated junctions (as proposed by

Options	Summary of issue	Response to issue
		Highways England), the A47 junction location selected for NWL at the southern end of the route makes very little difference to journey times with only a 1-2 minute difference between the two locations indicated by Highways England (HE) in their preferred route announcement. We are working with HE to make sure the two schemes are interfaced in the most efficient and cost effective manner, whilst seeking to minimise the environmental effects of the proposals.
Option C Option D	Option is the most direct route	These routes offer significantly shorter journey times and distances for many users. As shown in the consultation brochure this would be in the order of 3-7 minutes per vehicle at peak times.
Option C Option D	Option provides good links to Broadland Northway (NDR)	These options offer a more direct connection to the A1270 than Options A and B. This would assist with orbital movement around Norwich and improves the directness of routes for longer journeys to the coast from the south and west of Norwich in comparison with the do nothing scenario.
Option D	Option provides good links to other major road networks/between A47 to north	This Option would assist with orbital movement around Norwich and improves the directness of routes for longer journeys to the coast from the south and west of Norwich in comparison with the do nothing scenario.
Other transport improvements		
General	Need better improvements and safety in pedestrian/cycle facilities	Once a new link is in place, there would be traffic relief to some existing routes which could then be made more attractive for non-motorised users (Pedestrians, cyclists and equestrians). There would also be opportunities for access restrictions to be put in place to deter through traffic from some of the minor rural roads though the study area. Once a Preferred Route is announced, we will work with the Local Access Forum and relevant stakeholders to design a package of complementary measures to improve access and facilities for non-motorised users.
General	Traffic calming measures are needed	Once a preferred route is selected more detailed traffic modelling would be undertaken to identify locations which would potentially experience increased traffic as a result of the preferred option scheme and appropriate traffic management measures would be designed. We will work with the affected Parishes via the Local Liaison Group to bring forward a package of measures which seeks to deter inappropriate traffic from village roads. Measures may include weight restrictions and

Options	Summary of issue	Response to issue
		horizontal deflection to help reduce the component of larger vehicles and keep vehicle speeds low through villages.
General	Concern over potential use of traffic calming measures as considered that they cause congestion/noise/air pollution	Measures such as weight restrictions and horizontal deflection would help reduce the component of larger vehicles on village roads and this would help minimise noise and emissions.
General	Bus services need to improve	Existing routes and sparsely distributed population within the area to the west of Norwich are less ideal for efficient bus service operation (leading to long journeys which are not attractive to passengers). However, the NWL is envisaged to create opportunities for bus journey time improvements by providing traffic relief to some of the existing parallel routes which experience peak hour congestion. This would lead to more efficient journey times for buses on existing routes and the NWL itself may entice bus operators to create new services on longer routes through the study area. Once a Preferred Route is announced, we will be working with local bus operators to identify bus service and infrastructure improvements which may assist with improving the attractiveness of bus travel in the study area. The NWL and A47 dualling scheme would also potentially assist with improving access to existing Park and Ride sites at Costessey and the Airport.
General	HGV routes should be managed	Once the NWL is in place, there would be a far more attractive route available for HGVs. This should lead to the majority of larger vehicles using the NWL in preference to existing minor rural roads. Measures such as weight restrictions and traffic calming/speed restrictions are likely to be put in place to support the NWL scheme to mitigate effects where the NWL scheme would otherwise substantially increase traffic through residential areas without these measures Additional traffic modelling will be undertaken to test this for inclusion within the Environmental Assessments to inform the planning stage of work.
General	Junctions on A47 need improving/new junctions should not be roundabouts	We are working with Highways England (HE) who are currently developing the details of their junction strategy. We expect that grade separated junctions (e.g. bridges and underpasses that do not interrupt the flow of traffic) would be provided by HE and the NWL would tie in with these. The existing roundabouts at Easton and Honingham would

Options	Summary of issue	Response to issue
		also be removed as part of the A47 dualling scheme from North Tuddenham to Easton.
General	Better signage/street lighting is needed	A review of signs and street lighting will be carried out in the later stages of the project, so that appropriate provision is put in place when the new route opens, so that the NWL can be used safely and users can find their way adequately through the study area. However, the environmental effects of street lighting will also require careful consideration, especially in respect of ecology, given the sensitivity of the local area and prevalence of bats in particular.
Design		
Option B WEST	Positive comments regarding the use of the existing bridge	This option was included as it offers a potential solution that may be feasible without a new viaduct crossing the River Wensum.
Option B EAST	Opposition to new bridge/viaduct – particularly with regards to its impact on Wensum Valley, visual impact of the crossing, impact on landscape and views, and impact on flood risk.	A case study was undertaken in October 2017 which demonstrated that a viaduct option would be the most suitable and affordable solution for a new crossing of the River Wensum SAC/SSSI. A viaduct would have a minimal footprint within the flood plain and can be sufficiently elevated to minimise shadowing above habitats for protected species within the River Wensum. Other options considered included a tunnel and a lower height standard bridge with earthwork embankments but these were more likely to increase flood risk and pollution risk. A reference design for the viaduct has been discussed with the Environment Agency and Natural England and with adequate mitigation it is expected that an acceptable solution can be achieved.
Option B EAST	Support for a new bridge/viaduct	
Environment		
Option A Option B WEST Option B EAST Option C Option D	Concern over environmental impacts of all options, including: - Concern over loss of wildlife and habitats - Concern over loss of woodland - Concern over impact on countryside - Concern over impact on Wensum Valley/River Wensum - Concern that the scheme will accelerate climate	A reference design for the viaduct proposed as part of Options B East, C and D has been discussed with the Environment Agency and Natural England and with adequate mitigation it is expected that an acceptable solution can be achieved. Options A and B West do not require a new viaduct but may require localised works to the existing bridge at Attlebridge which would also require adequate environmental mitigation and protection. A Habitats Regulation Assessment will be undertaken in respect of all options in relation to the proposed crossing of the River Wensum to satisfy the stringent requirements applicable to the Special Area of Conservation. A Full Environmental Impact Assessment will be submitted with the application and this will also cover noise, air quality, climate change,

Options	Summary of issue	Response to issue
	change Concern over air and noise pollution	heritage, archaeology, transport, ground conditions and contamination. Extensive surveys are currently being undertaken to provide sufficient evidence in relation to protected species such as bats and noise modelling is also being undertaken to inform the development of an outline business case. The EIA and HRA will identify environmental mitigation measures that will delivered alongside the scheme. This could potentially include items such as Green and Dark bridges for ecology, noise attenuation measures along the NWL route, additional tree planting and replacement habitats.
Option A Option B WEST Option B EAST Option C Option D	This option will have the lower environmental impact in the area	
Cost		
Option A Option B EAST Option D	Option is not cost effective	The cost benefit case for all of the shortlisted options proposed within the consultation has been considered based on a comparison with the Do Nothing Option and other potential solutions. These were found to offer positive economic benefits to the sub-region around Norwich. A high BCR (Benefit Cost Ratio) in the range 2.0-4.0 was identified for the options within the consultation based on 2040 traffic modelling forecasts of journey time savings. However, Option A has a low BCR and provides less traffic relief than other routes, so offers less value for money than other options. A Strategic Outline Business Case is being prepared to demonstrate that the options considered offer good value for money and this will be used to inform the Regional Evidence Base for Large Local Major schemes seeking DfT funding.
Option A Option B WEST Option C	This option is the cheapest option/most cost-effective	

8. SUMMARY & CONCLUSIONS/RECOMMENDATIONS

8.1. SUMMARY

8.1.1. This Stage 2 Option Selection Report has recorded the findings of environmental, engineering, economic and traffic assessments; as well as consideration of stakeholder responses. The assessments have been carried out following guidance provided in WebTAG and the DMRB to inform the identification of a preferred route for the NWL.

8.1.2. At present, a significant gap exists between the A47 and the A1067/A1270 in terms of higher standard road network. Currently within this gap is a mix of historical single lane carriageway routes which are not able to correctly service the existing or future needs of the road network or the region. The consequences of strategic traffic growth for safety, congestion and environmental quality for residents and visitors to the region is likely to be significant without the provision of the proposed NWL.

8.1.3. A range of objectives developed to align with the current strategic objectives presented in national, regional, and local policy and associated guidance have been used to understand the potential impacts of a number of shortlisted routes carried through from an initial option analysis and assessment phase.

8.1.4. The route option assessment has compared six route options for the proposed NWL, considering the proposed A47 upgrade, tie in to the existing road network, and how the link will traverse through the Wensum Valley with minimal impact. The objective is a recommendation of a NWL preferred route, and a recommendation to progress to Stage 3 of the scheme assessment process.

8.1.5. The summary below outlines the key factors which have been considered during the assessment of the route options and which have informed the evaluation and recommendations that follow.

ENGINEERING

Horizontal Alignment, Land Use and Constraints

8.1.6. The assessment of the Options against horizontal alignment, land use and constraints considers the impact of the alignment corridors on the existing site constraints, and the main differentiator is how far each route avoids impact. Option A has the most significant impact being within an existing narrow corridor with property frontages. There is also a reasonable impact from both B Options as they involve upgrades to the A1067 within an existing constrained site. Option D West is near an electricity pylon, and together with Option D East, is close to an existing reservoir.

Junctions and Links

8.1.7. Route Option A requires several junctions with existing local roads, while all other options are directly comparable to each other in terms of junction provision. Option B West and East will have property accesses and links along the widened A1067, which are undesirable. Route Options D East and West will need to connect to local roads at their southern end subject to the final A47 junction.

Topography and Profile

8.1.8. Option A has best fit with the existing topography as the terrain for this route corridor is less undulating, this is followed closely by Option C which also has a good fit. Options B West and B East alignments have less fit, while Options D West and D East alignments significantly contrast with the existing terrain.

8.1.9. Options B East, D East and D West route alignments propose deep cuttings and high embankments (typically on the approaches to the viaduct crossing), whereas Option B West has slightly lower height embankments and cutting depths as has Option C. Option A requires the least height embankments and shallow cuttings. Though there is a difference in material to be disposed offsite across all options, this element has not been considered objectionable at this stage, as the quality of site won material is yet to be fully assessed and there could be opportunities for re-use for landscaping, or as part of a mitigation strategy for noise and visual impact.

Structures

8.1.10. The complexity of the form of structures and the number of structures included within the individual routes has been used to rate the options in relation to structures.

8.1.11. With crossing structures over the River Wensum and Tud in addition to a considerable number of road crossing bridges, Options D West and D East have the greatest structures impact. Route Options C, B East and B West, then follow in order of number and sizes of structures required including the River Wensum crossings. Option A only requires culverts and pedestrian crossing structures.

Drainage

8.1.12. The same highway drainage strategy applies to all options, and their respective flood strategies. The flood strategies are separately considered within the environmental assessment.

Public Utilities

8.1.13. Options D West and D East would impact on a strategic gas pipeline and cross a high voltage overhead line near the Tud River valley. Options C, B East, and B West cross the high voltage overhead power line east of Weston Longville and Weston Green, with Options B West and East also running adjacent to the line. Option A impacts on several main utilities and property connections along the link corridor, while Options B West and B East impacts on main utilities and property connections along the A1067 corridor.

A47 Tie-in

8.1.14. Though the Highways England A47 junction strategy is yet to be confirmed, the tie-in with Option A is expected to need minimal upgrade for the A47 junction and is preferred as it provides a more convenient and practical connection due to traffic flows not being too different from that anticipated for the B1535 (Wood Lane). Options B West, B East and C are expected to require minor upgrades and possibly the addition of roundabouts at the same location due to the increased traffic volumes relative to Option A.

8.1.15. Options D West and East will intersect the A47 close to Berry's Lane, with the proposed HE junction expected to require reconfiguring to carry the greater traffic anticipated for the NWL. Both route junction Options will entail accommodation of side roads at the junction, with Option D East needing more extensive connections due to the relative greater distance from existing roads.

Departures from Standard

8.1.16. Though full details of Departures from Standard are yet to be determined, Options B East and West would not comply with requirement of TD 41/95 of limiting direct accesses to dual carriageways. Option D West has the A47 junction in close proximity to the River Tud crossing, and may require a steeper gradient than desired to tie in. New junctions on Option A may require relaxation of TD 42/95 geometric layout requirements.

8.1.17. For vertical and horizontal curvature, there is currently no TD 9/93 Departures from Standard for Option C. Options D West and D East are below desirable minimum vertical curvature parameters at a single location each, while Option A horizontal curvature is two steps below desirable minimum on the A1067 approach.

Buildability

8.1.18. The buildability assessment is done mainly in relation to the complexity of construction works envisaged particularly the temporary traffic management arrangements including diversions required to safely undertake the works. The structures section above considers the impacts of structures within each route option.

8.1.19. Options B and A would entail extensive online construction along the A1067, and B1535 respectively, including diversion of through traffic, and arrangements for property access. Options D West and East are further remote from classified roads hence access for transport during construction will be challenging.

Engineering Options Assessment

8.1.20. A simple six-rank matrix engineering decision matrix has been prepared to rank the relative performance of the route Options against decision criteria. The matrix evaluates each option against each criterion, with a position rank of 1 representing the best performing Option (positive impact), while a rank of 6 represents the worst performing (negative impact). The overall summary outlines the relative overall ranking of the options for all criteria.

Table 8.1 - Engineering Decision Matrix for Route Selection

Engineering	Route A	Route B (west)	Route B (east)	Route C	Route D (west)	Route D (east)
Horizontal Alignment, Land Use and Constraints	6	5	4	1	3	2
Junctions and Links	6	3	2	1	4	4
Topography and Profile	1	3	4	2	6	5
Structures	1	4	2	3	6	5
Drainage	1	1	1	1	1	1
Public Utilities	4	3	2	1	6	5
A47 Tie-in	1	2	2	2	5	6
Departures from Standard	1	6	5	1	1	1
Buildability	4	3	2	1	6	5
Overall	**3**	**4**	**2**	**1**	**6**	**5**

ENVIRONMENT

8.1.21. There are a lot of potential important environmental issues that need to be taken into account during all stages of the process of this scheme. All route options have environmental impact associated with them, however in general at this stage, Route Option A is the least environmentally impactful and Option D, for most disciplines, has the largest environmental impacts.

8.1.22. The environmental impacts and potential mitigation outlined at this stage has been taken from predominately desk-based information and the WebTAG assessment worksheets. The environmental appraisal summary in **Table 8.2** below shows the results of these WebTAG assessments for all route options.

Table 8.2 - Environmental Appraisal Summary Table

Environmental Impacts	Route Options				
	Option A	**Option B West**	**Option B East**	**Option C**	**Option D (west and east)**
Noise	Considered to be the best option as it adversely affects (in terms of moderate and major impacts) the fewest properties.	Considered to be the worst option as it adversely affects (in terms of moderate and major impacts) the highest number of properties.	Considered the third best option in terms of moderate and major adverse impacts on properties.	Considered the second best option in terms of moderate and major adverse impacts on properties.	Considered the second worst option in terms of moderate and major adverse impacts on properties.
Air Quality	Slight beneficial local air quality impact; affects fewest numbers of properties	Negative local air quality impact	Negative local air quality impact	Negative local air quality impact	Worst negative local air quality impact; affects largest numbers of properties
Greenhouse Gases	Net present value $(CO_2)_e$ of £8,622,855; lowest emissions of greenhouse gases	Net present value $(CO_2)_e$ of -£1,358,528; second lowest emissions of greenhouse gases	Net present value $(CO_2)_e$ of -£4,900,284; second highest emissions of greenhouse gases	Net present value $(CO_2)_e$ of -£4,149,699; third highest emissions of greenhouse gases	Net present value $(CO_2)_e$ of -£10,575,555; highest emissions of greenhouse gases

Landscape	Slight Adverse	Slight Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Historic Environment	Large Adverse	Large Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Biodiversity	Very Large Adverse	Very Large Adverse	Very Large Adverse	Large Adverse	Large Adverse
Water Environment	Minor Adverse	Minor Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Geology and Soils	This Option has the least exposure to the construction of embankments/ piled structures over Alluvium layer.	This Option has a limited exposure to construction of embankments and piled structure over Alluvium layer.	This Option has a considerable exposure to construction of embankments and piled structure over Alluvium layer.	This Option has a considerable exposure to construction of embankments and piled structure over Alluvium layer.	This Option has the greatest exposure to construction of embankments and piled structure over Alluvium layer.

8.1.23. Going forward, next steps will include:

- Further, more detailed onsite surveys and assessment work once preferred route is announced for all the environmental disciplines;
- Identification of detailed appropriate mitigation measures that will be then assessed in the planning application process;
- Consultation will be undertaken with all applicable statutory bodies and other important stakeholders; and
- Input into the detailed design at an early stage to ensure environmental impacts are minimised as early as possible in the process.

TRAFFIC AND ECONOMICS

8.1.24. Option A was found to cater for significantly fewer journeys with only around 9,000-10,000 vehicles per day expected to use the new link in 2025. This route is less well aligned with desire lines through the study area. Options B, C and D were shown to be about three times more attractive with AADT flows predicted in the region of 29,000-32,000 vehicles per day in 2040. Of all options, Option C was shown to attract the highest flows catering for about 31,700 journeys per day. This option is able to cater for a wide range of desire lines through the study area. Due to its connectivity to the Wood Lane junction it is able to intercept traffic that would otherwise use the B1535 and in conjunction with the A47 dualling scheme is able to also offer journey time savings for orbital movements around Norwich as journey time constraints are removed on the section of A47 between Easton and Honingham.

8.1.25. Looking at the benefits derived from the economic assessment, Option C provides the highest Present Value of Benefits (PVB) followed by B East, Option D and B West with Option A having the lowest PVB. From a benefits point of view Option C is the best option.

8.1.26. Performance in terms of economic assessment indicates that all options would have a High-Low Benefit Cost Ratio, with BCR values of 1.4-2.6 based on journey time savings and transport user benefits across the network assessed using TUBA software in conjunction with the traffic model. The BCR values are shown in **Table 8.3** below. Despite the substantially lower cost of Option A, this also has the lowest BCR of all options (estimated at 1.4). Whilst the highest cost solution Option D West falls in the Medium BCR category. Option B West offers the highest BCR of 2.6 and Options B East, C and D East are also within the High BCR category as shown in Table 8.3.

Table 8.3 – Scheme Costs and BCR Summary

	Route Options					
	Option A	Option B West	Option B East	Option C	Option D West	Option D East
Initial Benefit Cost Ratio	1.4	2.6	2.2	2.5	1.8	2.0
Adjusted Benefit Cost Ratio	1.4	2.6	2.2	2.5	1.9	2.0
Adjusted VfM Category	Low	High	High	High	Medium	High

8.1.27. The proposed B1535 upgrade to the west of the study area produces a Low overall benefit to cost ratio (BCR) of 1.4 as would be expected from the least direct route utilising a single carriageway.

8.1.28. The five remaining routes are new high standard dual carriageways which will potentially become part of the MRN and produce either a Medium or High BCRs of more than 1.5, representing good value for money.

STAKEHOLDER ACCEPTABILITY

8.1.29. Feedback was collected during the two rounds of public consultation from a range of stakeholders as set out in section 7 above. In relation to the general principle of the NWL, the majority of stakeholders were supportive of the proposals, as long as adequate environmental mitigation and supporting traffic management measures were put in place to enable the solution to be sustainable. In relation to specific options, the majority of stakeholders' support Options D or C.

8.1.30. The NNUH, Norfolk Constabulary and Norfolk Fire and Rescue Service support the NWL, recognising the benefits the NWL would bring to their emergency response times. They have already seen the benefits to the north and east of Norwich that the Broadland Northway has already provided.

8.1.31. The feedback also included notable responses from the Environment Agency (EA) and Natural England (NE). Both EA and NE require a solution which does not impact on the integrity of the River Wensum SAC and SSSI. The EA also highlighted that the River Tud is classed as a Priority Habitat as a chalk river in the WWF-UK 2014 report 'The State of England's Chalk Streams'.

8.1.32. In both cases EA and NE consistently indicate a preference to minimise the number of river crossings, although noting that Option A is expected to have the least impact on flood risk and does not require a new crossing. Both the EA and NE also confirm that a new viaduct is considered an acceptable solution subject to appropriate design and construction methodology, should a new road crossing be required.

8.1.33. Support for creating a Norwich Western Link has also been received from key individuals and organisations, both through the consultations and following separate engagement.

8.1.34. Letters of support for the scheme have been received to evidence the strong and widespread backing the scheme has at both a local and regional level. Individuals and organisations who have written in support include:

- Keith Simpson MP
- Chloe Smith MP
- District councils (Broadland District Council, Norwich City Council, Breckland Council and South Norfolk Council)
- Public transport providers (First Eastern Counties Buses and Konectbus)
- Norfolk and Norwich University Hospital
- Norfolk Constabulary
- Norfolk Fire and Rescue Service
- New Anglia Local Enterprise Partnership
- Norfolk Chamber of Commerce
- Road Haulage Association
- Norwich Airport
- Easton and Otley College
- Clarion Housing Group

8.1.35. Common reasons cited in these letters for why an NWL is needed include traffic congestion on the existing road network in the area and the potential for improved journey times and reliability, better access to business and employment sites and to the hospital and improved quality of life for local residents.

8.1.36. In addition, the seven Conservative Norfolk MPs wrote to Secretary of State for Transport the Rt Hon Chris Grayling MP in February 2019 asking that he consider prioritising funding for the Norwich Western Link.

8.1.37. Cllr Bill Borrett, who sits on the NWL Member Group, also received an email from the East of England Ambulance Service NHS Trust in May 2019 stating their support for Option D.

8.1.38. Representations regarding the NWL have also been received from town and parish councils and local councillors, both through public consultations, the Norwich Western Link Local Liaison Group (comprised of local town and parish council representatives located in the area to the west of Norwich) and other engagement. The vast majority of representations received from these councils regarding the principle of creating an NWL are supportive of the need for the scheme.

8.1.39. While most individuals and organisations who have contacted Norfolk County Council support the need for an NWL, some correspondence has indicated significant reservations and/or objections to the principle of creating a Norwich Western Link. Such representations have been received from:

- Clive Lewis MP

- Norwich Green Party
- Environmental and campaign groups (Norfolk Wildlife Trust, the Woodland Trust, the Campaign to Protect Rural England and the Wensum Valley Alliance).

8.1.40. The most commonly cited reason for these reservations and objections are the impact on the environment and the ecology of the area.

8.1.41. The County Council has also received correspondence from landowners in the area to the west of Norwich, however support and objections indicated in these representations is largely focused on specific route options rather than regarding the principle of an NWL.

8.1.42. The balance of support compared to objections received from key stakeholders is broadly similar to that seen through the responses to the two public consultations, with the significant majority of responses agreeing that an NWL is needed.

8.2. RECOMMENDED PREFERRED OPTION SELECTION

8.2.1. This Option Selection Report has considered all aspects of the design of a potential scheme preferred route alignment for a Norwich Western Link. The decision on a Preferred Route Alignment (PRA) takes on board engineering scheme design considerations such as drainage, geotechnical, structural and topographical considerations in addition to environmental effects, scheme risks, cost and transport benefits across all of the shortlisted options as well as feedback from two rounds of public consultation.

8.2.2. It is firstly important to select an option which is fit for purpose and maximises opportunities for tackling the key transport issues within the study area and meeting the study objectives. An assessment of the route options against the High Level and Specific objectives was undertaken during the OAR phase in 2018. Options B, C and D generally performed well against both the high level and specific objectives. However, Option A was found to be less successful in terms of addressing the scheme specific objectives as it is further west and less able to reduce rat running and congestion.

8.2.3. Transport modelling indicates that the route options considered were all found to offer improvements in comparison with the Do-Nothing Scenario, with a new road link providing additional capacity and opportunities for traffic relief to existing routes which suffer from peak time congestion close to Norwich or suffer from inappropriate rat running through minor rural villages due to the lack of suitable alternatives available.

8.2.4. Selecting an option which scores well against the scheme specific objectives and has good value for money also contributes towards public acceptability. The feedback from public consultation indicates that Options C and D were well supported with both of these being considered to offer a fairly or very effective solution to the key transport issues in the study area. Options B West and B East received similar levels of support to the Do-Nothing option or other alternatives, so are less likely to receive public support if taken forward as the preferred option. The feedback in relation to Option A was particularly negative with almost 75% of respondents considering this option to be an ineffective solution. This suggests that either Options C or D would be more likely to be publicly acceptable as a Preferred Option than other alternatives and people saw these to be best aligned with the scheme objectives. However, it is clear that local residents within the study area would wish to see additional environmental mitigation and supporting sustainable transport measures put in place to accompany any new road options taken forward to the next stage.

8.2.5. Given the sensitivity of the scheme, and with environmental concerns high on the public agenda and a critical technical requirement of the project, the options review shown in **Table 8.2** sets out the high-level summary findings of the environmental appraisal. This indicates that Options D (west and East) offered the worst performance from an environmental perspective across the majority of categories. This is related to the increased proximity to the edge of Norwich urban area, which has a higher concentration of receptors for noise and air quality and the requirement to include a second viaduct structure over the River Tud in terms of landscape and water environment, geology and soils.

8.2.6. The exceptions were in the Biodiversity and Historic Environment categories, where Options D West and D East both offer less impact than Options A and B (West and East). However, Options D and C both faired equally in these two categories and still showed large adverse effects against biodiversity and moderate adverse effects for historic environment. Referring to the more detailed appraisal in Chapter 5, Option C was considered to offer the least effect on the historic environment.

8.2.7. In the context of the Special Area of Conservation and SSSI which applies to the River Wensum, Option D, C or B East are all expected to have similar effects with a new viaduct proposed for all of these options crossing the SAC. It is expected that the SAC risk can be appropriately mitigated for all of these options with a sufficiently tall structure that minimises shadowing and a robust temporary works design and surface water drainage design to protect the watercourse from pollution. However, Natural England have highlighted that those Options that go over the River Wensum and other rivers present an increased risk due to their potential intrusive nature to the sensitive environment. Natural England and the Environment Agency have also made it clear that they would prefer the number of river crossings to be minimised but in the event that a new crossing is required an appropriately elevated viaduct solution would potentially be acceptable – this is expected to present a lower risk solution than widening of existing bridge crossings.

8.2.8. From an engineering perspective all options have various technical challenges to enable a scheme to be delivered. **Table 8.1** considers each option against a range of factors and this shows that in 6 of the 9 categories Option C was considered to offer the optimum solution. This includes horizontal alignment as it is further from existing properties and land use constraints. During construction Option A is most likely to cause disruption as it is predominantly online construction and would have significant traffic management requirements. All other options are predominantly offline.

8.2.9. In relation to all other engineering factors, Option C scored better than Options D East and D West. Option D West is also the costliest option and several respondents to the public consultation have highlighted that this option is less desirable in terms of the efficient use of public money.

8.2.10. On balance, considering all factors, it is therefore recommended that Option C is taken forward as the Preferred Route as this offers a solution which offers good value for money, is publicly acceptable but less environmentally intrusive than Option D and easier to build, cheaper to install and lower risk to deliver through the planning process than Option D.

8.3. DESIGN RESPONSES AND RECOMMENDATIONS

8.3.1. In response to consultation feedback in relation to a wide range of comments on environmental issues, it will also be important for members of the public to see that effects have been minimised and appropriate mitigation is provided, for instance noise mitigation where the route is close to residential properties. Bio-diversity net gain could also be sought to off-set the habitat loss that would result from the scheme.

8.3.2. Environmental key stakeholders such as Natural England, Environment Agency also supported this view, with particular reference to minimising the scheme footprint within the floodplain and pollution control around the River Wensum SAC/SSSI.

8.4. PACKAGING OF SUPPLEMENTARY TRANSPORT MEASURES

8.4.1. In response to the above comments and general themes from the public consultation feedback as set out within paragraph 8.2.4, it is recommended that any option taken forward needs to be accompanied by a package of supporting non-motorised user interventions to encourage active and sustainable travel for shorter distance trips, for example creating new cycle and equestrian routes on minor rural roads that will receive a traffic reduction linking existing and growing communities and helping to alleviate congestion in the inner routes close to Norwich for instance between Taverham and Costessey, Ringland and Weston Longville, as well as improving access to workplaces and the proposed food hub.

8.4.2. To inform the development of a complementary package of non-motorised user interventions, a Walking, Cycling & Horse Riding Assessment and Review will be undertaken in accordance with DMRB HD 42/17. This guidance is prepared in line with Highways England's Strategic Business Plan and Roads Investment Strategy, as well as the Infrastructure Act 2015.

8.4.3. A sustainable transport strategy would then be produced for input to the Outline Business Case which seeks to maximise opportunities for transferring shorter distance band trips to non-motorised modes of travel such as walking and cycling where possible.

8.4.4. The measures would focus on enhancing accessibility and safety for non-motorised users on existing routes where there would be traffic relief as a result of the NWL scheme. This could include targeted access restrictions to through-traffic on some routes or dedication of Quiet Lanes to keep traffic volumes low (for example by implementing Traffic Regulation Orders and partial route closures but retaining essential vehicle access only for landowners with property accesses directly onto these routes). This would help make the routes more attractive and safer for Non-Motorised Users.

8.4.5. Given the rural setting of the area and attractiveness of the landscape, the NWL could also assist with supporting longer distance leisure trips by equestrians and cyclists provision. For leisure use, this would generally consist of giving priority to cycles/equestrians on quieter existing roads where parallel routes exist and looking at minor highway interventions to keep traffic speeds sufficiently low and raising driver awareness of vulnerable users on these routes whilst appropriately managing conflicts between vehicles and vulnerable users.

8.4.6. At present it is anticipated that the assessment and strategy would focus on the following key routes, based on initial scoping discussions with cycle officers at NCC.

- Longwater to Taverham via Queens Hills
- Ringland to Easton and Costessey P&R
- Ringland to Lenwade via Weston Longville
- Hockering to Honingham
- Great Witchingham to Attlebridge
- Identify A1067 crossing opportunities at Attlebridge and Drayton
- Identify how best to achieve Marriotts Way connectivity
- Connectivity with Highways England proposals for A47 multi-user crossings

8.4.7. In relation to public transport, the need for commercial viability of services is noted as the key driver for bus routing, with operators attracted to routes which have higher density development alongside to maximise patronage and viability. Since the NWL is not coupled directly with development, it is unlikely that the NWL route itself would support new bus service routes directly.

8.4.8. However, the NWL scheme is envisaged to support important bus services such as the X29/29 service from the North West of the County by intercepting some of the traffic that currently uses Fakenham Road and road routes parallel with the NWL such as the outer ring road. This would potentially assist with improving bus journey time reliability on existing routes by freeing up road space and capacity on the western edge of the City. Coupled with the A47 dualling scheme from North Tuddenham to Easton and removal of existing roundabouts on A47, the two schemes would also assist with speeding up bus journey times for 23/ 23A and 24 which operate on A1074 Dereham Road. With improved reliability, existing services would be more likely to attract patronage and investment, leading to improved frequency.

8.4.9. Following the NWL Preferred Route Announcement, meetings will be held with bus operators to understand opportunities in more detail, exploring whether the provision of a new link through the study area would create new commercial opportunities for additional bus services as a result of traffic relief to alternative routes. For example, exploring whether more direct links between settlements to the north of Norwich (such as North Walsham and Aylsham amongst others) could be established with key destinations on the south west of the city (e.g. NNUH, UEA and NRP) with the NWL in place, or whether enhanced Park and Ride services could be facilitated with improved vehicle accessibility to the Costessey and Airport sites.

8.4.10. All of the above would assist with meeting the specific NWL scheme objectives below; and any associated mode shift would also contribute towards strengthening the business case for the scheme:

- Make the transport network safer for all users (including non-motorised users)
- Encourage a shift to more sustainable modes of transport, such as public transport, walking and cycling
- Improve access to green space
- Contribute to the improved health and well-being of local residents
- Improve connectivity and access to Norwich International Airport, Norwich Research Park and Norfolk & Norwich University Hospital

8.5. NEXT STEPS

8.5.1. The following steps will be taken prior to the development of an Outline Business Case in the later part of 2019:

8.5.2. Transport Modelling of the preferred option package will be undertaken with sensitivity analysis with a range of growth scenarios tested to inform the OBC. This will be brought in line with the latest information available from the Local Planning Authority once the new Greater Norwich Local Plan becomes available in mid-2019.

8.5.3. The junction strategy will be worked up in more detail for the grade separated interface with A47, working collaboratively with Highways England to outcomes presented in this report and potentially allow sensitivity testing for cumulative effects with other Transforming Cities schemes which may increase demand for park and ride, bus services and cycling in the route corridor.

8.5.4. The traffic modelling work would also investigate whether additional traffic calming measures are required to support the preferred option, to prevent the scheme from attracting new traffic to existing routes.

8.5.5. Further discussions will be held with relevant NCC officers and the NWL Project Board regarding the detail of the preferred options package to understand what further design development is required.

8.5.6. Continue to engage with Local Liaison Groups to seek input from a wider group of external stakeholders and local residents to help shape the final package of preferred options.

8.5.7. In order to more proactively engage with environmental groups, it is proposed that a Local Ecology Liaison Group will be initiated for the project.

8.5.8. Further technical work is required to understand the sensitivity and groundwater contamination risks to the SAC.

8.5.9. Intrusive testing of ground conditions is required and topographical surveys to inform the design development stage.

8.5.10. Liaisons with statutory utility providers to identify requirements for any utility protection or diversionary works, and the cost and programme implications for the preferred route option.

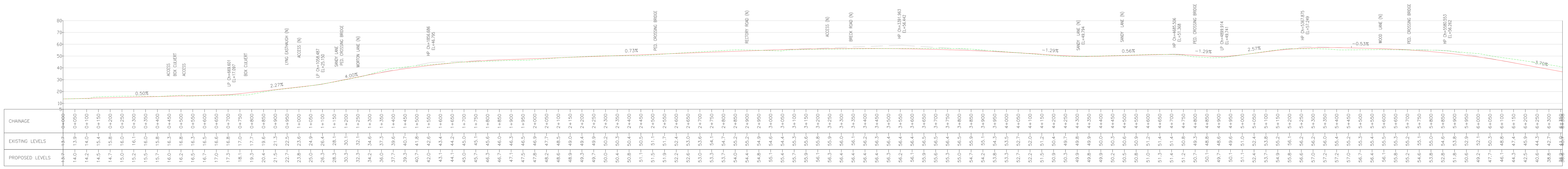
8.5.11. Further seasonal ecology surveys for the scheme footprint and potential zone of influence around the preferred Option C.

8.5.12. Further work to determine the preferred procurement strategy is required and opportunities for Early Contractor Involvement are recommended to inform the methodology for construction prior to planning submission, so that an acceptable and practical solution can be found and agreed with key stakeholders.

8.5.13. Further traffic modelling of the preferred route will be carried out following the OBC using an updated version of the traffic model when it becomes available This would ensure that the latest available data is used to inform the Full Business Case(FBC) to minimise risk of challenge at a later stage of the process. Data collection for this task would include capturing new mobile phone data and updated traffic counts across the network.

Appendix A

PROVISIONAL ROUTE OPTION LAYOUTS



ROUTE OPTION A
H. SCALE 1:10000
V. SCALE 1:2000

DO NOT SCALE

LEGEND – AERIAL VIEW

- PROPOSED HIGHWAY BOUNDARY (INDICATIVE LOCATION)
- PROPOSED DRAINAGE FEATURE
- PROPOSED A47 DUALLING (BY HIGHWAYS ENGLAND)
- PROPOSED STRUCTURE (INDICATIVE LOCATION)
- PROPOSED ROAD SURFACE
- PROPOSED RESERVOIR (BY WENSUM VALLEY GOLF CLUB)
- EXISTING FOOTPATHS/BRIDLEWAYS/BYWAYS
- EXISTING DITCHES/WATER COURSES
- PROPOSED LOCAL ROADS/TRACKS DIVERSIONS
- EXISTING LOCAL ROADS/TRACKS TO BE STOPPED UP
- EXISTING ROADS TO BE RE-PROFILED/LOWERED

LEGEND – VERTICAL PROFILE

- EXISTING GROUND PROFILE
- PROPOSED ROAD PROFILE

NOTES

1. THE LOCATION OF EXISTING FEATURES HAVE BEEN INTERPRETED FROM AVAILABLE ORDNANCE SURVEY AND AERIAL SURVEY MAPPING OVER THE SITE EXTENTS AND FURTHER DETAILED SURVEYS WILL BE REQUIRED TO CONFIRM ALL FEATURES.
2. THIS DRAWING IS NOT TO BE USED AS A REFERENCE FOR SETTING OUT OR CONSTRUCTION. IT IS A COMPOSITE DRAWING SHOWING THE SPATIAL RELATIONSHIP BETWEEN THE PROPOSED AND EXISTING FEATURES.
3. THE LOCATIONS AND SIZING OF ALL PROPOSED FEATURES AND STRUCTURES ARE INDICATIVE, AND ARE TO BE CONFIRMED FOLLOWING DETAILED SITE SURVEYS AND INVESTIGATIONS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AND REPORTS ON THIS HIGHWAY SCHEME PROPOSAL.
5. THE NORWICH WESTERN LINK (NWL) STRATEGY ASSUMES THAT SOME EXISTING LOCAL ROADS AND TRACKS CAN BE DIVERTED OR STOPPED UP, TO MINIMISE THE NUMBER OF LINKS TO THE NWL IN CASE OF A SINGLE CARRIAGEWAY, OR THE NUMBER OF CROSSINGS IN THE CASE OF A NWL DUAL CARRIAGEWAY.
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13. THE PROPOSED ROAD PROFILE DOES NOT FULLY OPTIMISE EARTHWORKS, AS THE EXISTING GROUND CONDITIONS ARE YET TO BE DETERMINED. THE GEOTECHNICAL INVESTIGATION MAY NECESSITATE A REVISION OF THE PRELIMINARY ROAD PROFILE TO TAKE INTO ACCOUNT, ANY UNSUITABLE SOILS, CONTAMINATED LAND, AND/OR A HIGH POSITION OF THE GROUND WATER LEVEL.
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P01	03/06/2019	AS	FIRST ISSUE	JJL	JNL

DRAWING STATUS:
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CLIENT:
NORFOLK COUNTY COUNCIL

ARCHITECT:
-

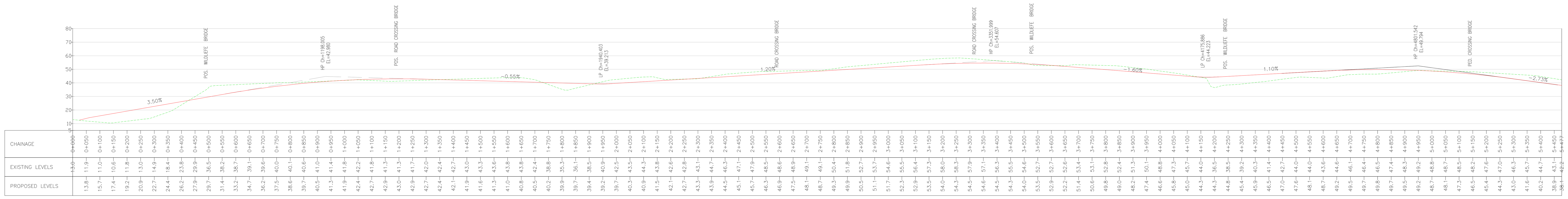
SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
PROPOSED LINK ROAD OPTION A
OVERVIEW PLAN

SCALE @ A1:	CHECKED:	APPROVED:
1:10000	JJL	JNL

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	AS	AS	June 19

DRAWING No:	REV:
1922-WSP-00-ZZ-CE-SK-1000	P02



ROUTE OPTION B WEST
H. SCALE 1:10000
V. SCALE 1:2000

DO NOT SCALE

LEGEND – AERIAL VIEW

- PROPOSED HIGHWAY BOUNDARY (INDICATIVE LOCATION)
- PROPOSED DRAINAGE FEATURE
- PROPOSED A47 DUALLING (BY HIGHWAYS ENGLAND)
- PROPOSED STRUCTURE (INDICATIVE LOCATION)
- PROPOSED ROAD SURFACE
- PROPOSED RESERVOIR (BY WENSUM VALLEY GOLF CLUB)
- EXISTING FOOTPATHS/BRIDLEWAYS/BYWAYS
- EXISTING DITCHES/WATER COURSES
- PROPOSED LOCAL ROADS/TRACKS DIVERSIONS
- EXISTING LOCAL ROADS/TRACKS TO BE STOPPED UP
- EXISTING ROADS TO BE RE-PROFILED/LOWERED

LEGEND – VERTICAL PROFILE

- EXISTING GROUND PROFILE
- PROPOSED ROAD PROFILE

NOTES

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CLIENT: NORFOLK COUNTY COUNCIL

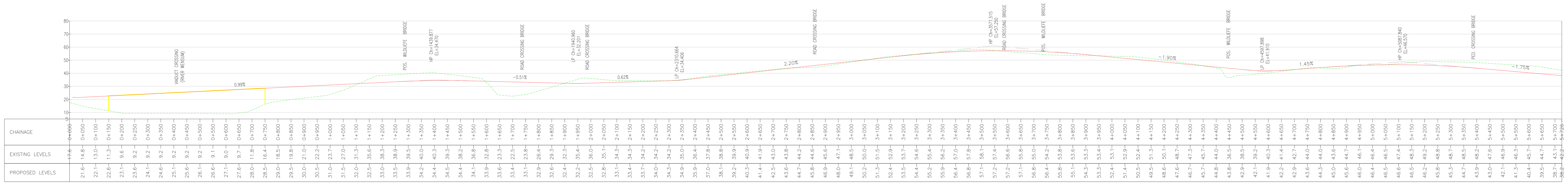
ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: PROPOSED LINK ROAD OPTION B (WEST) OVERVIEW PLAN

SCALE @ A1: 1:10000	CHECKED: JJL		APPROVED: JNL
PROJECT NO: 70041922	DESIGNED: AS	DRAWN: AS	DATE: JUNE 19

DRAWING No: 1922-WSP-00-ZZ-CE-SK-2000 REV: P02



ROUTE OPTION C
H. SCALE 1:10000
V. SCALE 1:2000

DO NOT SCALE

LEGEND – AERIAL VIEW

- PROPOSED HIGHWAY BOUNDARY (INDICATIVE LOCATION)
- PROPOSED DRAINAGE FEATURE
- PROPOSED A47 DUALLING (BY HIGHWAYS ENGLAND)
- PROPOSED STRUCTURE (INDICATIVE LOCATION)
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- EXISTING LOCAL ROADS/TRACKS TO BE STOPPED UP
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LEGEND – VERTICAL PROFILE

- EXISTING GROUND PROFILE
- PROPOSED ROAD PROFILE

NOTES

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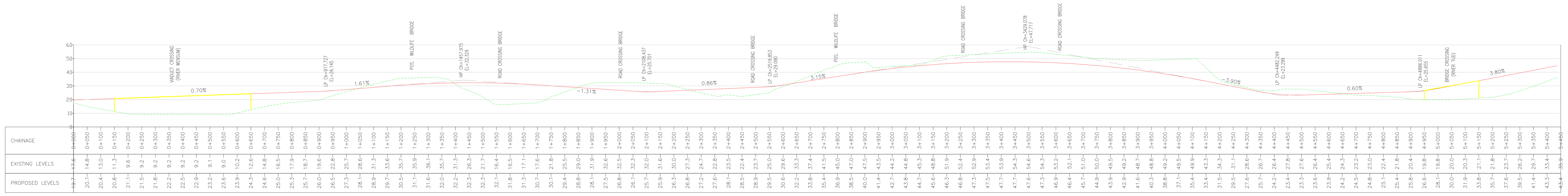
SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
PROPOSED LINK ROAD OPTION C
OVERVIEW PLAN

SCALE @ A1: 1:10000	CHECKED: JJL		APPROVED: JNL
PROJECT NO: 70041922	DESIGNED: AS	DRAWN: AS	DATE: JUNE 19

DRAWING No:	REV:
1922-WSP-00-ZZ-CE-SK-3000	P02



ROUTE OPTION D (WEST)
H. SCALE 1:10000
V. SCALE 1:2000

DO NOT SCALE

LEGEND – AERIAL VIEW

- PROPOSED HIGHWAY BOUNDARY (INDICATIVE LOCATION)
- PROPOSED DRAINAGE FEATURE
- PROPOSED A47 DUALLING (BY HIGHWAYS ENGLAND)
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LEGEND – VERTICAL PROFILE

- EXISTING GROUND PROFILE
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NORFOLK COUNTY COUNCIL

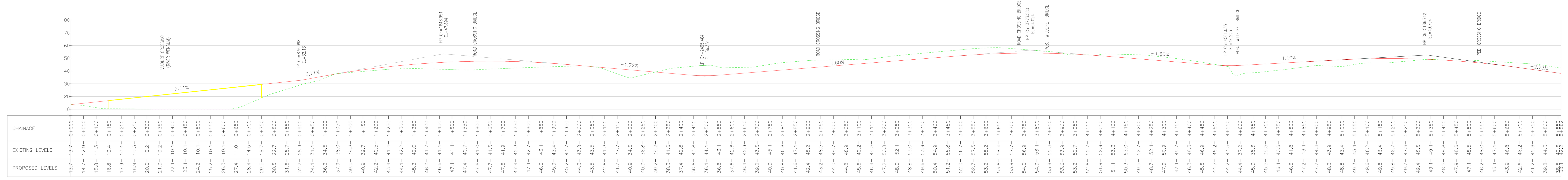
ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
PROPOSED LINK ROAD OPTION D (WEST)
OVERVIEW PLAN

SCALE @ A1:	CHECKED:		APPROVED:
1:10000	JJL		JNL
PROJECT NO: 70041922	DESIGNED: AS	DRAWN: AS	DATE: JUNE 19

DRAWING No: 1922-WSP-00-ZZ-CE-SK-4000
REV: P02



ROUTE OPTION B EAST
H. SCALE 1:10000
V. SCALE 1:2000

DO NOT SCALE

LEGEND – AERIAL VIEW

- PROPOSED HIGHWAY BOUNDARY (INDICATIVE LOCATION)
- PROPOSED DRAINAGE FEATURE
- PROPOSED A47 DUALLING (BY HIGHWAYS ENGLAND)
- PROPOSED STRUCTURE (INDICATIVE LOCATION)
- PROPOSED ROAD SURFACE
- PROPOSED RESERVOIR (BY WENSUM VALLEY GOLF CLUB)
- EXISTING FOOTPATHS/BRIDLEWAYS/BYWAYS
- EXISTING DITCHES/WATER COURSES
- PROPOSED LOCAL ROADS/TRACKS DIVERSIONS
- EXISTING LOCAL ROADS/TRACKS TO BE STOPPED UP
- EXISTING ROADS TO BE RE-PROFILED/LOWERED

LEGEND – VERTICAL PROFILE

- EXISTING GROUND PROFILE
- PROPOSED ROAD PROFILE

NOTES

1. THE LOCATION OF EXISTING FEATURES HAVE BEEN INTERPRETED FROM AVAILABLE ORDNANCE SURVEY AND AERIAL SURVEY MAPPING OVER THE SITE EXTENTS AND FURTHER DETAILED SURVEYS WILL BE REQUIRED TO CONFIRM ALL FEATURES.
2. THIS DRAWING IS NOT TO BE USED AS A REFERENCE FOR SETTING OUT OR CONSTRUCTION. IT IS A COMPOSITE DRAWING SHOWING THE SPATIAL RELATIONSHIP BETWEEN THE PROPOSED AND EXISTING FEATURES.
3. THE LOCATIONS AND SIZING OF ALL PROPOSED FEATURES AND STRUCTURES ARE INDICATIVE, AND ARE TO BE CONFIRMED FOLLOWING DETAILED SITE SURVEYS AND INVESTIGATIONS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AND REPORTS ON THIS HIGHWAY SCHEME PROPOSAL.
5. THE NORWICH WESTERN LINK (NWL) STRATEGY ASSUMES THAT SOME EXISTING LOCAL ROADS AND TRACKS CAN BE DIVERTED OR STOPPED UP, TO MINIMISE THE NUMBER OF LINKS TO THE NWL IN CASE OF A SINGLE CARRIAGEWAY, OR THE NUMBER OF CROSSINGS IN THE CASE OF A NWL DUAL CARRIAGEWAY.
6. THE PROPOSED NWL HIGHWAY BOUNDARY IS AN INDICATIVE OUTLINE OF THE PROPOSED NORFOLK COUNTY COUNCIL HIGHWAY CORRIDOR EXTENTS, BUT WILL NEED TO BE REVIEWED FOLLOWING REFERENCING OF EXISTING LAND BOUNDARIES; AND FURTHER DEVELOPMENT OF THE HIGHWAY DESIGNS INCLUDING REQUIREMENTS FOR LOCAL CARRIAGEWAY WIDENING, EARTHWORKS EMBANKMENT HEIGHT AND EXTENTS, COMPENSATION DRAINAGE FEATURES, AND TEMPORARY CONTRACTOR ACCOMMODATION WORKS.
7. THE PROPOSED CARRIAGEWAY HORIZONTAL ALIGNMENT IS SUBJECT TO CONFIRMATION OF EXACT LATERAL CLEARANCES, BUFFER ZONES, AND MITIGATION FROM EXISTING SITE FEATURES INCLUDING HERITAGE GRADE LISTED BUILDINGS, AND ENVIRONMENTALLY SENSITIVE SITES.
8. THE EXISTING GROUND AND PROPOSED ROAD SURFACES ARE PRELIMINARY, BASED ON UK GOVERNMENTS FREE OPEN SOURCE DATA LIDAR DIGITAL TERRAIN MAPPING DATA. ALL THE LEVELS AND POSITIONS ARE TO BE REVIEWED AND ADJUSTED FOLLOWING COMPLETION OF A DETAILED GROUND TOPOGRAPHICAL SURVEY OF THE PREFERRED ROUTE, AND MORE DETAILED ASSESSMENT OF SIGHT DISTANCE AND VISIBILITY REQUIREMENTS MIGHT NECESSITATE SOME LAYOUT CHANGES OR DEPARTURES AND RELAXATIONS FROM DEPARTMENT FOR TRANSPORT (DFT) HIGHWAY STANDARDS.
9. FOLLOWING ESTABLISHMENT OF THE MORE ACCURATE POSITIONS OF EXISTING BURIED AND OVERHEAD UTILITY PLANT, THE ROUTE GEOMETRY MAY NEED TO BE REVISED AS PART OF MITIGATION MEASURES TO MINIMISE NRWSA UTILITY DIVERSIONS.
10. THOUGH DISCUSSIONS ARE ONGOING BETWEEN NORFOLK COUNTY COUNCIL AND HIGHWAYS ENGLAND, THE A47 HIGHWAY IMPROVEMENT DETAILS, AND ALIGNMENT OF THE PROPOSED DUAL CARRIAGEWAY ARE YET TO BE CONFIRMED BY HIGHWAYS ENGLAND; AND AN APPROPRIATE GRADE SEPARATED JUNCTION TO CONNECT THE NORWICH WESTERN LINK WITH THE A47 IS YET TO BE DETERMINED.
11. THE PROPOSED HIGHWAY LINK DESIGN DOES NOT TAKE INTO ACCOUNT ANY COMPLEMENTARY NON-ROAD MEASURES TO BE IMPLEMENTED AS PART OF THE WIDER SCHEME SUCH AS NEW PEDESTRIAN ROUTES, OR ANY PROPOSED TRAFFIC CONTROL ON EXISTING LOCAL ROADS, AS THESE ARE STILL BEING ASSESSED AND AGREED.
12. THE PRELIMINARY BASIN LOCATIONS HAVE BEEN IDENTIFIED FOLLOWING OUTLINE FLOOD AND DRAINAGE ASSESSMENT OF SURFACE WATER RUNOFF FROM AN IMPERMEABLE HIGHWAY PAVEMENT SURFACE, ASSUMING A CONSTANT CROSS-SECTION WIDTH, TO ALIGN WITH THE PRELIMINARY ROAD PROFILE. THE BASIN LOCATIONS MAY CHANGE WITH THE FINAL ROAD PROFILE, AND SIZES WILL VARY WHEN SURFACE AREAS ARE RE-ASSESSED BASED ON DETAILED CROSS-SECTIONS WHICH MAY INCLUDE LOCAL CARRIAGEWAY WIDENING AND ROAD SIDE FACILITIES. THE FEASIBILITY OF DRAINAGE INFILTRATION IS SUBJECT TO THE PERCOLATION TESTING AT THESE LOCATIONS, AND CONFIRMATION OF THE GROUNDWATER SENSITIVITY.
13. THE PROPOSED ROAD PROFILE DOES NOT FULLY OPTIMISE EARTHWORKS, AS THE EXISTING GROUND CONDITIONS ARE YET TO BE DETERMINED. THE GEOTECHNICAL INVESTIGATION MAY NECESSITATE A REVISION OF THE PRELIMINARY ROAD PROFILE TO TAKE INTO ACCOUNT, ANY UNSUITABLE SOILS, CONTAMINATED LAND, AND/OR A HIGH POSITION OF THE GROUND WATER LEVEL.
14. THE REQUIREMENT FOR WILDLIFE STRUCTURES ("GREEN" BRIDGES, "DARK" BRIDGES, BAT GANTRIES ETC) ARE SUBJECT TO CONFIRMATION BY AN ECOLOGIST.
15. THE LOCATION, NAMING, AND DESIGNATION OF ALL EXISTING LOCAL ROADS AND PUBLIC RIGHTS OF WAY HAVE BEEN DETERMINED FROM THE INTERACTIVE MAP OF PUBLIC RIGHTS OF WAY http://maps.norfolk.gov.uk/highways/ BUT WILL NEED TO BE CONFIRMED FROM THE NORFOLK DEFINITIVE MAP REGISTER. ALL ROAD SUFFIXED (EX) ON THE PROPOSED PROFILE VIEW ARE ROADS/TRACKS TO BE STOPPED, OR EXTINGUISHED, AND (N) REPRESENTS ROADS REALIGNED, CREATED OR DIVERTED.

REV	DATE	BY	DESCRIPTION	CHK	APP
P02	19/06/2019	AS	NOTES AMENDED	JJL	JL
P01	03/06/2019	AS	FIRST ISSUE	JJL	JNL

DRAWING STATUS: S0 - WORK IN PROGRESS

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wsp.com

CLIENT: NORFOLK COUNTY COUNCIL

ARCHITECT: -

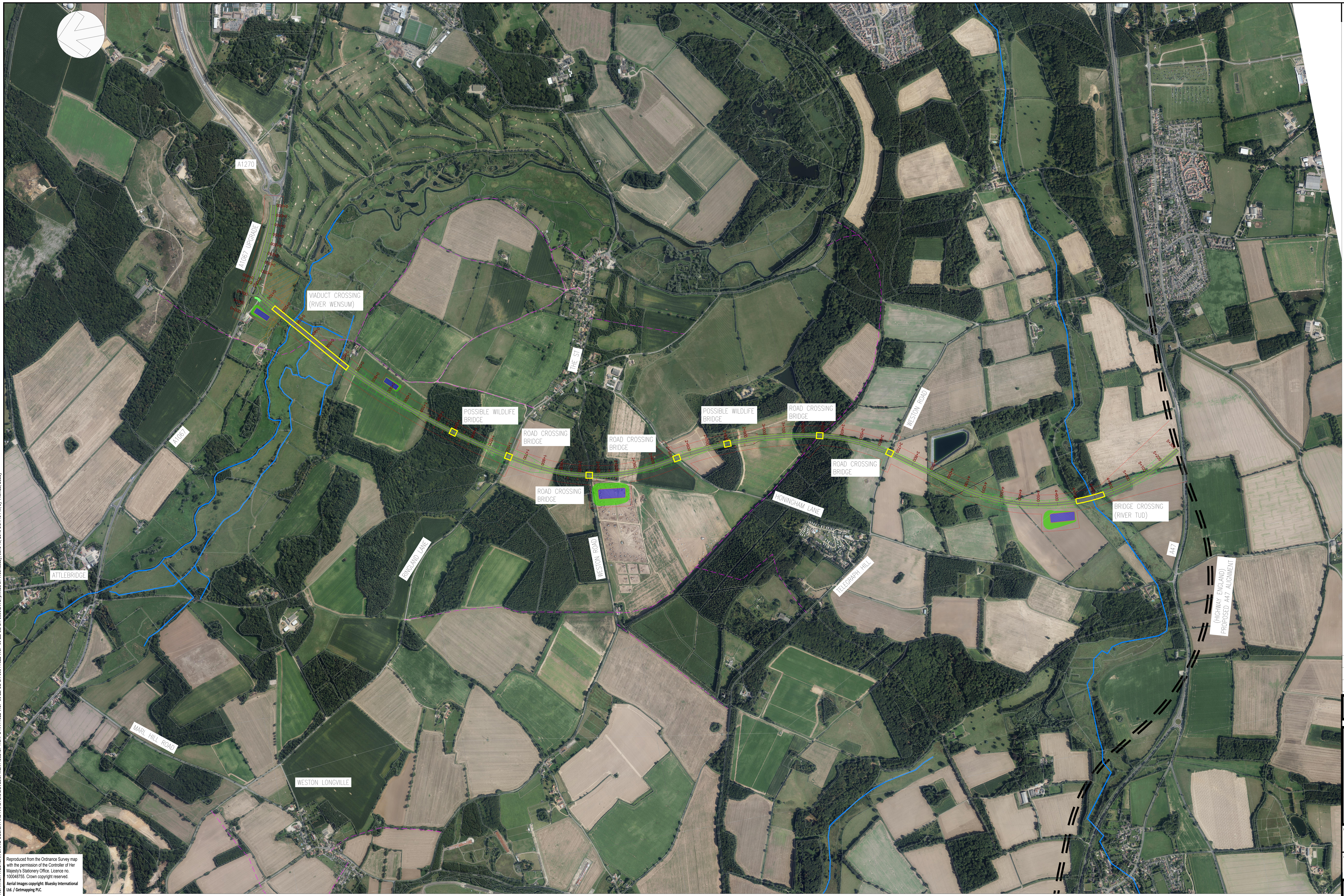
SITE/PROJECT: NORWICH WESTERN LINK

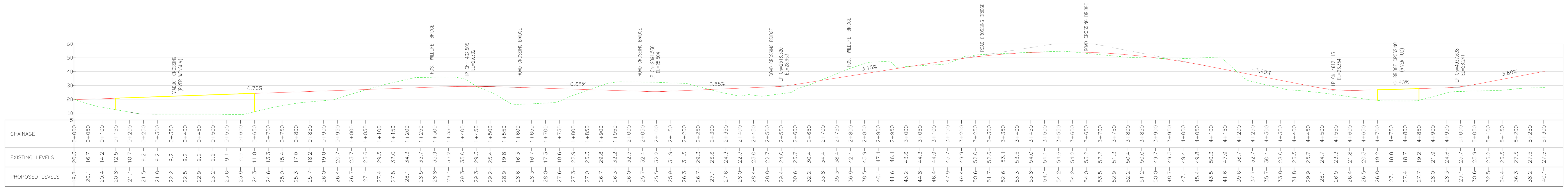
TITLE: PROPOSED LINK ROAD OPTION B (EAST) OVERVIEW PLAN

SCALE @ A1:	CHECKED:	APPROVED:
1:10000	JJL	JNL

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	AS	AS	JUNE 19

DRAWING No:	REV:
1922-WSP-00-ZZ-CE-SK-5000	P02





ROUTE OPTION D (EAST)
H. SCALE 1:10000
V. SCALE 1:2000

DO NOT SCALE

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REV	DATE	BY	DESCRIPTION	CHK	APP
P02	19/06/2019	AS	NOTES AMENDED	JJL	JL
P01	03/06/2019	AS	FIRST ISSUE	JJL	JNL

DRAWING STATUS: S0 - WORK IN PROGRESS

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SITE/PROJECT: NORWICH WESTERN LINK

TITLE: PROPOSED LINK ROAD OPTION D (EAST) OVERVIEW PLAN

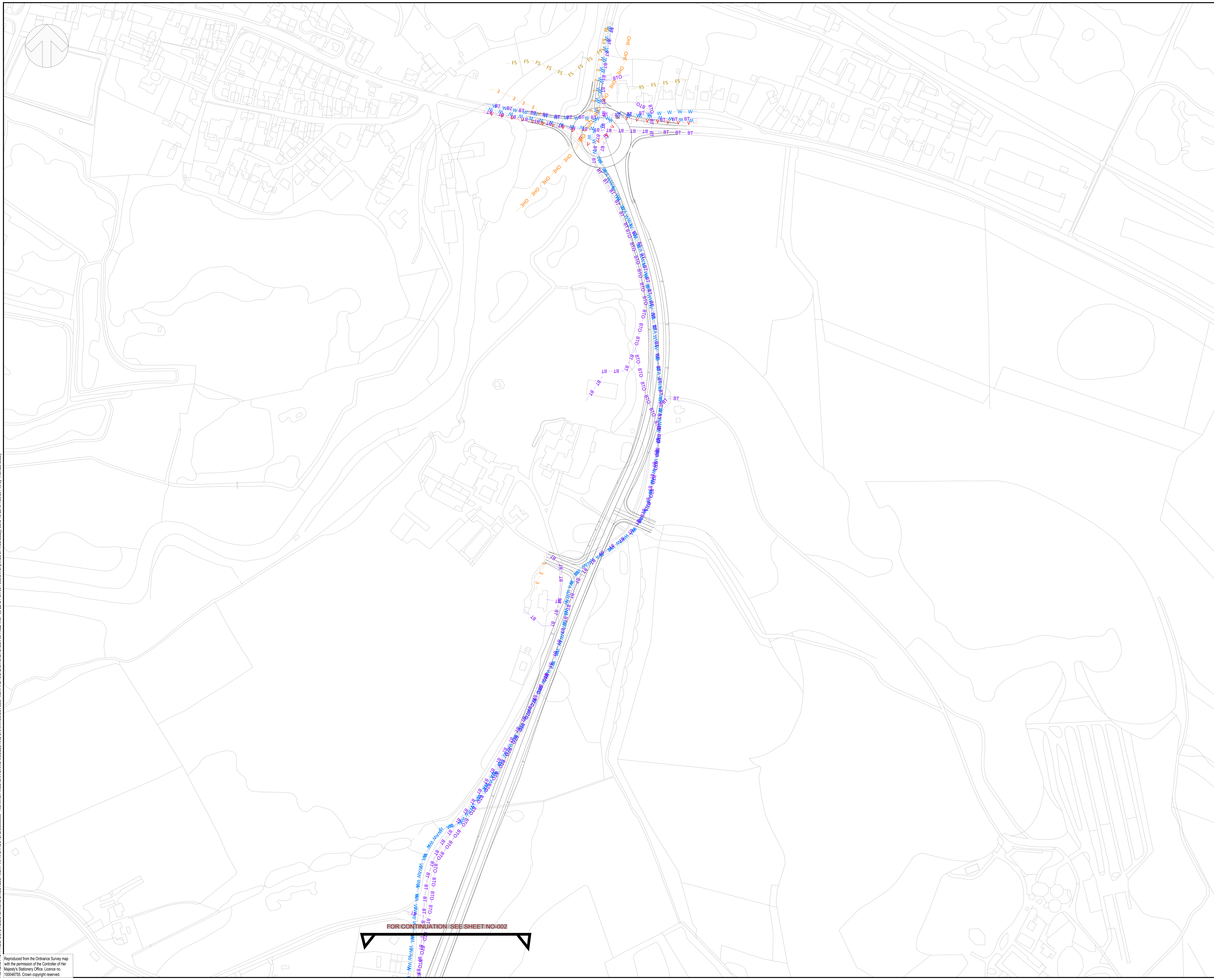
SCALE @ A1:	CHECKED:	APPROVED:
1:10000	JJL	JNL

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	AS	AS	JUNE 19

DRAWING No:	REV:
1922-WSP-00-ZZ-CE-SK-6000	P02

Appendix B

EXISTING UTILITY INFORMATION



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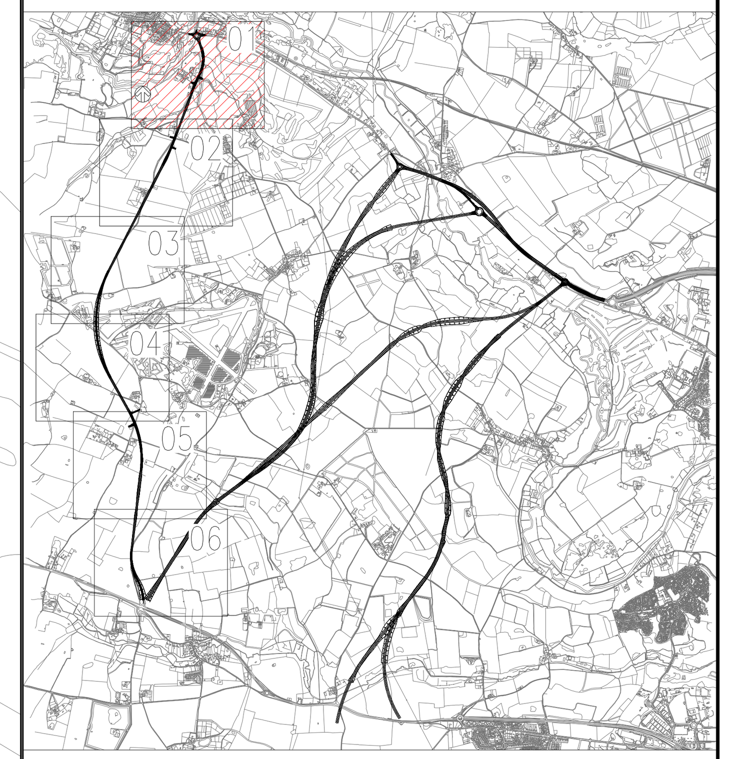
DO NOT SCALE



LOCATION PLAN
SCALE : NTS

NOTES:

1. THIS DRAWING IS BASED ON OS MAPPING HENCE THE ACCURACY OF FEATURES CANNOT BE GUARANTEED.
2. THE POSITION OF CABLES, WATER MAINS AND SERVICES, DRAINS AND SEWERS AS SHOWN ON THIS DRAWING ARE BASED ON INFORMATION EXTRACTED FROM ASSET RECORDS PROVIDED BY THE STATUTORY UNDERTAKERS THROUGH CORNERSTONE PROJECTS LTD IN FEBRUARY 2019. ALL POSITIONS MUST BE REGARDED AS APPROXIMATE ONLY.
3. SERVICES TO INDIVIDUAL PROPERTIES ARE NOT SHOWN BUT THEIR PRESENCE SHOULD BE ANTICIPATED.
4. THE APPARATUS FOR STREET LIGHTING, TRAFFIC SIGNALS, ROAD SIGNS, ILLUMINATED BOLLARDS AND SOME OVERHEAD APPARARTUS ARE NOT ALWAYS SHOWN BUT THEIR PRESENCE SHOULD BE ANTICIPATED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE APPROPRIATE STATUTORY UNDERTAKERS PRIOR TO COMMENCEMENT OF THE WORKS TO ESTABLISH THE EXACT LOCATION OF THEIR PLANT WHICH SHALL BE CONFIRMED BY HAND DUG TRIAL PITS.
6. UNDERGROUND SERVICES MUST BE LOCATED IN ACCORDANCE WITH HSE GUIDANCE NOTE HS (G) 47 AND BSI'S PAS 128:2014, AND GUIDANCE FROM THE STATUTORY UNDERTAKER.
7. OVERHEAD POWER LINES MUST BE DEALT WITH IN ACCORDANCE WITH HSE GUIDANCE NOTE GS 6 (THIRD EDITION).
8. FOR CLARITY EXISTING UTILITY PLANT IS NOT NECESSARILY PRESENTED IN THE SAME COLOURS USED BY EACH UTILITY STATUTORY UNDERTAKER IN ITS ORIGINAL RECORDS FORMAT.
9. FOR DETAILS OF SIZE, NUMBER OF DUCTS, PRESSURE, VOLTAGE, MATERIAL AND SECTIONAL DATA ALWAYS REFER TO ORIGINAL UTILITY RECORDS.
10. THE INFORMATION ON THIS DRAWING IS GIVEN WITHOUT OBLIGATION OR WARRANTY, AND ITS ACCURACY IS LIMITED BY THE ADVISED VALIDITY PERIOD FOR EACH STATUTORY UTILITY UNDERTAKER RECORDS, TYPICALLY 3 MONTHS FROM DATE OF ISSUE.

LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS: S0 - WORK IN PROGRESS

wsp

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wsp.com

CLIENT: NORFOLK COUNTY COUNCIL

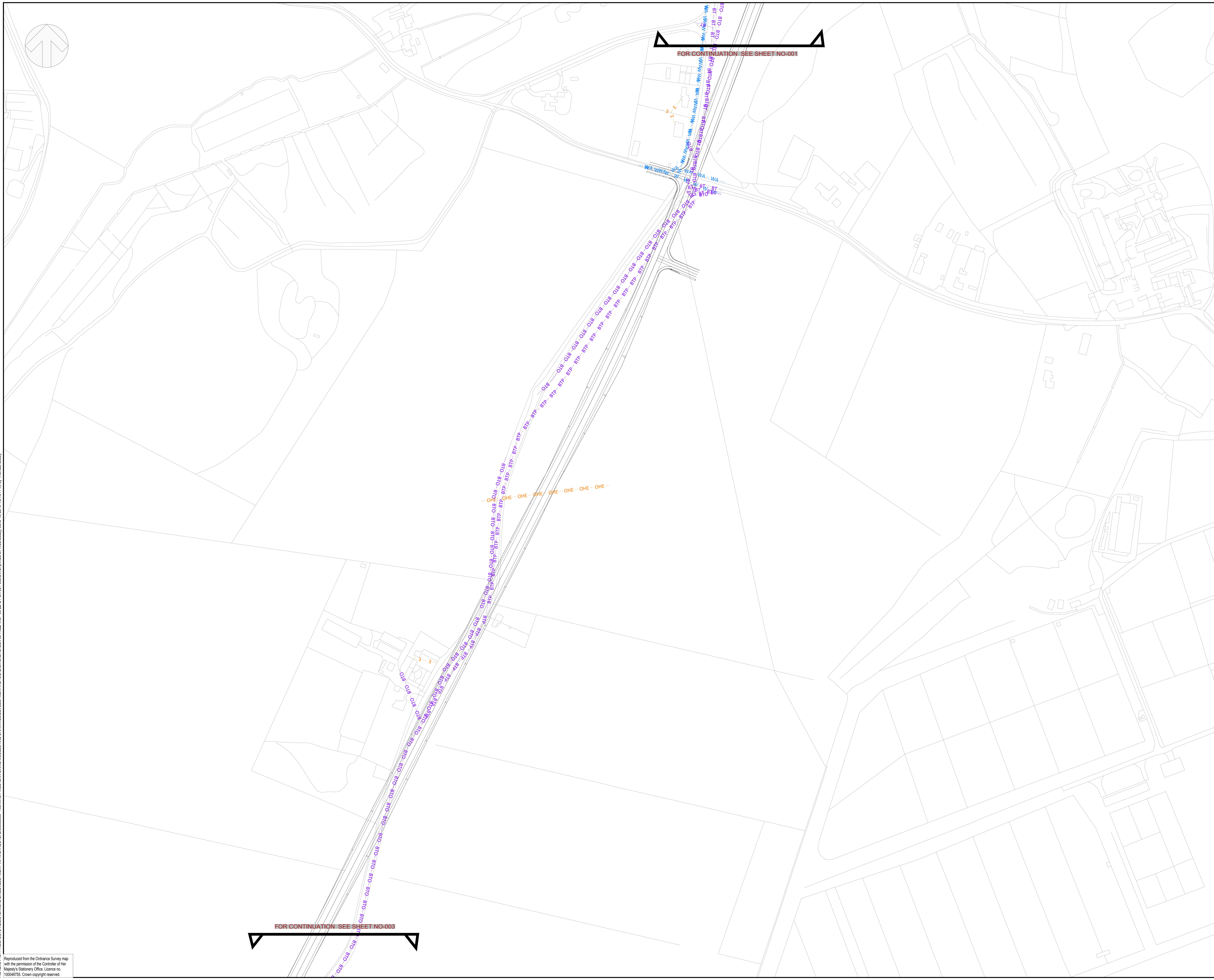
ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION A) SHEET 1 OF 6

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-001 | REV: P01



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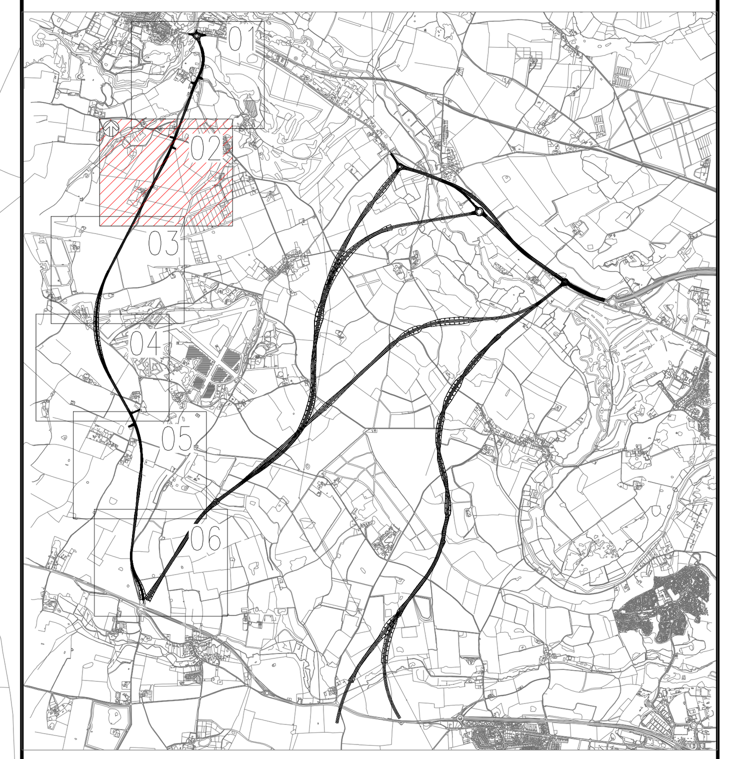
DO NOT SCALE



LOCATION PLAN
SCALE : NTS

NOTES:

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6. UNDERGROUND SERVICES MUST BE LOCATED IN ACCORDANCE WITH HSE GUIDANCE NOTE HS (G) 47 AND BSI'S PAS 128:2014, AND GUIDANCE FROM THE STATUTORY UNDERTAKER.
7. OVERHEAD POWER LINES MUST BE DEALT WITH IN ACCORDANCE WITH HSE GUIDANCE NOTE GS 6 (THIRD EDITION).
8. FOR CLARITY EXISTING UTILITY PLANT IS NOT NECESSARILY PRESENTED IN THE SAME COLOURS USED BY EACH UTILITY STATUTORY UNDERTAKER IN ITS ORIGINAL RECORDS FORMAT.
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LEGEND

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WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS:
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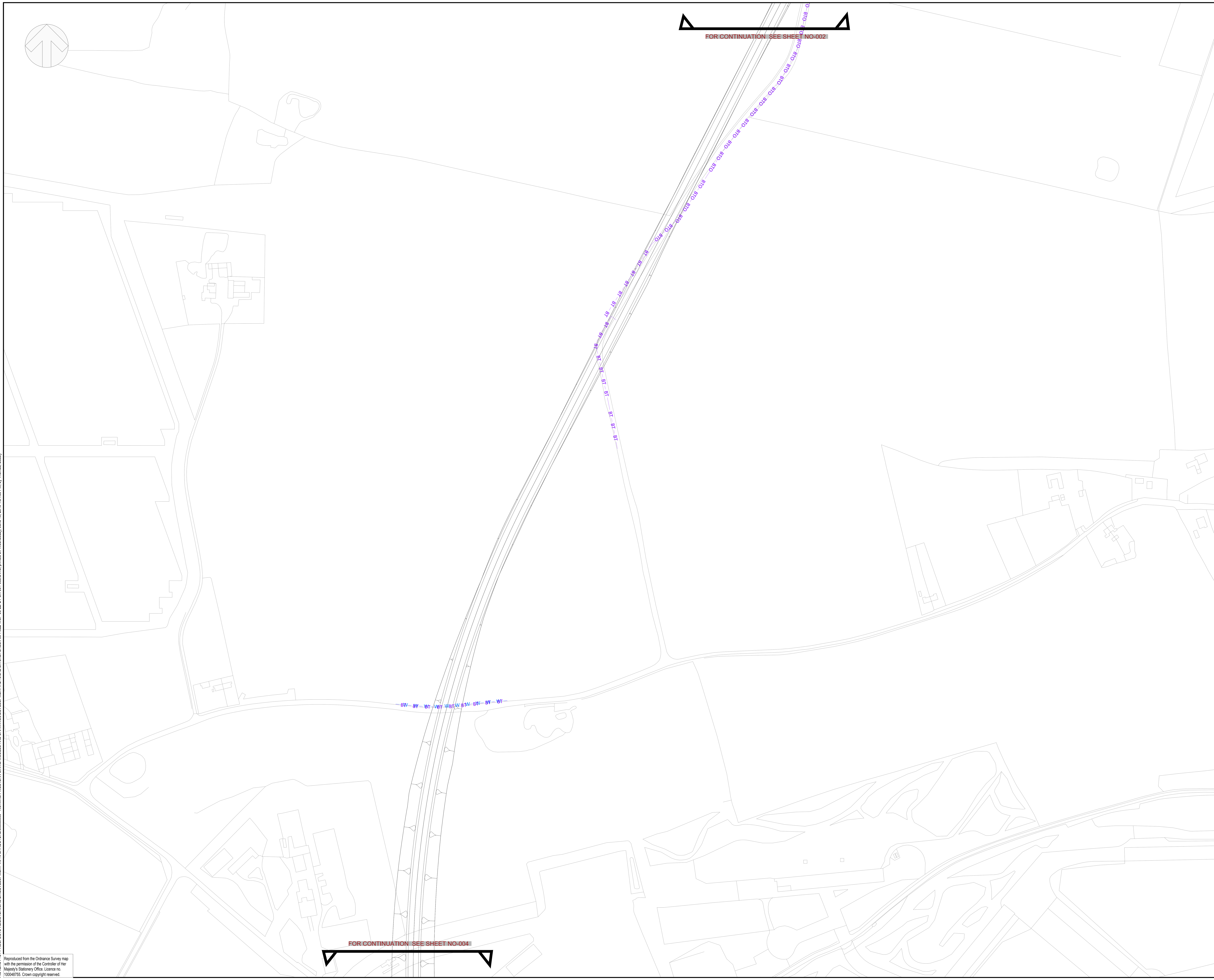
SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION A)
SHEET 2 OF 6

SCALE @ A1: 1:2000	CHECKED: AS	APPROVED: AP
PROJECT NO: 70041922	DESIGNED: - / DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-002
REV: P01



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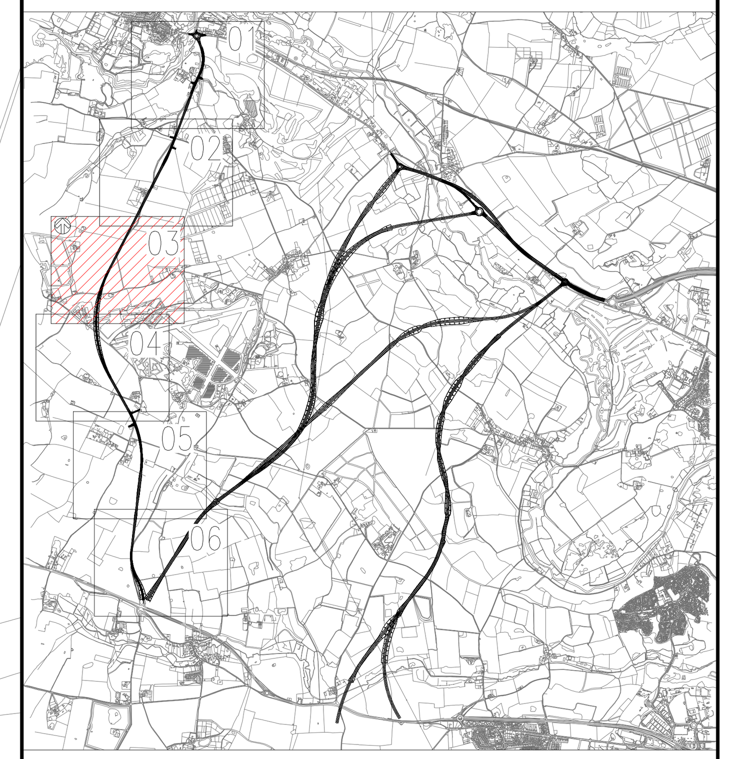

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SCALE : NTS

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W — W — W — W
WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
BT PLANNED	BTP — BTP — BTP
ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS:
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wsp.com

CLIENT:
NORFOLK COUNTY COUNCIL

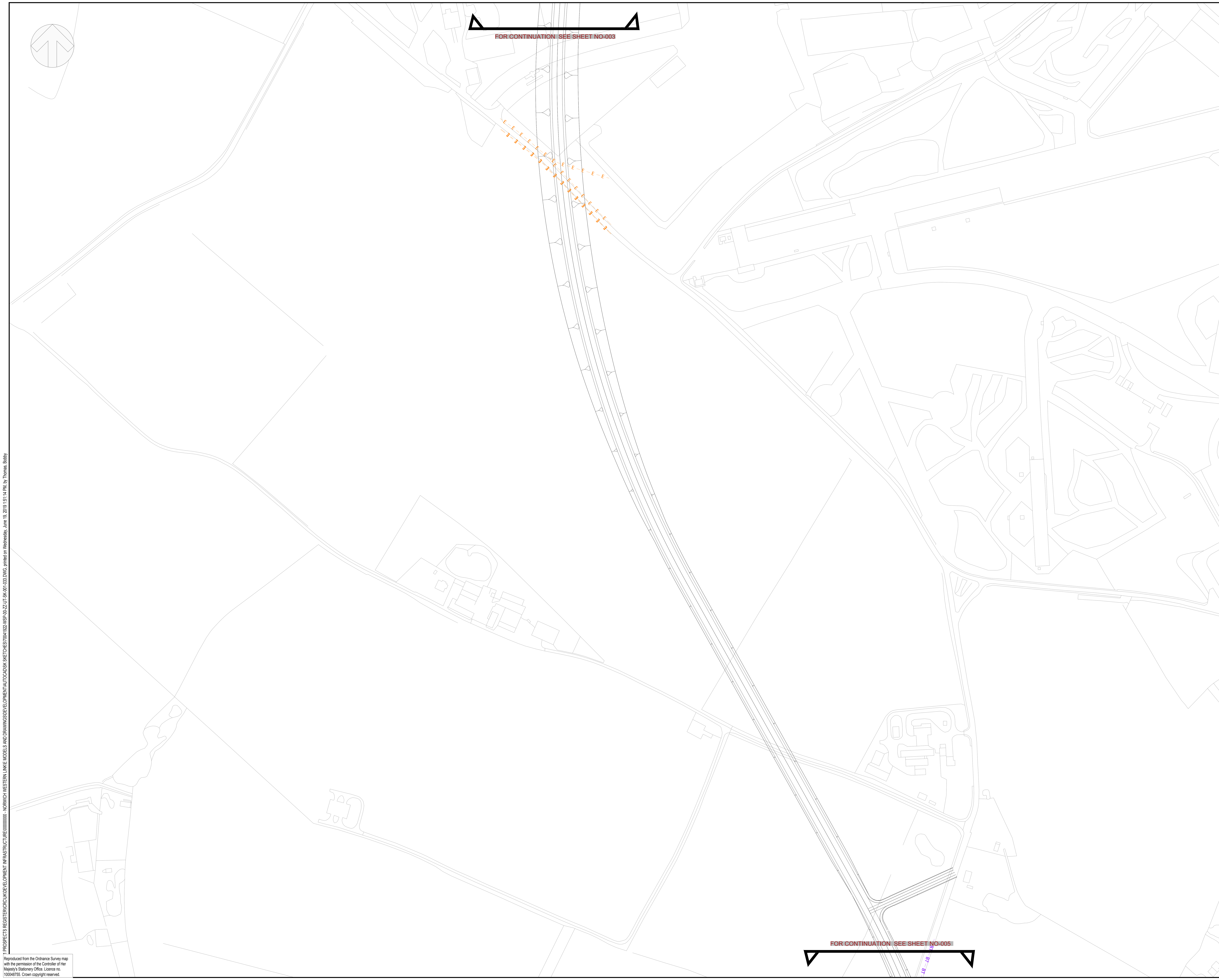
ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION A)
SHEET 3 OF 6

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19

DRAWING No:	REV:
1922-WSP-00-ZZ-UT-SK-003	P01



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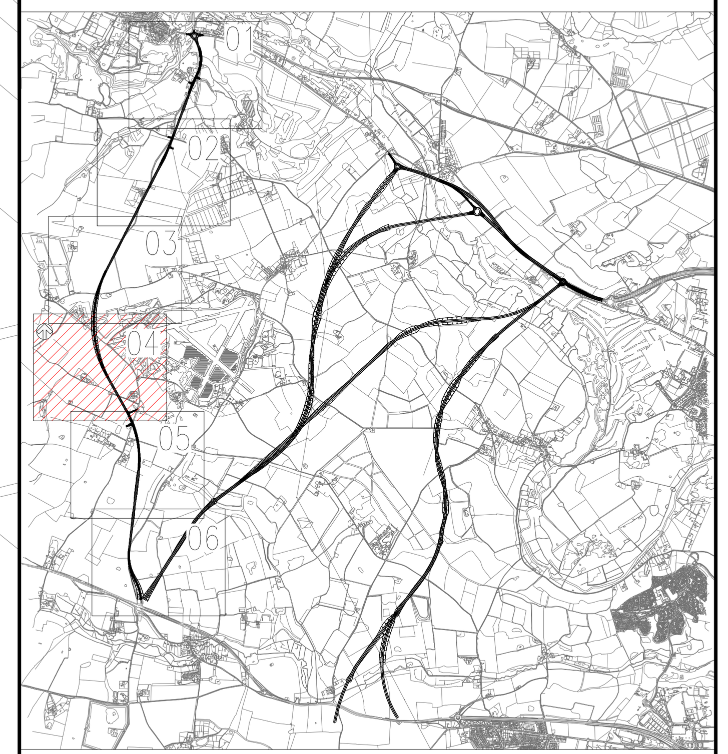

LOCATION PLAN
SCALE : NTS

NOTES:

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS:
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CLIENT:
NORFOLK COUNTY COUNCIL

ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION A)
SHEET 4 OF 6

SCALE @ A1: 1:2000	CHECKED: AS	APPROVED: AP
PROJECT NO: 70041922	DESIGNED: - / DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-004
REV: P01

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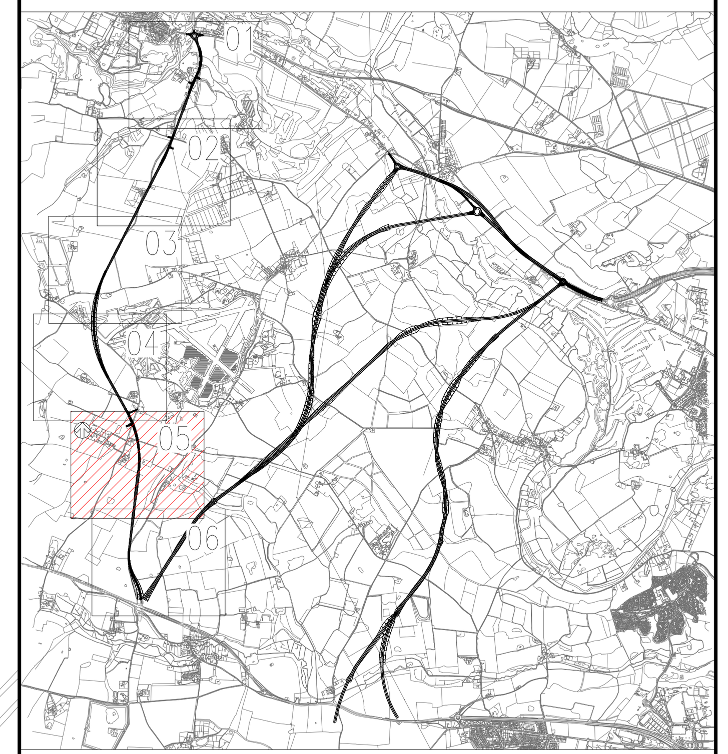

LOCATION PLAN
SCALE : NTS

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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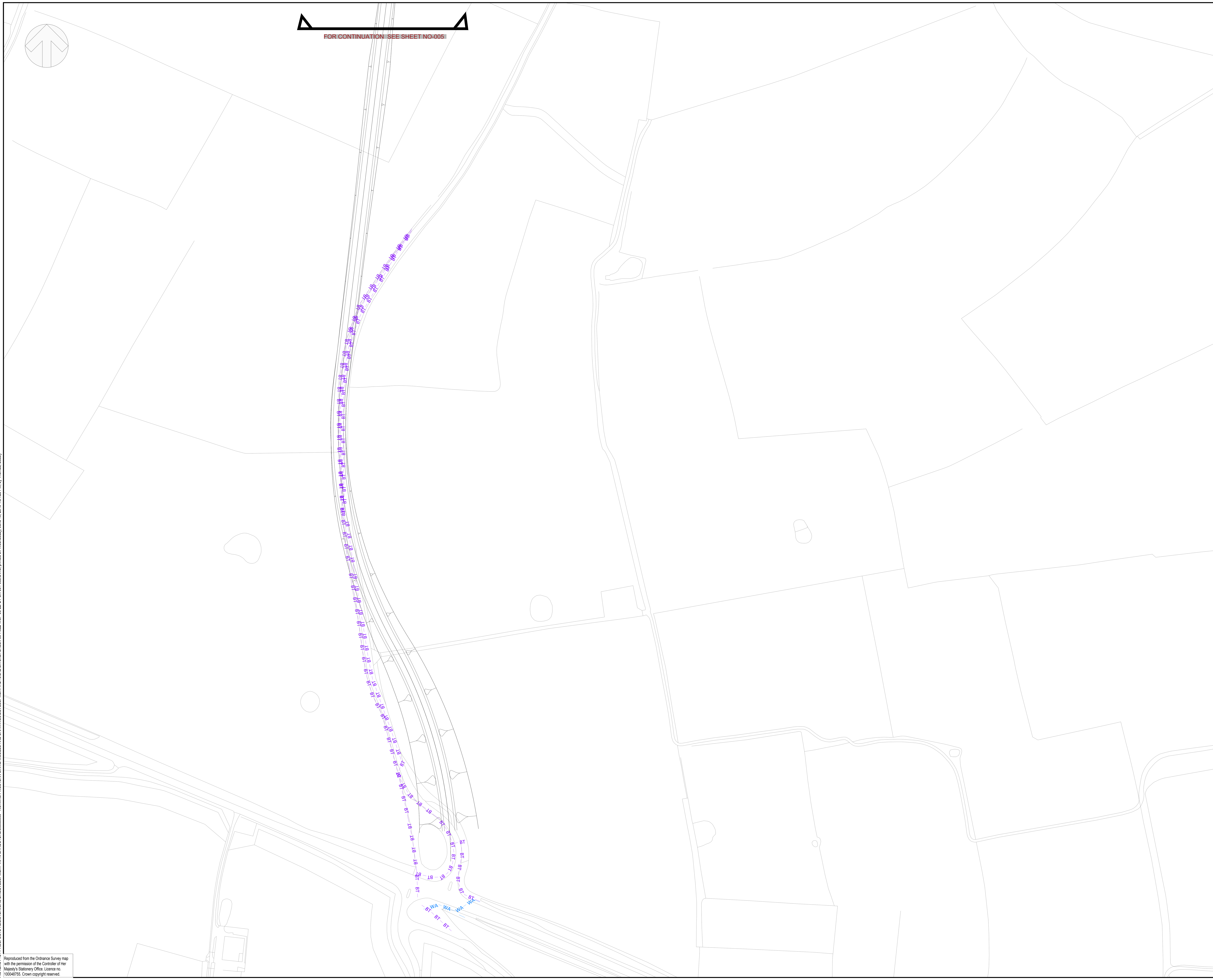
ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION A)
SHEET 5 OF 6

SCALE @ A1: 1:2000	CHECKED: AS	APPROVED: AP
PROJECT NO: 70041922	DESIGNED: - / DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-005 | REV: P01



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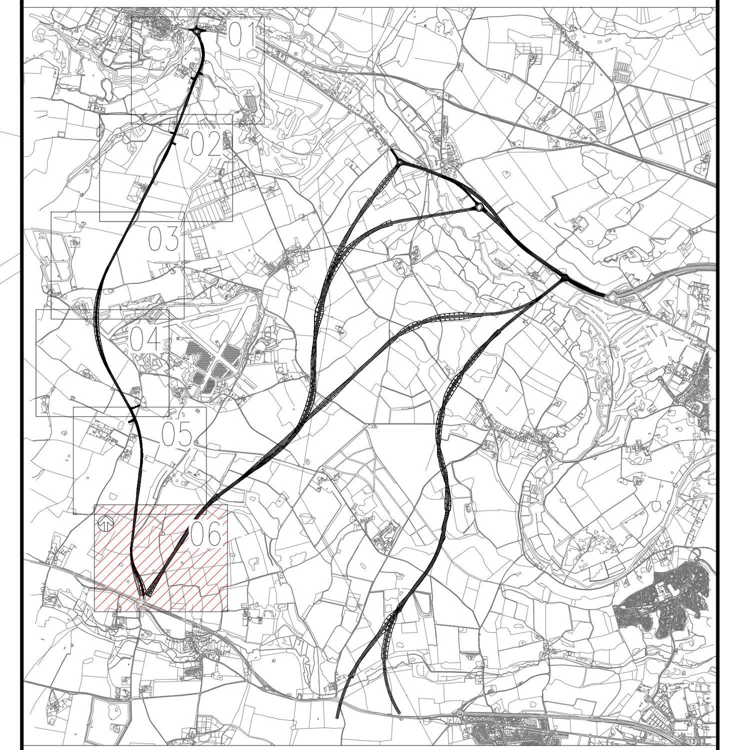

LOCATION PLAN
SCALE : NTS

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS:
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wsp.com

CLIENT:
NORFOLK COUNTY COUNCIL

ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION A)
SHEET 6 OF 6

SCALE @ A1:	CHECKED:	APPROVED:	
1:2000	AS	AP	
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-006
REV: P01

File name P:\01 PROSPECTS REGISTER\CRCUK\DEVELOPMENT INFRASTRUCTURE\00000000 - NORWICH WESTERN LINK\E MODELS AND DRAWINGS\DEVELOPMENT\AUTOCAD\SK SKETCHES\70041922-WSP-00-ZZ-UT-SK-001-033.DWG, printed on Wednesday, June 19, 2019 1:51:23 PM, by Thomas, Bobby

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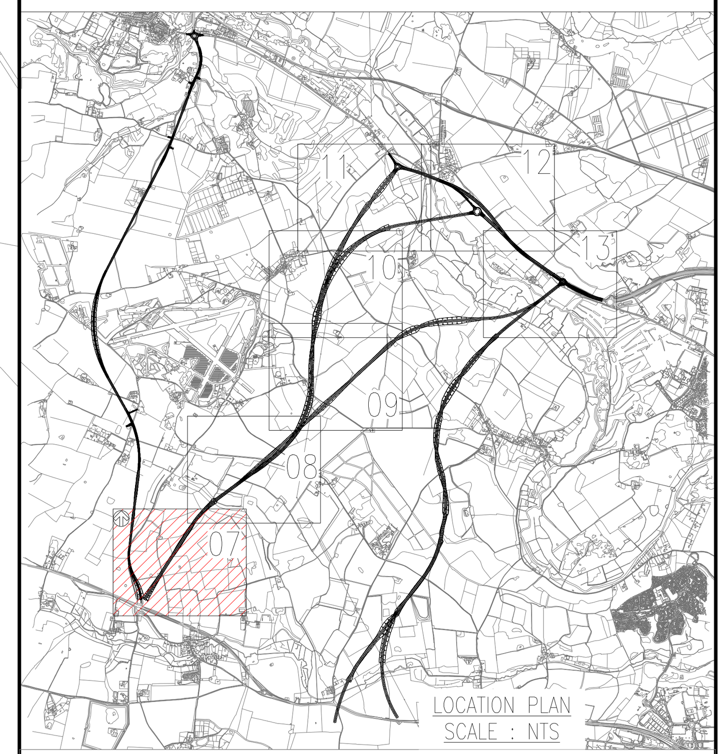

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS: S0 - WORK IN PROGRESS

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wsp.com

CLIENT: NORFOLK COUNTY COUNCIL

ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION B WEST) SHEET 1 OF 7

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-007 | REV: P01

FOR CONTINUATION SEE SHEET NO-009

FOR CONTINUATION SEE SHEET NO-007

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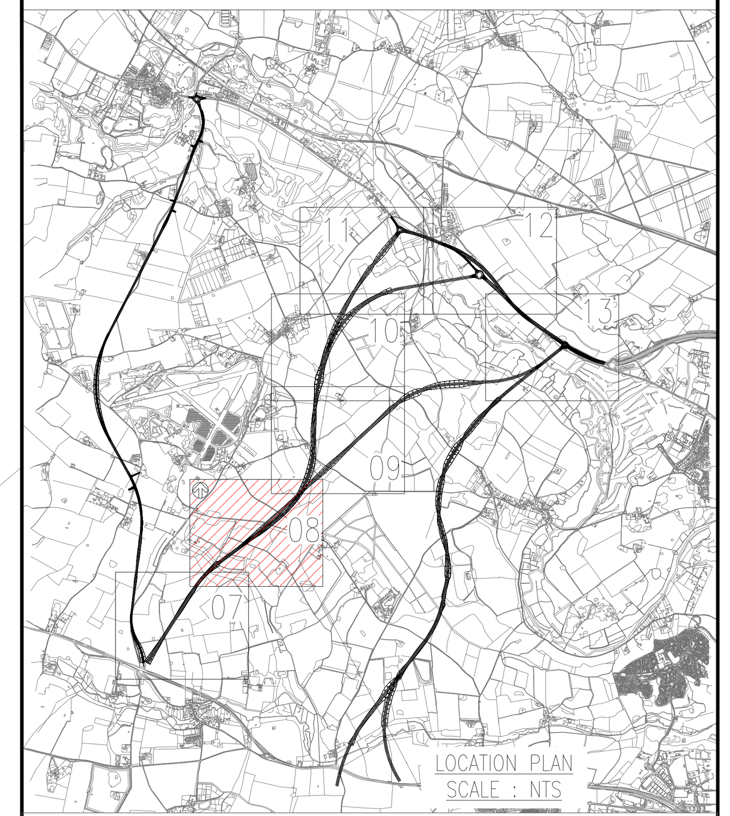

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LEGEND

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WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
BT PLANNED	BTP — BTP — BTP
ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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CLIENT:
NORFOLK COUNTY COUNCIL

ARCHITECT:
-

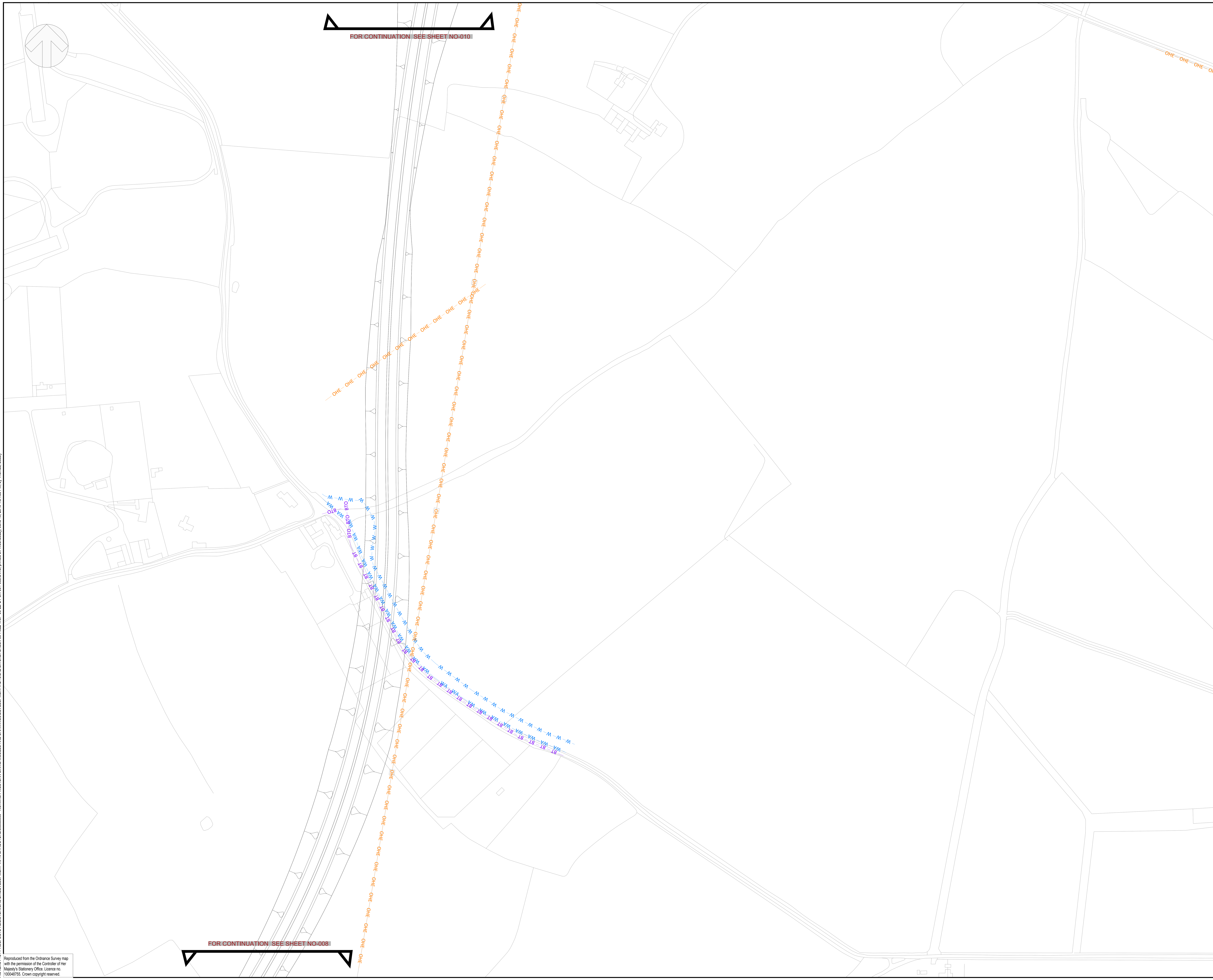
SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION B WEST)
SHEET 2 OF 7

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-008 REV: P01

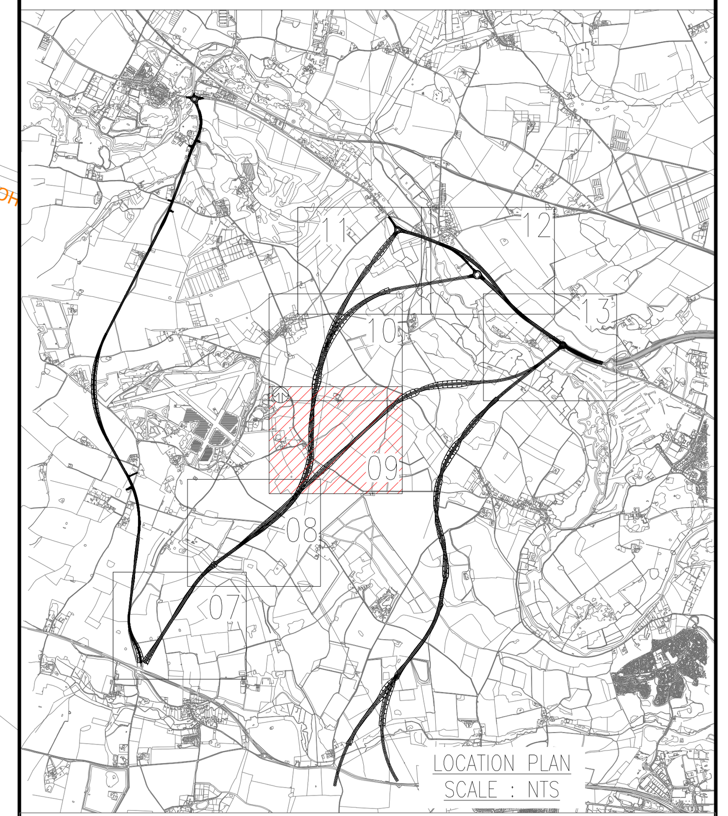
FOR CONTINUATION SEE SHEET NO-010



FOR CONTINUATION SEE SHEET NO-008

File name P:\01 PROSPECTS REGISTER\CRC\UK\DEVELOPMENT INFRASTRUCTURE\00000000 - NORWICH WESTERN LINK\E MODELS AND DRAWINGS\DEVELOPMENT\AUTOCAD\SK SKETCHES\70041922-WSP-00-ZZ-UT-SK-001-033.DWG, printed on Wednesday, June 19, 2019 1:51:38 PM, by Thomas, Bobby

DO NOT SCALE



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ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P02	19/06/2019	BT	LABELS UPDATED	-	-
P01	11/03/2019	BT	FIRST ISSUE	-	-

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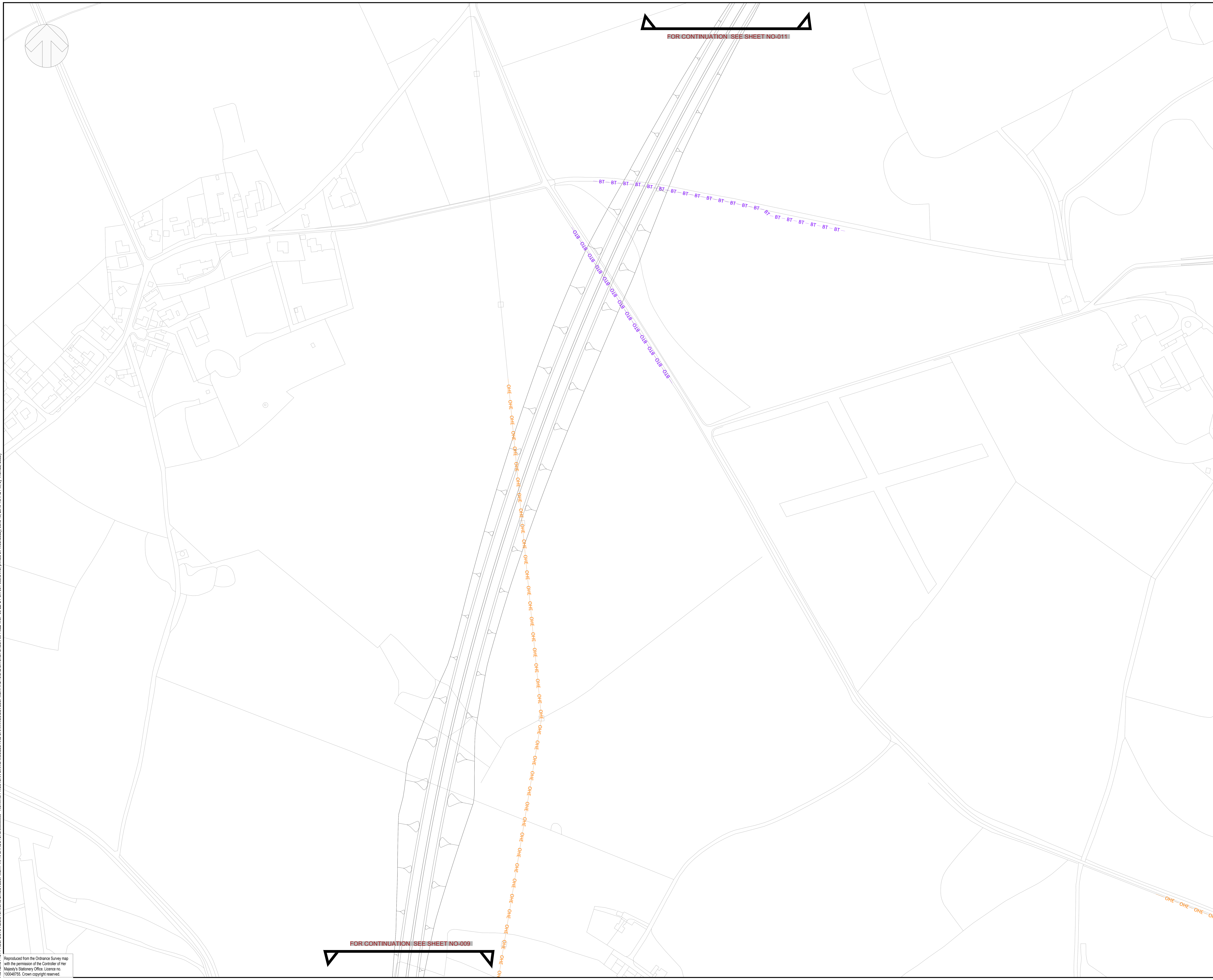
SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION B WEST)
SHEET 3 OF 7

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19

DRAWING No:
1922-WSP-00-ZZ-UT-SK-009

REV:
P02



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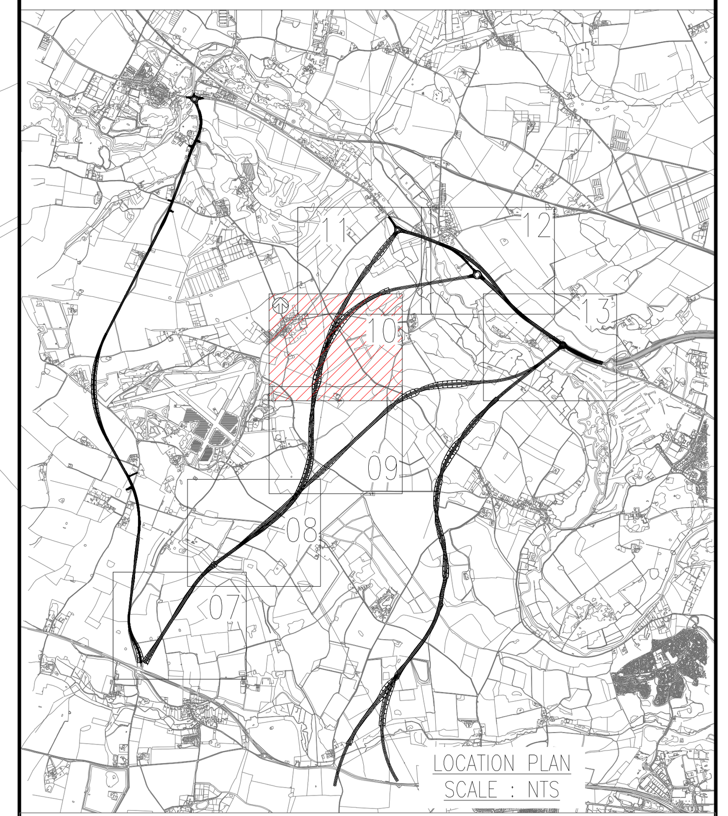

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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CLIENT: NORFOLK COUNTY COUNCIL

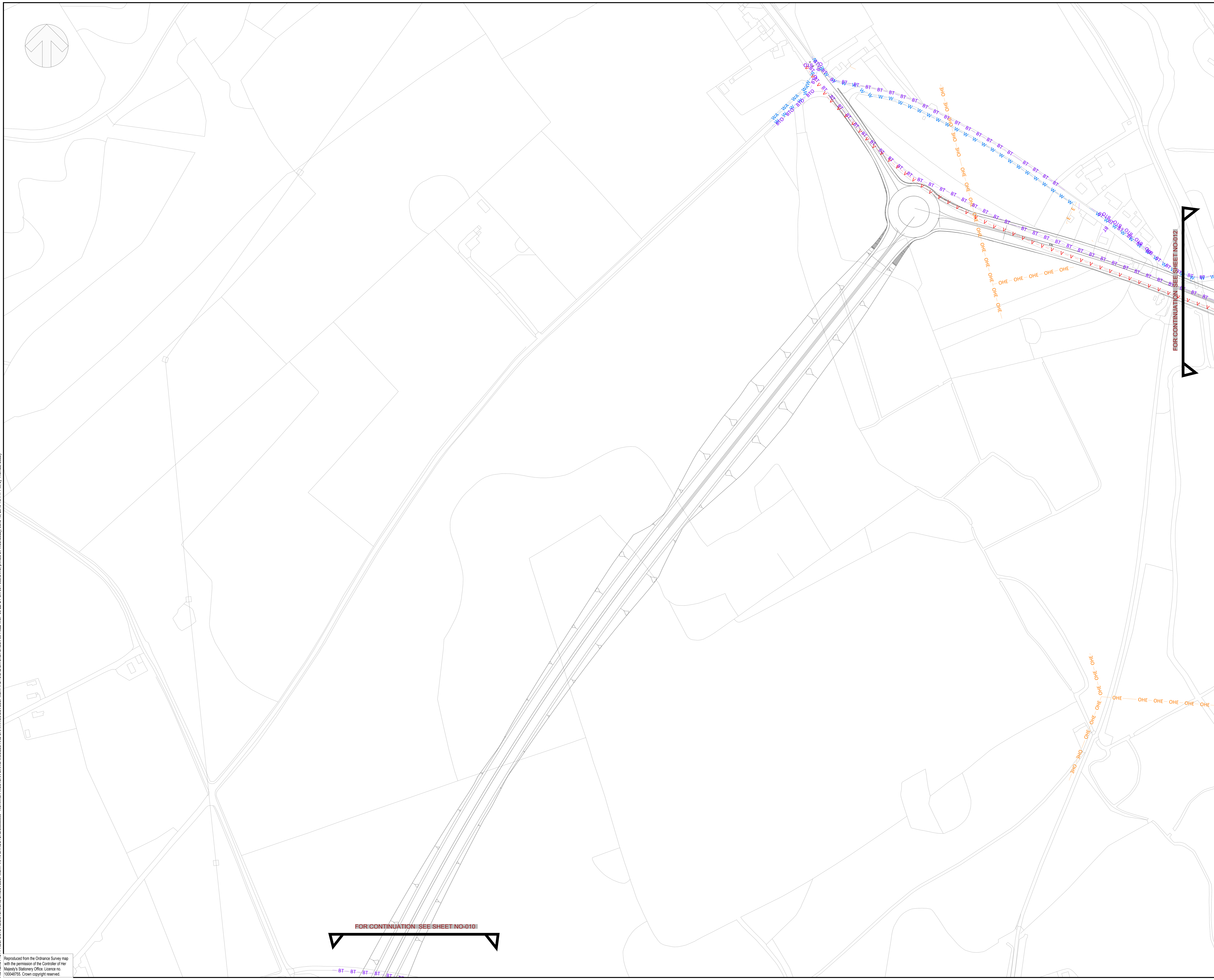
ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION B WEST) SHEET 4 OF 7

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-010 | REV: P01



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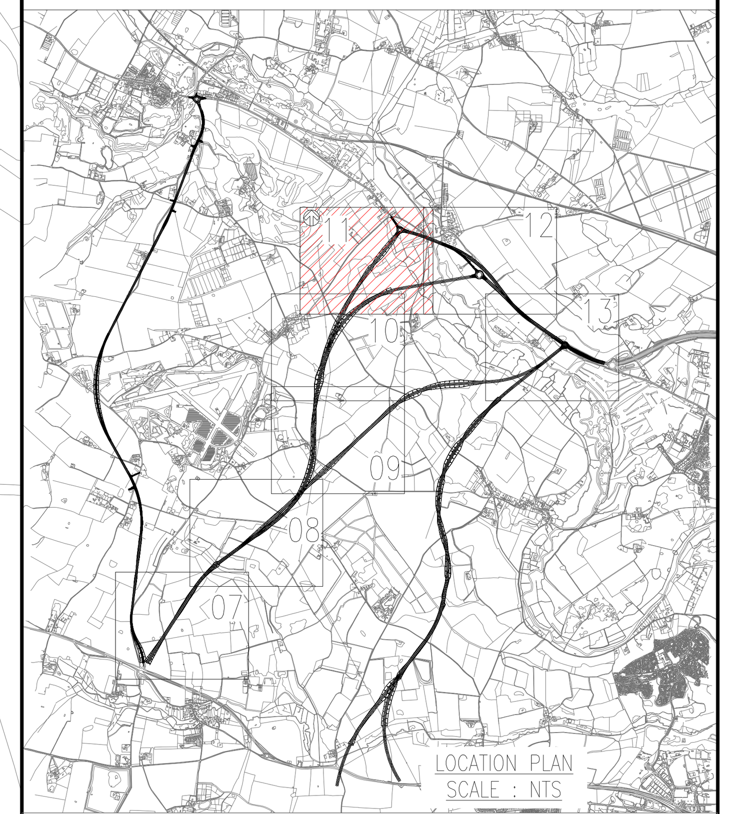

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	▬ ▬
WATER	W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION B WEST) SHEET 5 OF 7

SCALE @ A1: 1:2000	CHECKED: AS	APPROVED: AP
PROJECT NO: 70041922	DESIGNED: - / DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-011 | REV: P01

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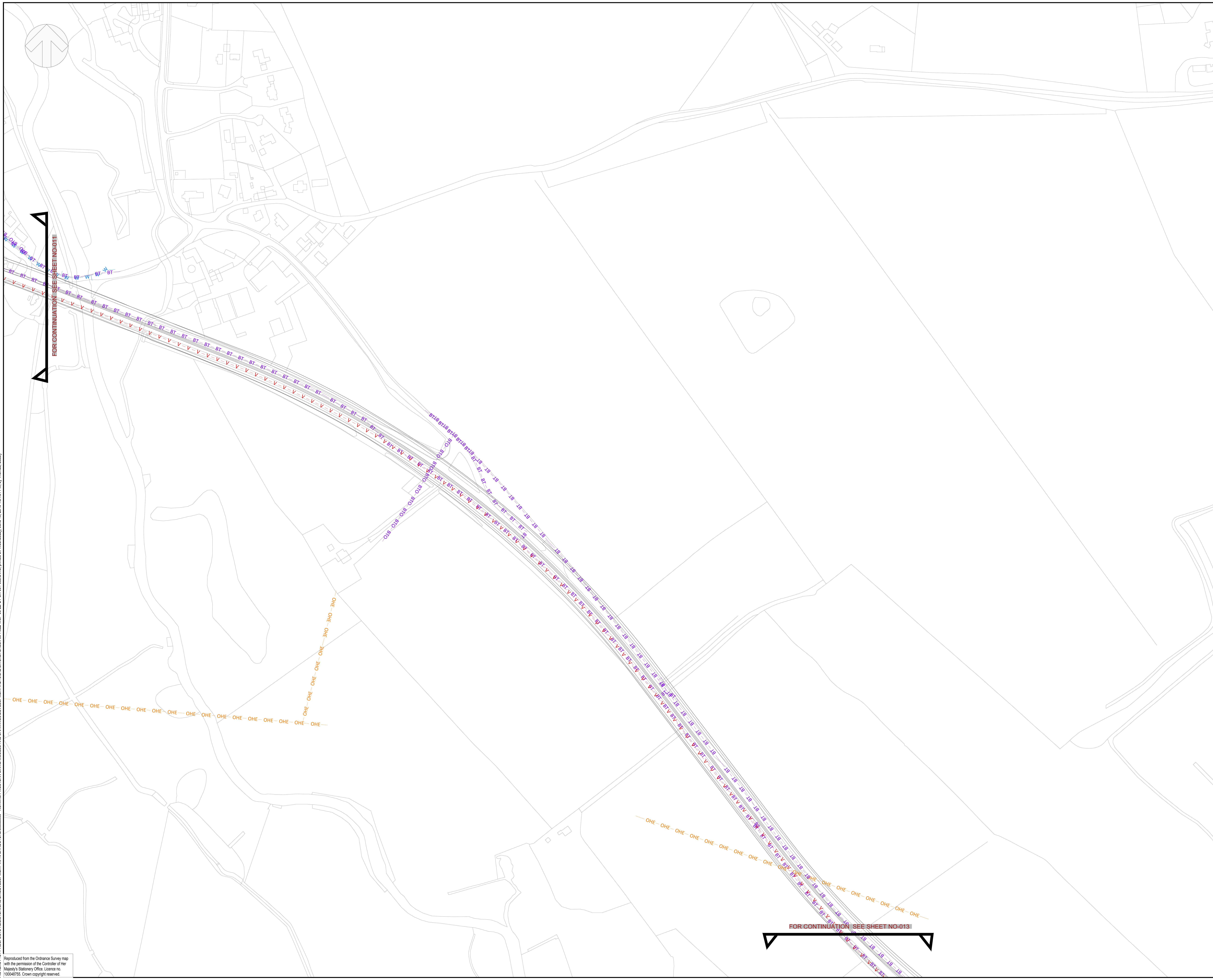

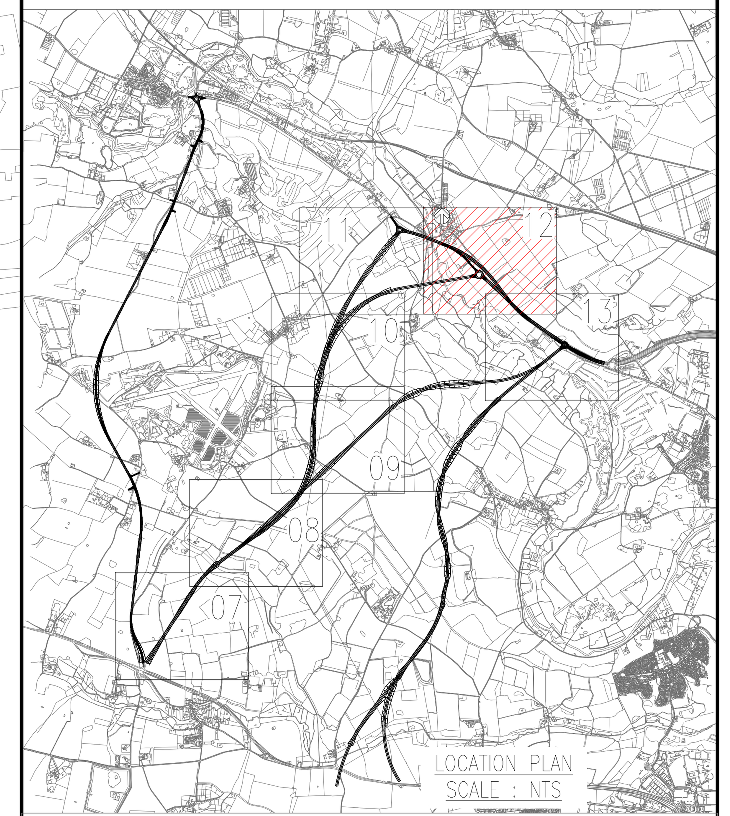

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W — W — W — W
WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
BT PLANNED	BTP — BTP — BTP
ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

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TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION B WEST)
SHEET 6 OF 7

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-012 REV: P01

File name P:\01 PROSPECTS REGISTER\CRC\UK\DEVELOPMENT INFRASTRUCTURE\00000000 - NORWICH WESTERN LINK\E MODELS AND DRAWINGS\DEVELOPMENT\AUTOCAD\SK SKETCHES\70041922-WSP-00-ZZ-UT-SK-001-033.DWG, printed on Wednesday, June 19, 2019 1:51:51 PM, by Thomas, Bobby

File name P:\01 PROSPECTS REGISTER\CRC\UK\DEVELOPMENT INFRASTRUCTURE\00000000 - NORWICH WESTERN LINK\E MODELS AND DRAWINGS\DEVELOPMENT\AUTOCAD\SK SKETCHES\70041922-WSP-00-ZZ-UT-SK-001-033.DWG, printed on Wednesday, June 19, 2019 1:51:56 PM, by Thomas, Bobby

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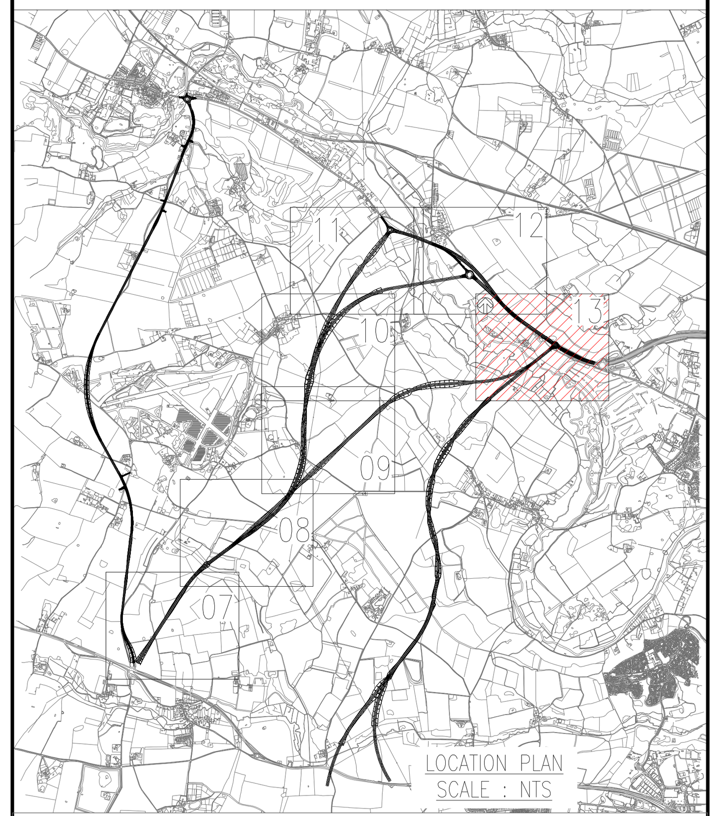

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WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
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TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION B WEST)
SHEET 7 OF 7

SCALE @ A1:	CHECKED:		APPROVED:
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PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-013
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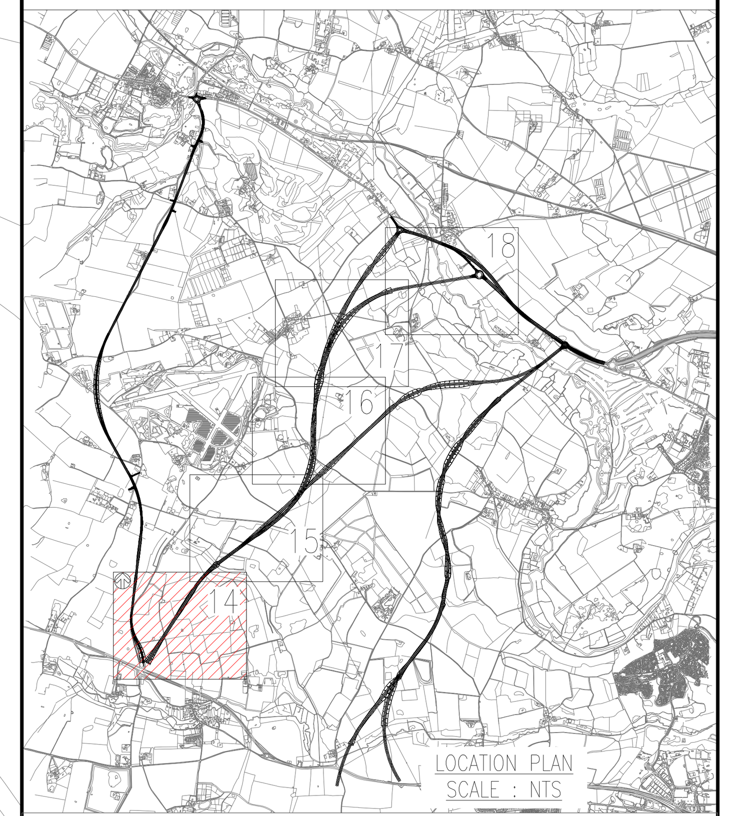

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PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W — W — W — W
WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
BT PLANNED	BTP — BTP — BTP
ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
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P01	11/03/2019	BT	FIRST ISSUE	-	-

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SITE/PROJECT:
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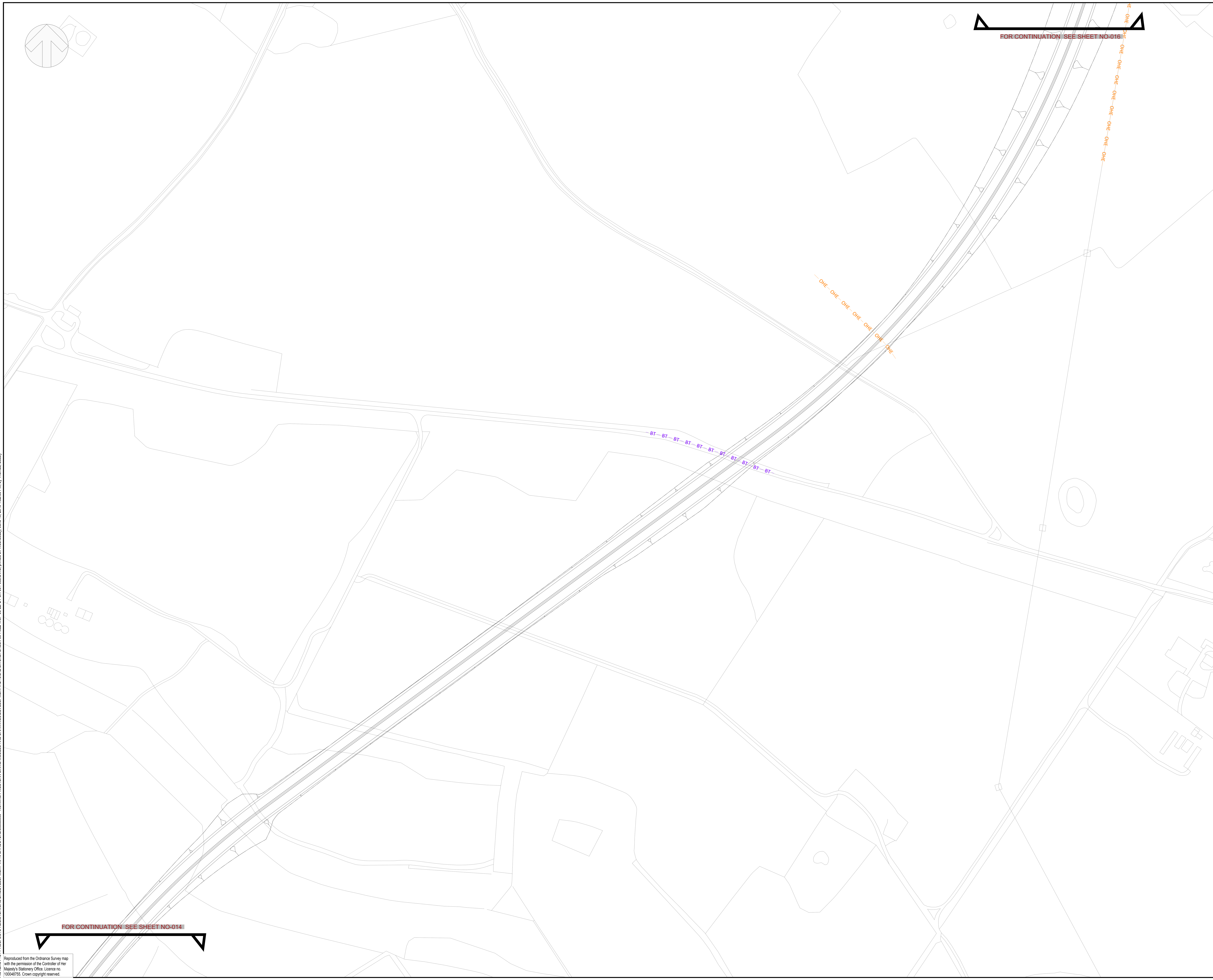
TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION B EAST)
SHEET 1 OF 5

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-014 | REV: P01



FOR CONTINUATION SEE SHEET NO-016

FOR CONTINUATION SEE SHEET NO-014

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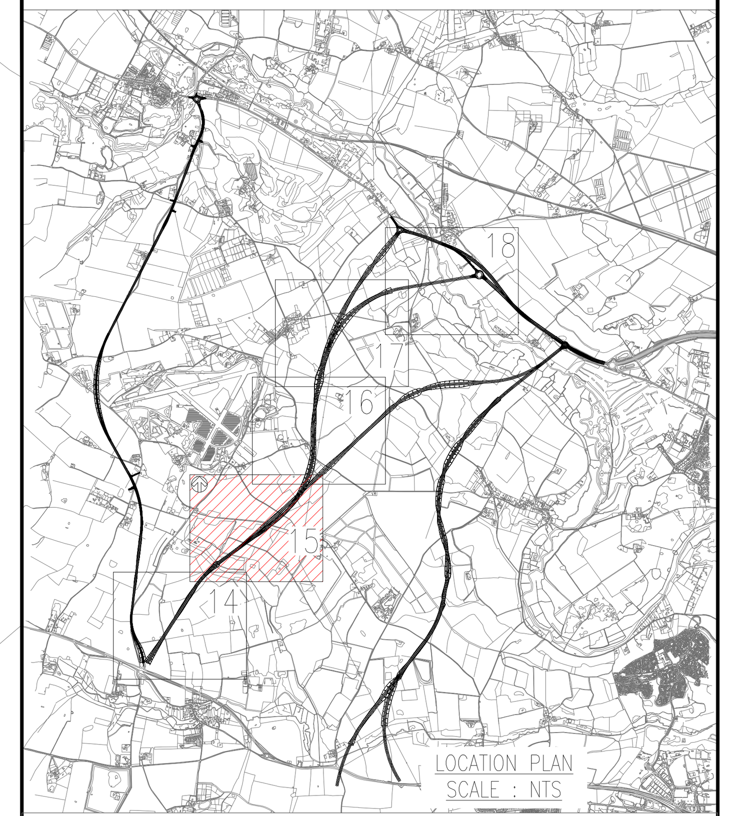

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WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

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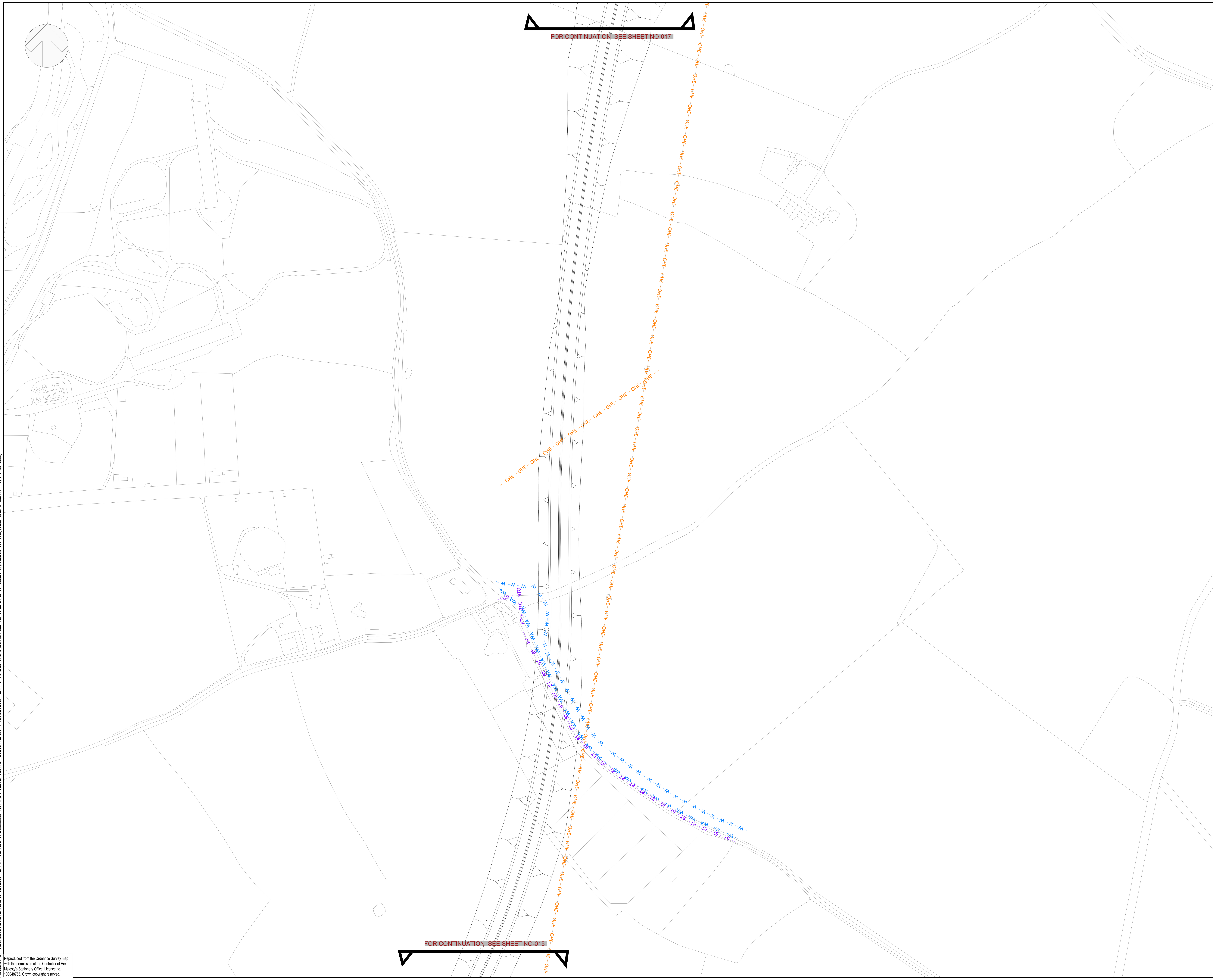
SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19
DRAWING No: 1922-WSP-00-ZZ-UT-SK-015			REV: P01



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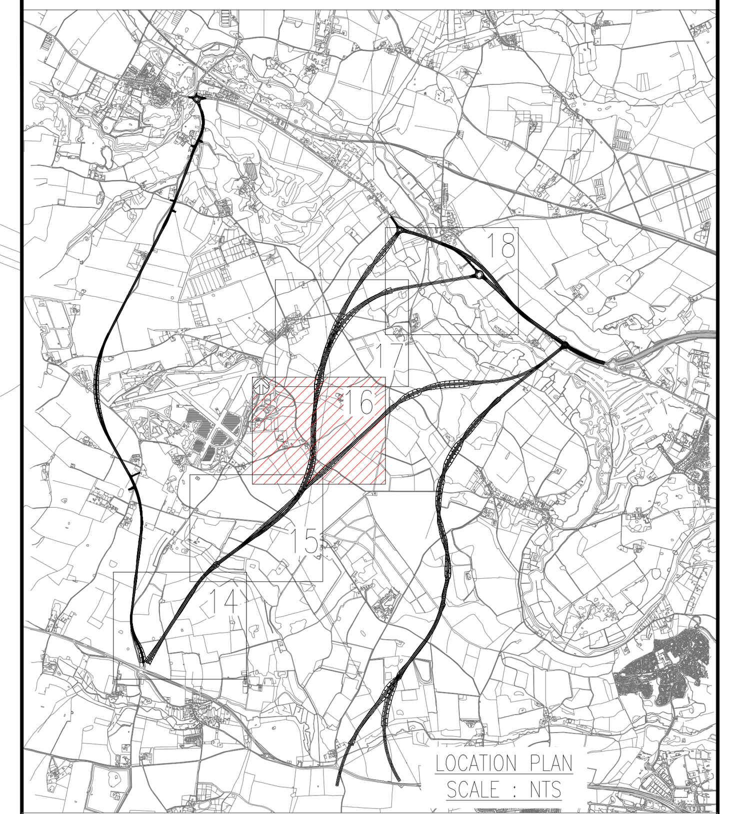

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BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

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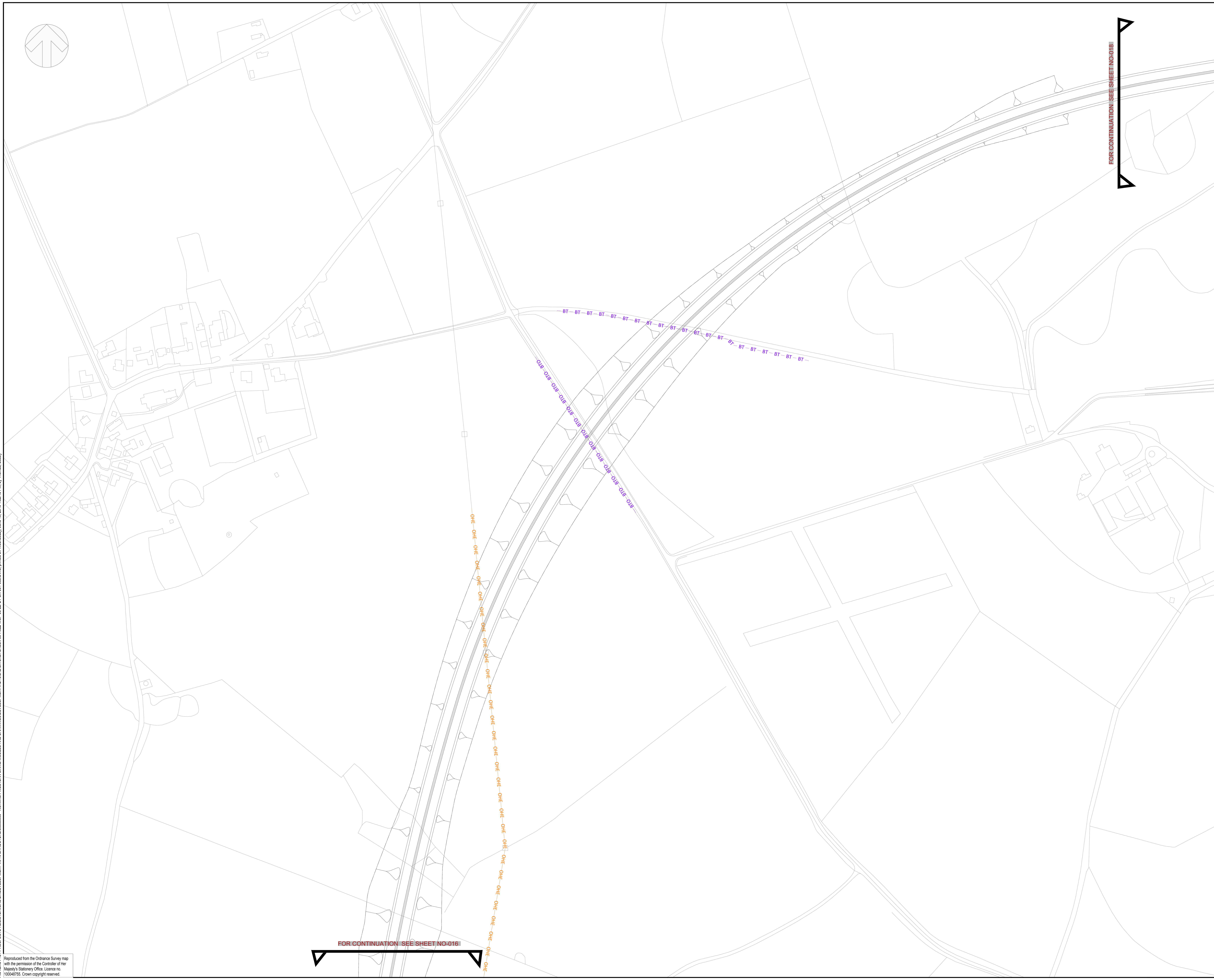
EXISTING UTILITY PLAN
(ROUTE OPTION B EAST)
SHEET 3 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-016
REV: P01



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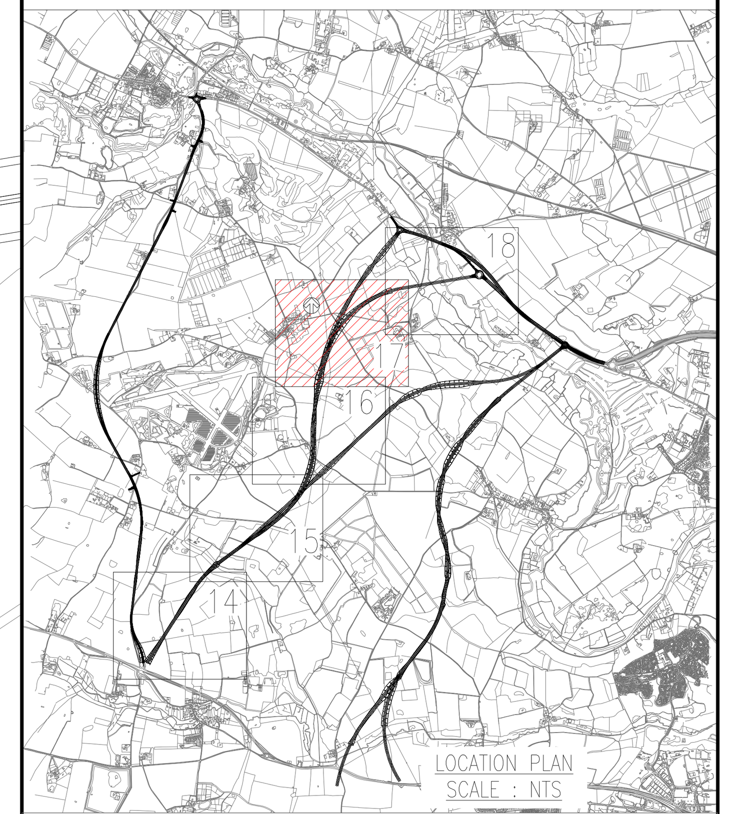

NOTES:

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS:
S0 - WORK IN PROGRESS

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wsp.com

CLIENT:
NORFOLK COUNTY COUNCIL

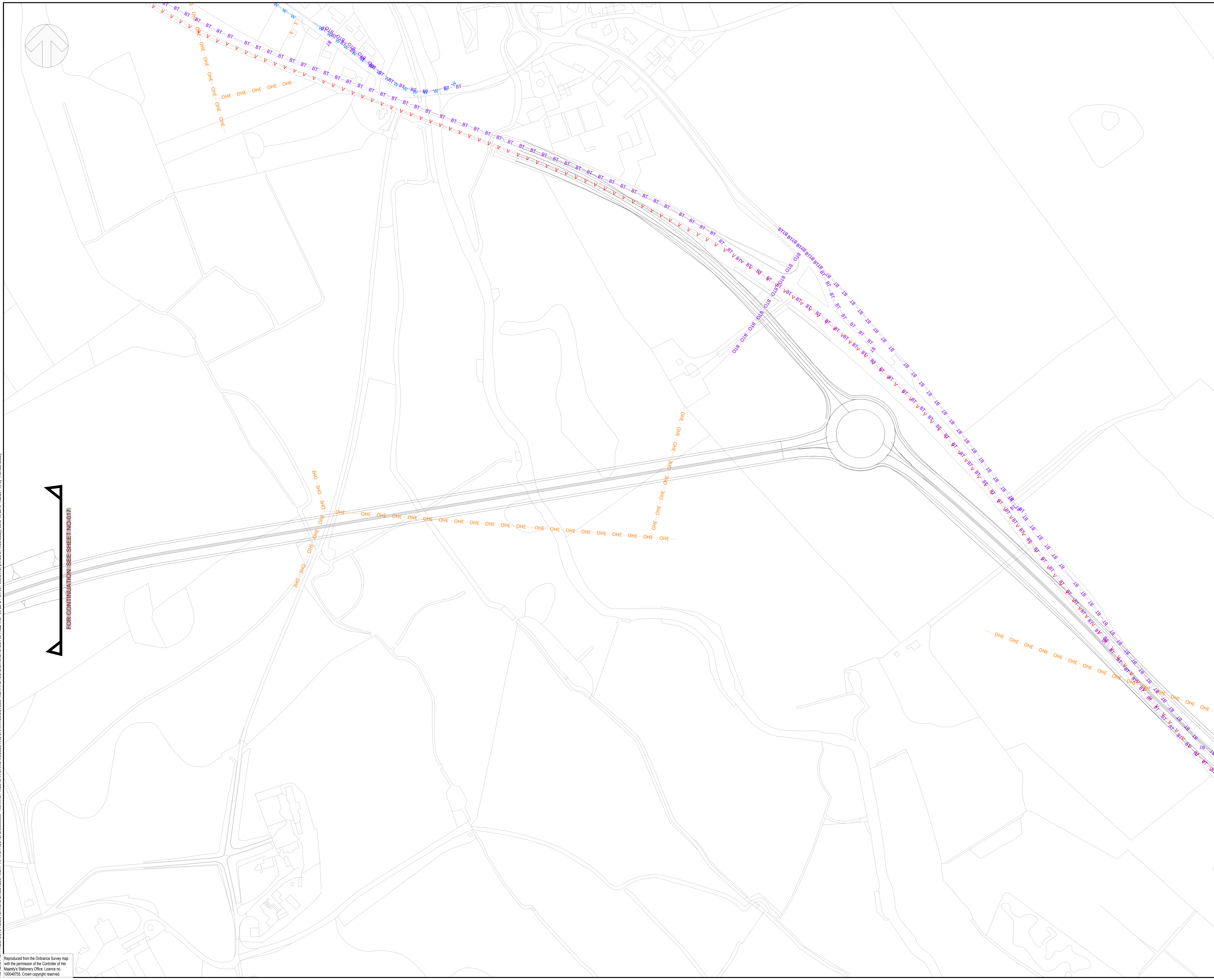
ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION B EAST)
SHEET 4 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No:	REV:
1922-WSP-00-ZZ-UT-SK-017	P01



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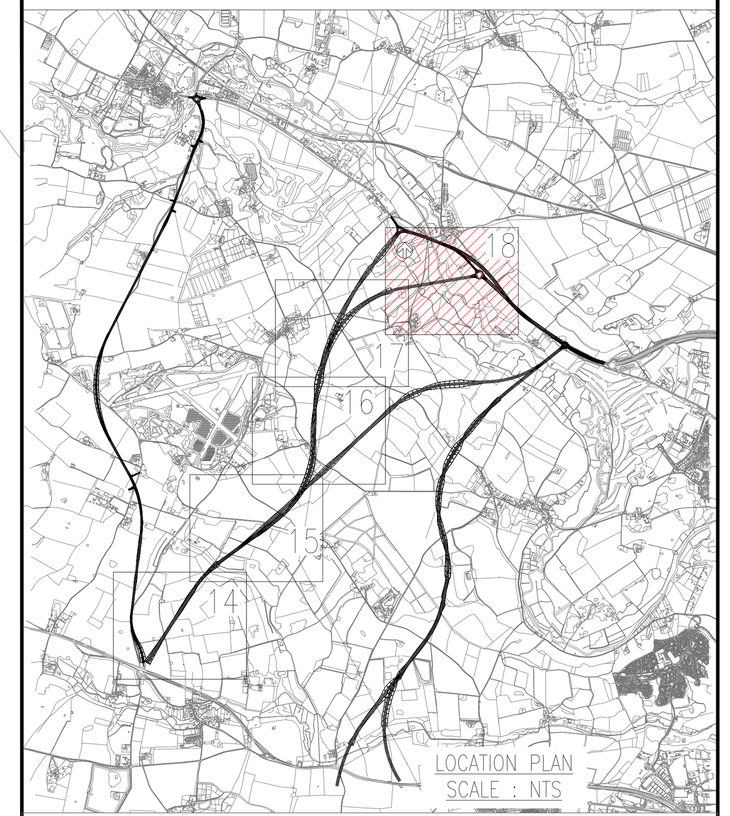

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W — W — W — W
WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
BT PLANNED	BTP — BTP — BTP
ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P02	19/06/2019	BT	LABELS UPDATED	-	-
P01	11/03/2019	BT	FIRST ISSUE	-	-

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CLIENT: NORFOLK COUNTY COUNCIL

ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION B EAST) SHEET 5 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-018 — REV: P02

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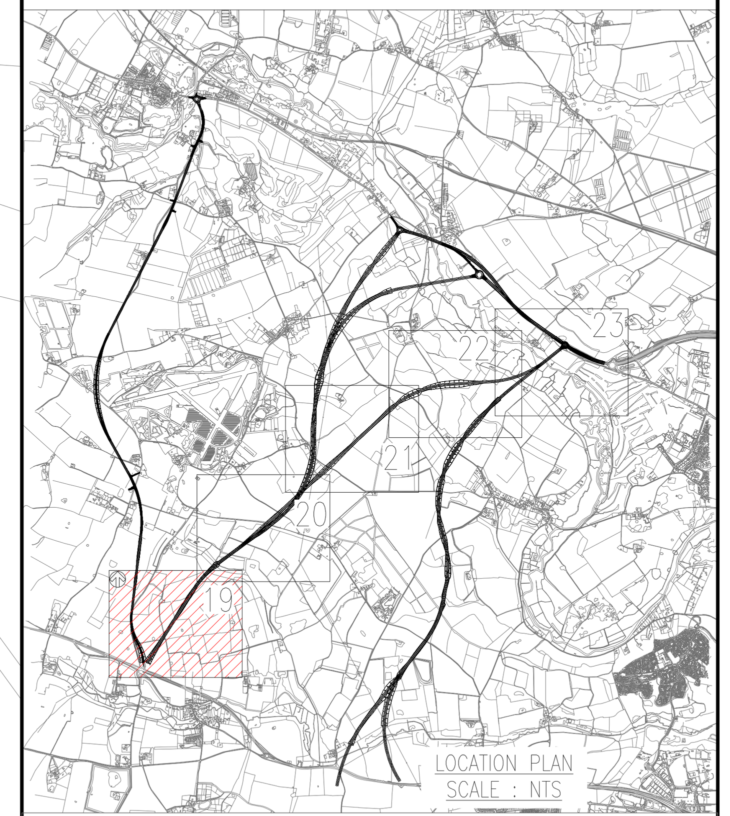

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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CLIENT:
NORFOLK COUNTY COUNCIL

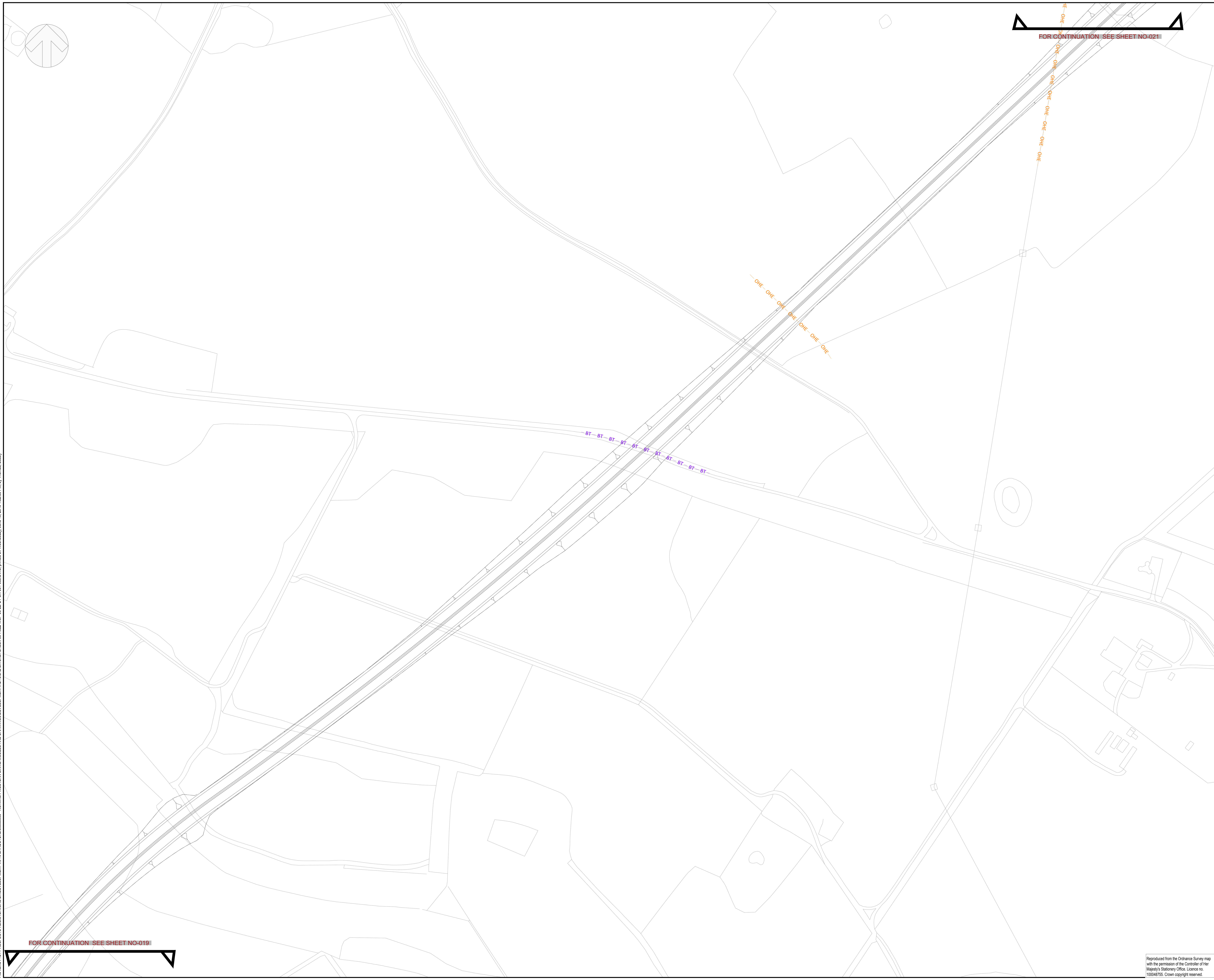
ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION C)
SHEET 1 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19

DRAWING No:	REV:
1922-WSP-00-ZZ-UT-SK-019	P01



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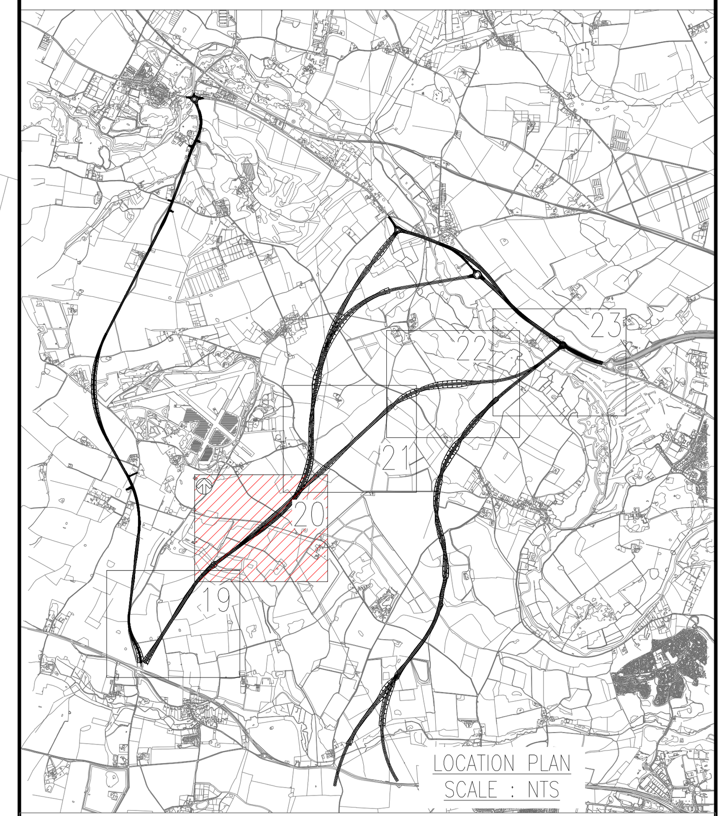

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WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
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ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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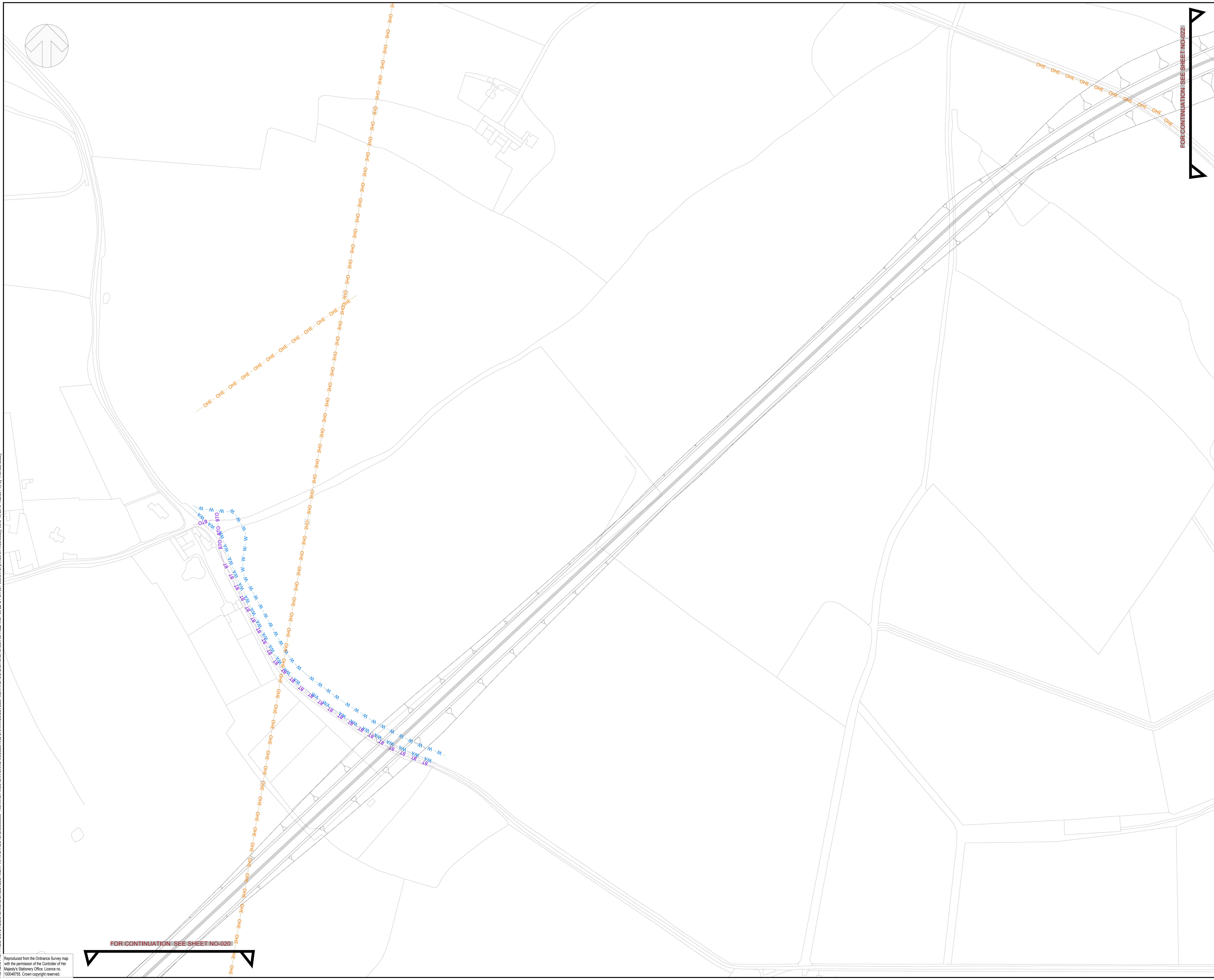
ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION C) SHEET 2 OF 5

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-020 REV: P01



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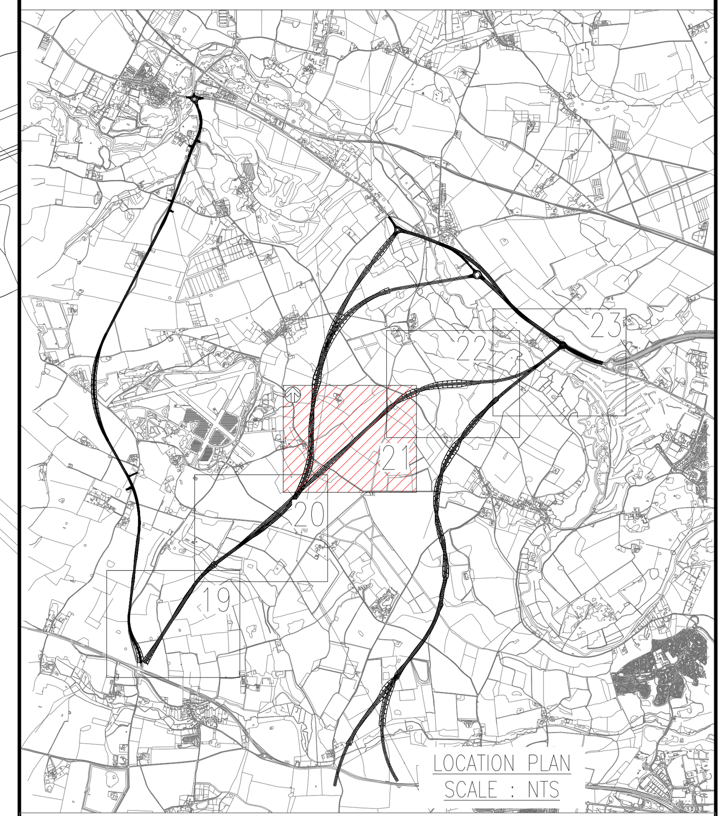

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION C) SHEET 3 OF 5

SCALE @ A1:	CHECKED:	APPROVED:
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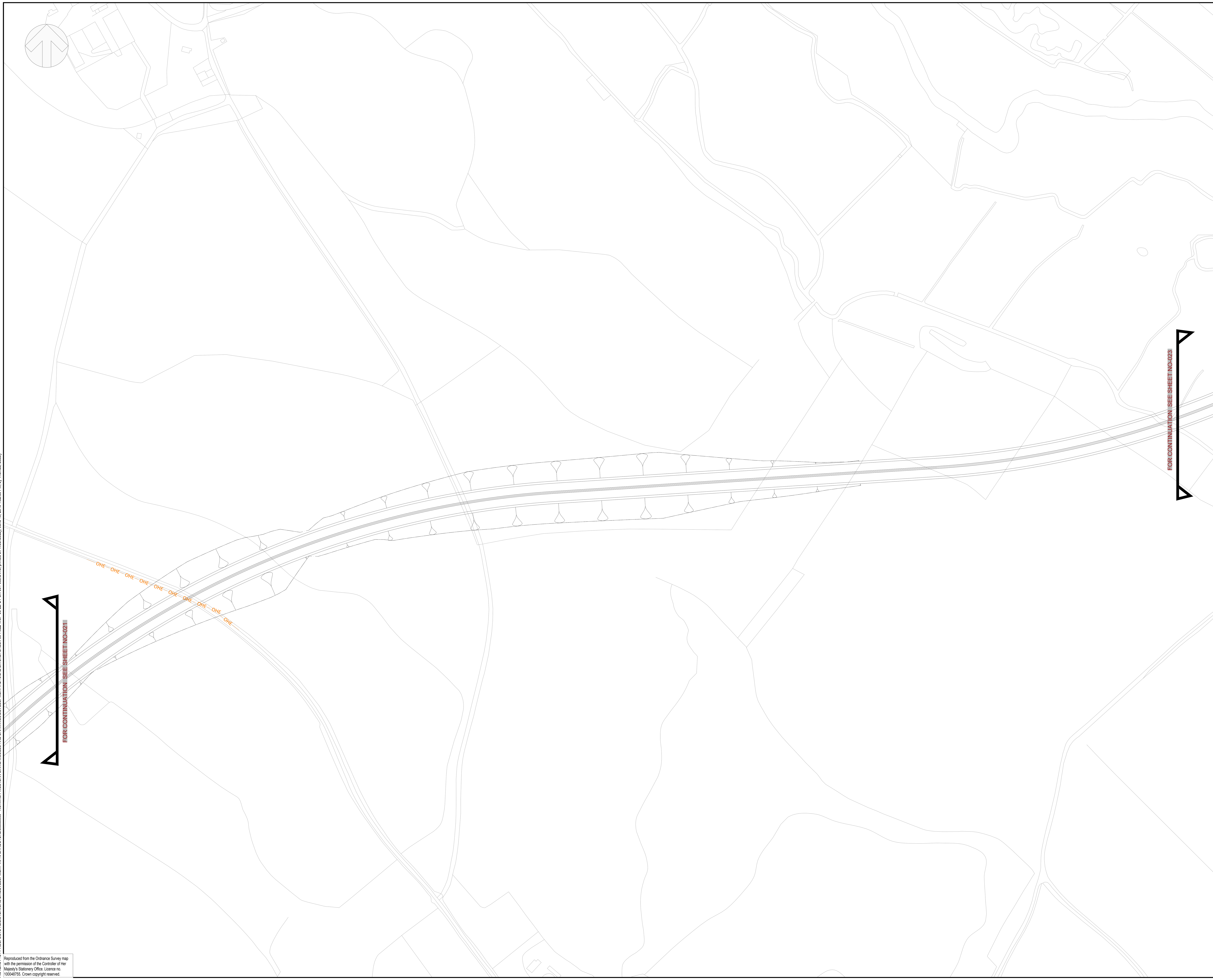
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19

DRAWING No:	REV:
1922-WSP-00-ZZ-UT-SK-021	P01



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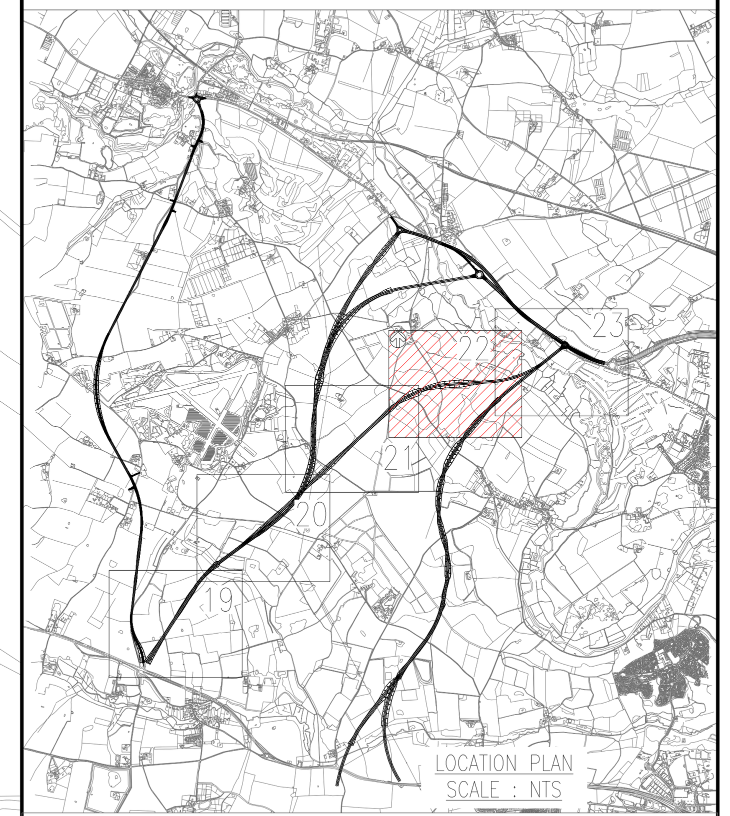

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LEGEND

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WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION C) SHEET 4 OF 5

SCALE @ A1: 1:2000	CHECKED: AS	APPROVED: AP
PROJECT NO: 70041922	DESIGNED: - / DRAWN: BT	DATE: April 19
DRAWING No: 1922-WSP-00-ZZ-UT-SK-022		REV: P01

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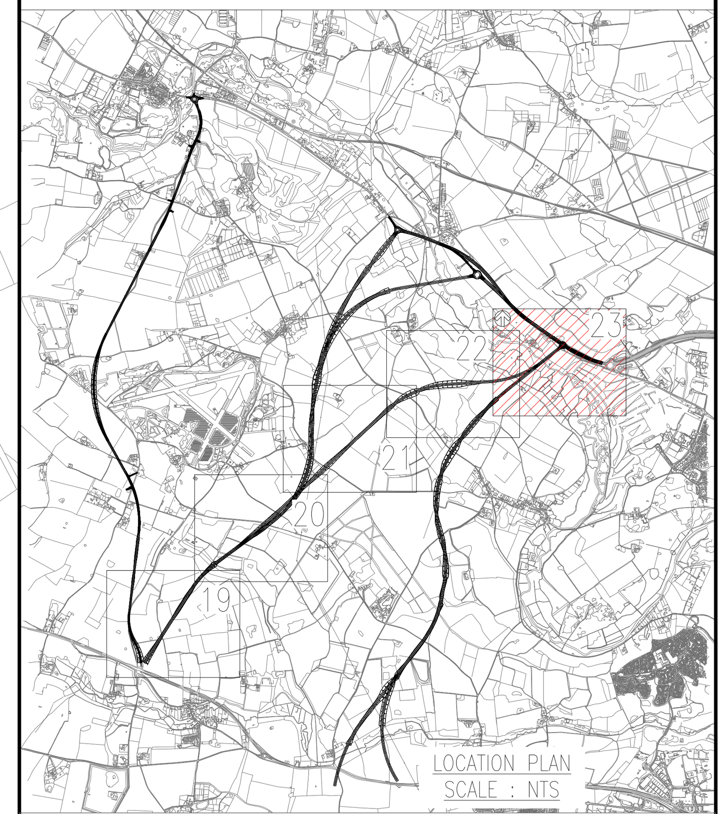

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

DRAWING STATUS:
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CLIENT:
NORFOLK COUNTY COUNCIL

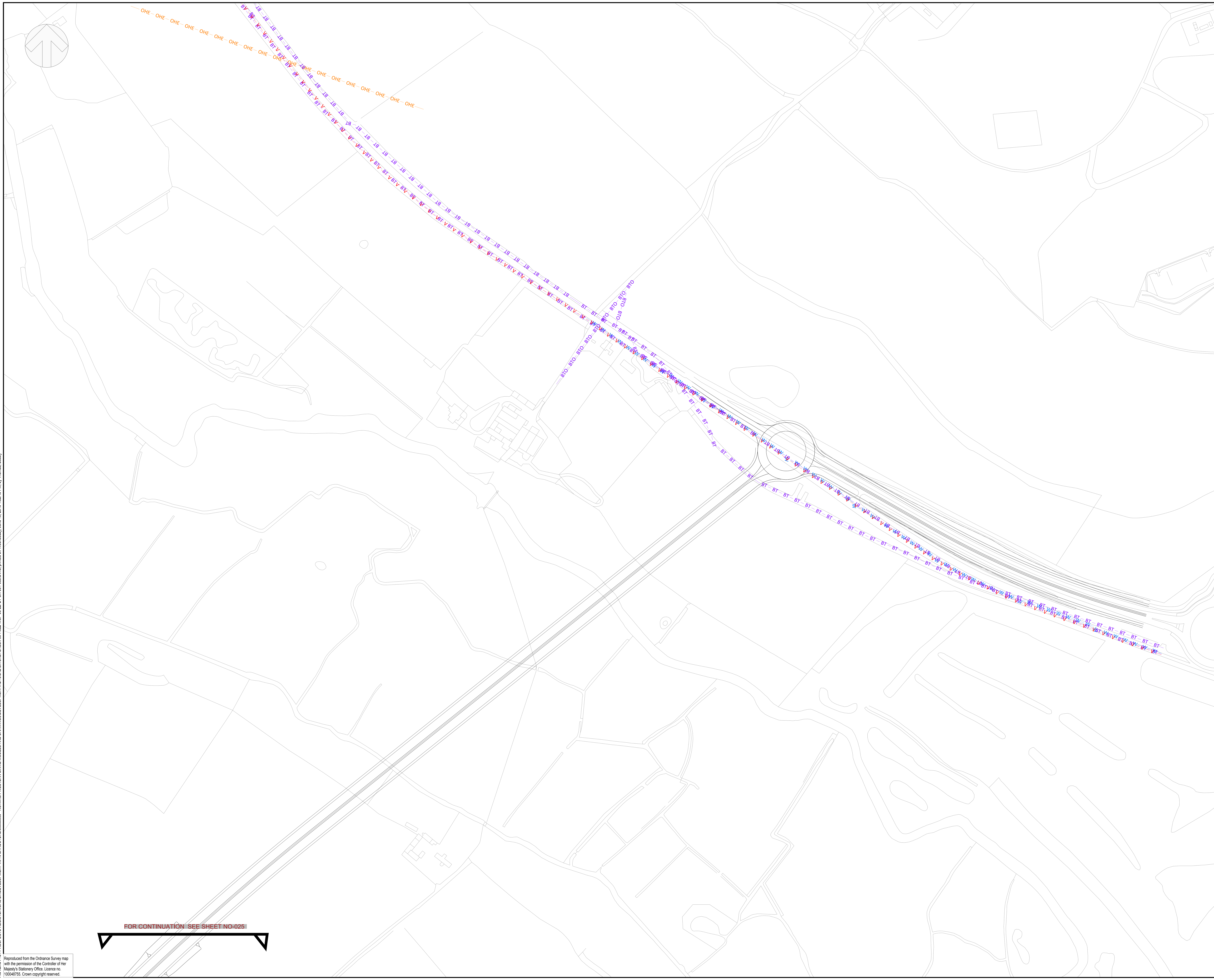
ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION C)
SHEET 5 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-023
REV: P01



File name P:\01 PROSPECTS REGISTER\CRC\UK\DEVELOPMENT INFRASTRUCTURE\00000000 - NORWICH WESTERN LINK\E MODELS AND DRAWINGS\DEVELOPMENT\AUTOCAD\SK SKETCHES\70041922-WSP-00-ZZ-UT-SK-001-033.DWG, printed on Wednesday, June 19, 2019 1:52:49 PM, by Thomas, Bobby

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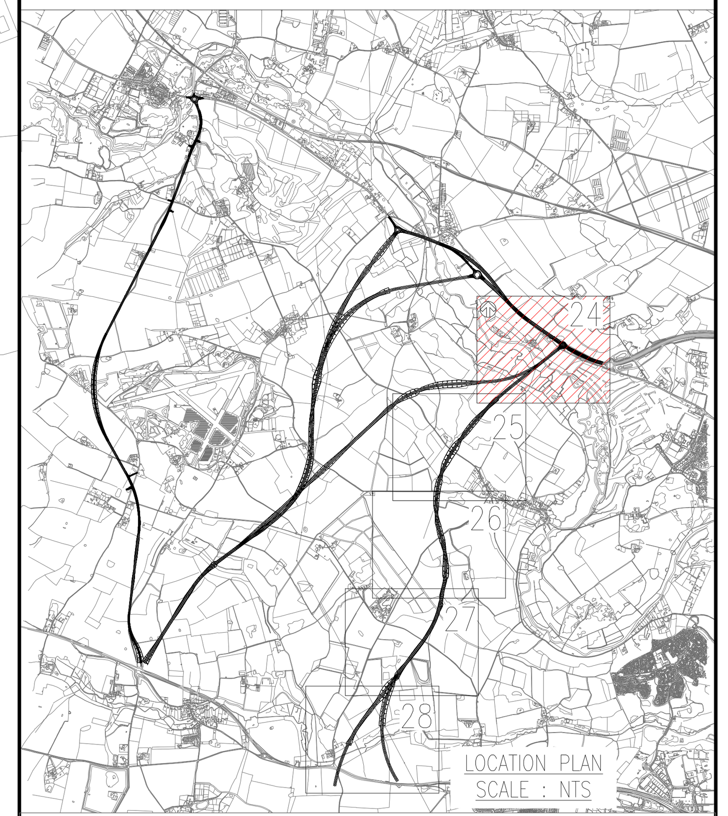

NOTES:

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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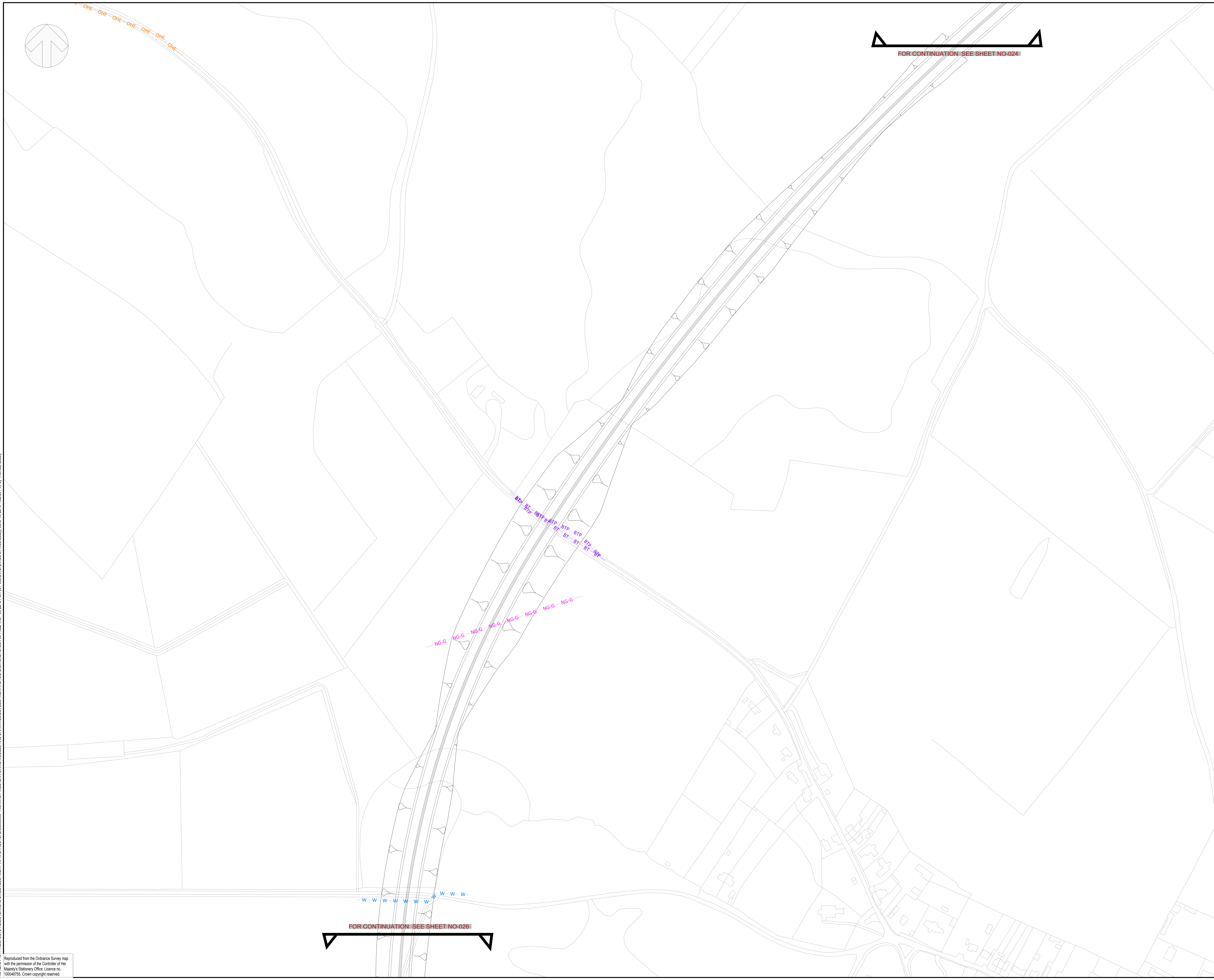
CLIENT:
NORFOLK COUNTY COUNCIL

ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION D)
SHEET 1 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19
DRAWING No:			REV:
1922-WSP-00-ZZ-UT-SK-024			P01



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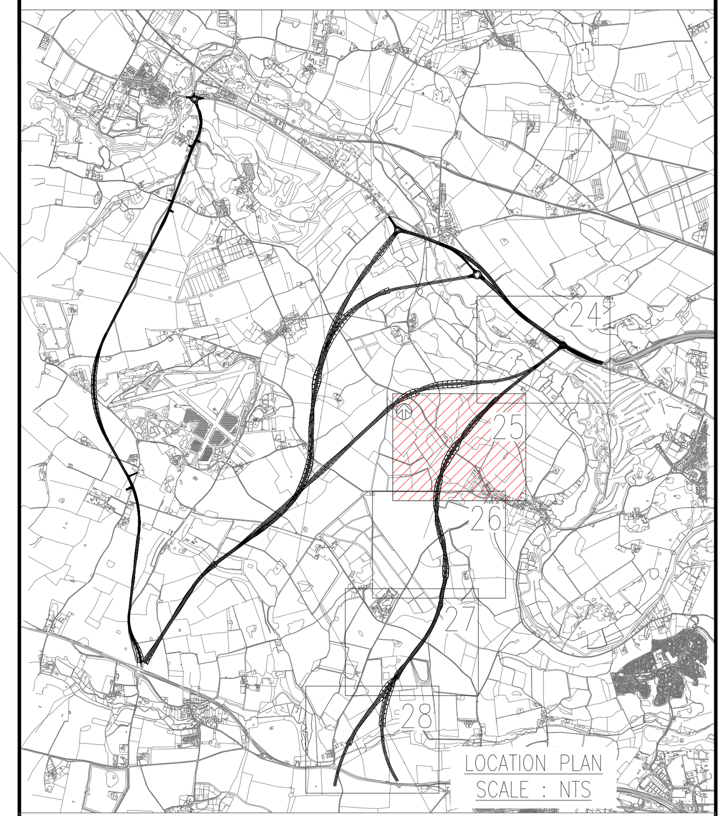

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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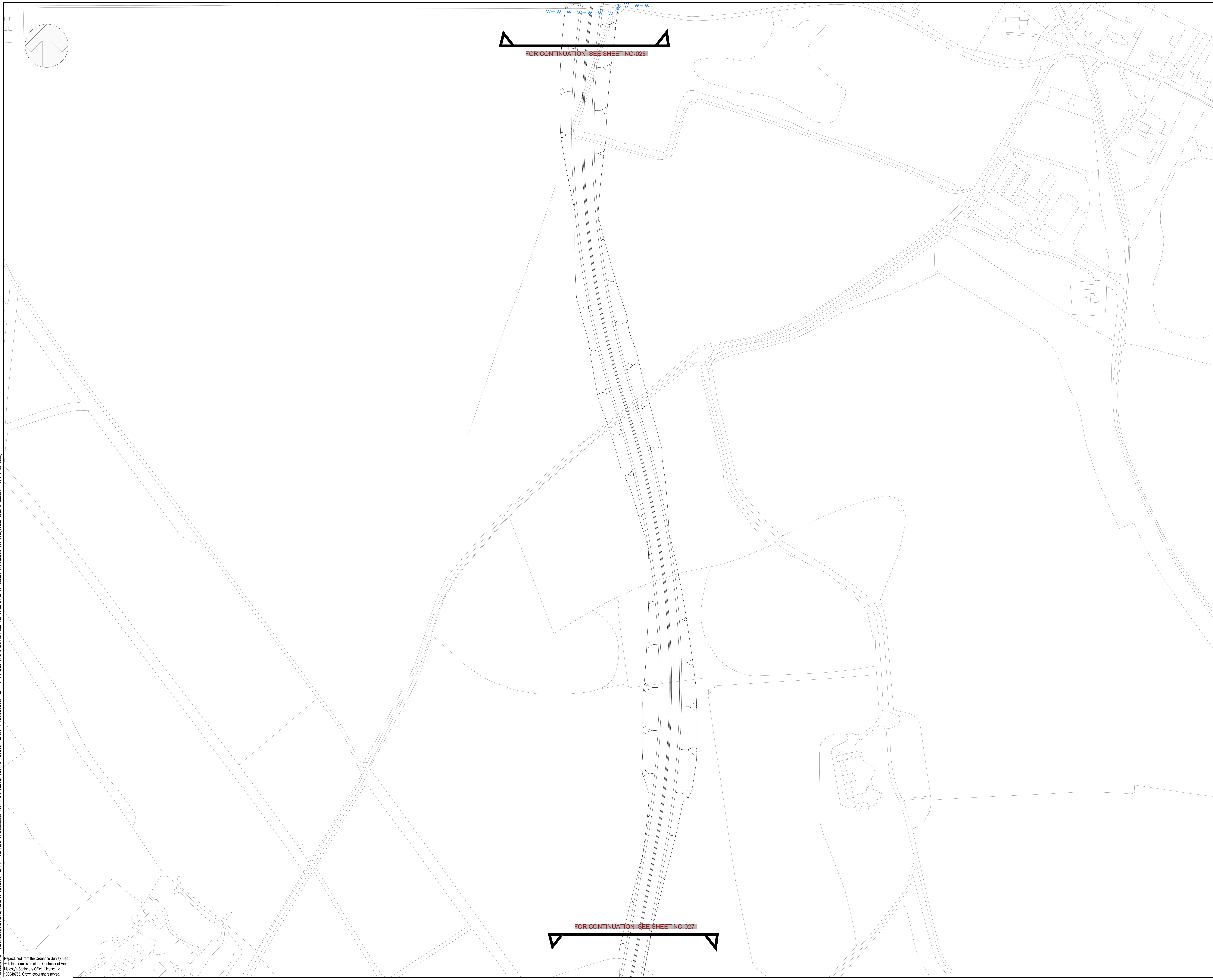
ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION D) SHEET 2 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-025 | REV: P01



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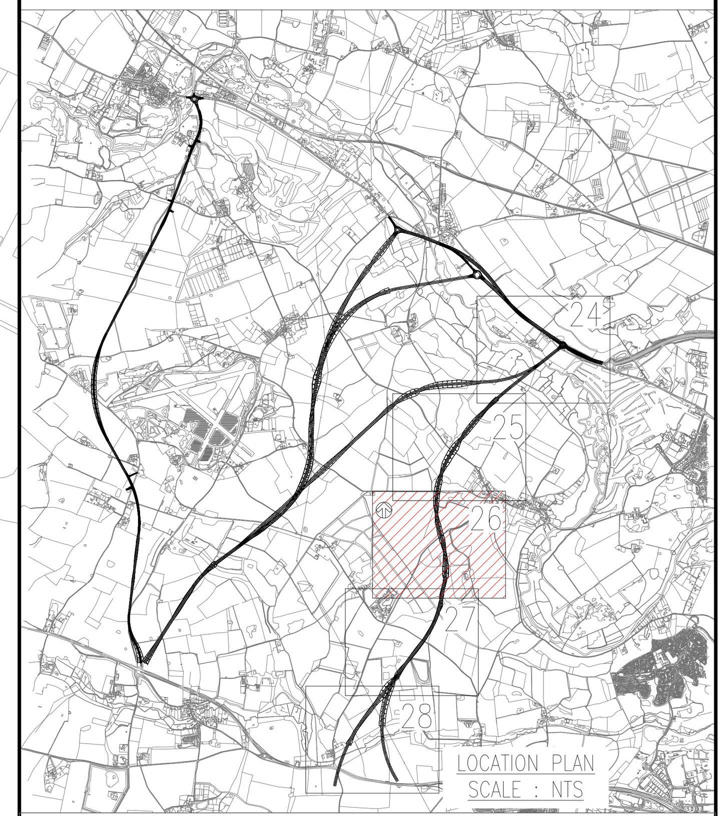

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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wsp.com

CLIENT:
NORFOLK COUNTY COUNCIL

ARCHITECT:
-

SITE/PROJECT:
NORWICH WESTERN LINK

TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION D)
SHEET 3 OF 5

SCALE @ A1:	CHECKED:		APPROVED:
1:2000	AS		AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-026
REV: P01

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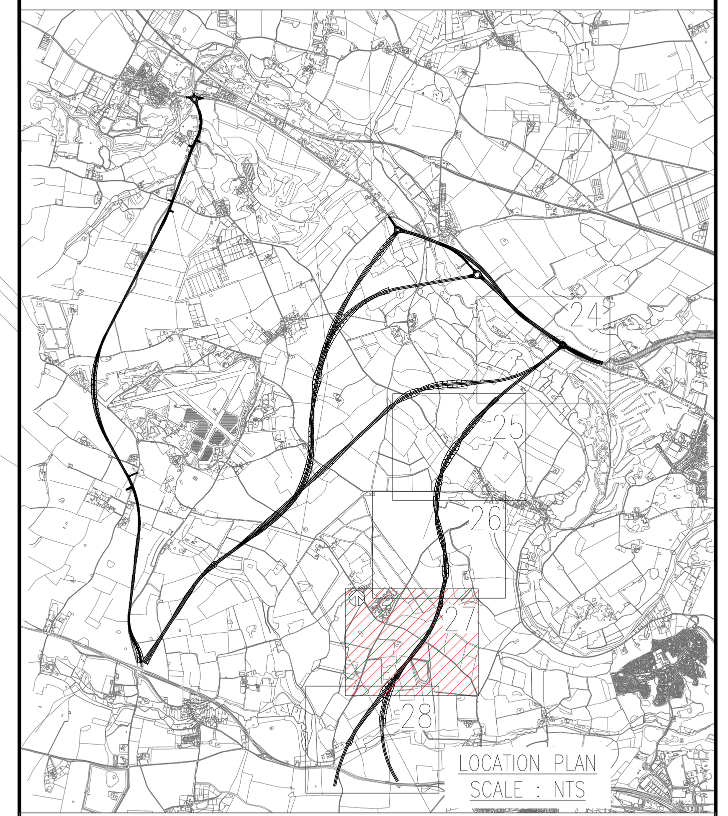

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W — W — W — W
WATER ABANDONED	WA — WA — WA
FOUL SEWER	FS — FS — FS
BT	BT — BT — BT
BT OVERHEAD	BTO — BTO — BTO
BT PLANNED	BTP — BTP — BTP
ELECTRICITY	E — E — E — E
ELECTRICITY OVERHEAD	OHE — OHE
VIRGIN	V — V — V — V
NATIONAL GRID GAS	NG-G — NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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ARCHITECT: -

SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION D) SHEET 4 OF 5

SCALE @ A1:	CHECKED:	APPROVED:
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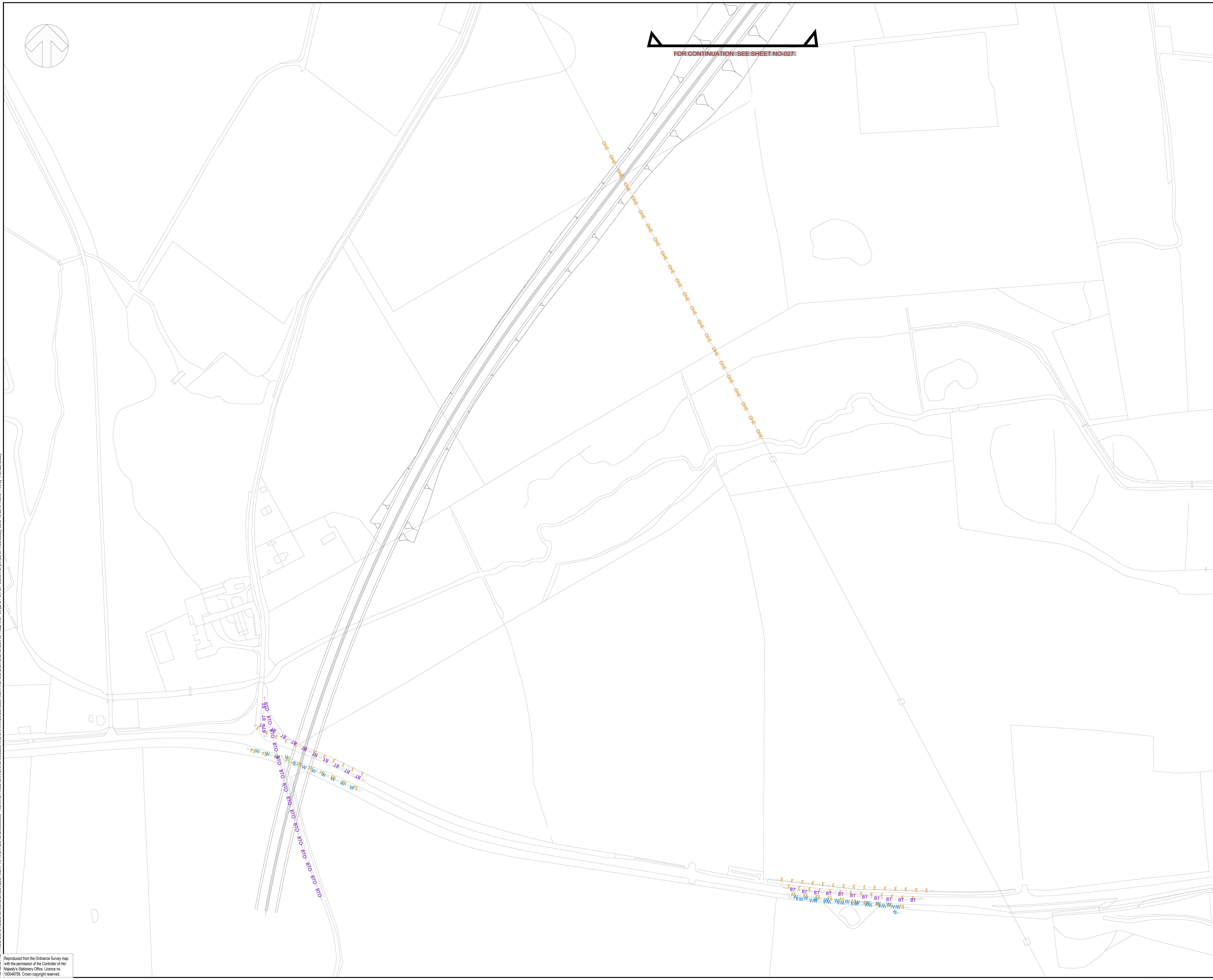
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70041922	-	BT	April 19

DRAWING No:	REV:
1922-WSP-00-ZZ-UT-SK-027	P01



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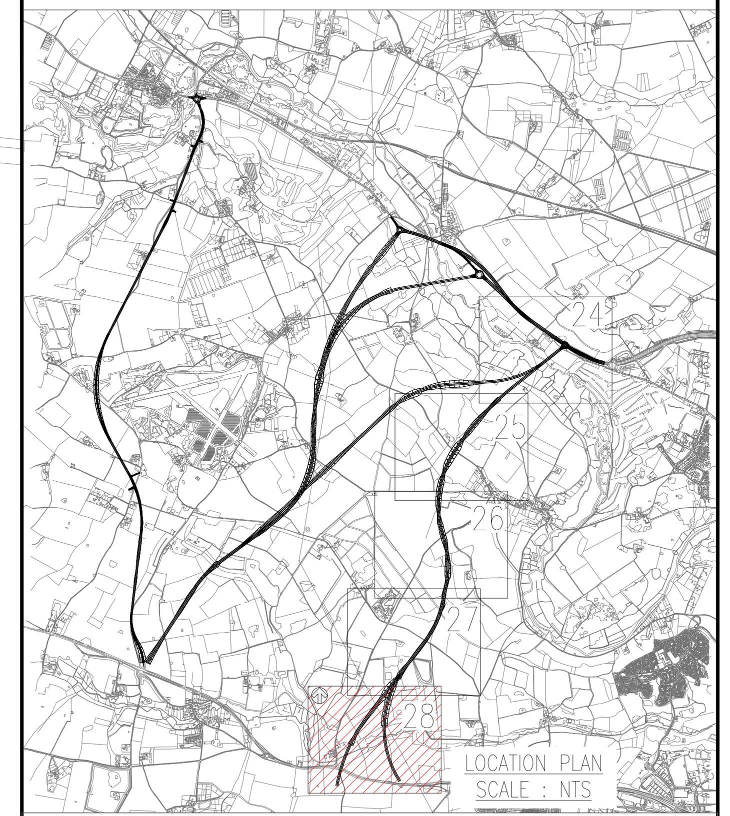

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	— W — W — W — W —
WATER ABANDONED	— WA — WA — WA —
FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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ARCHITECT:
-

SITE/PROJECT:
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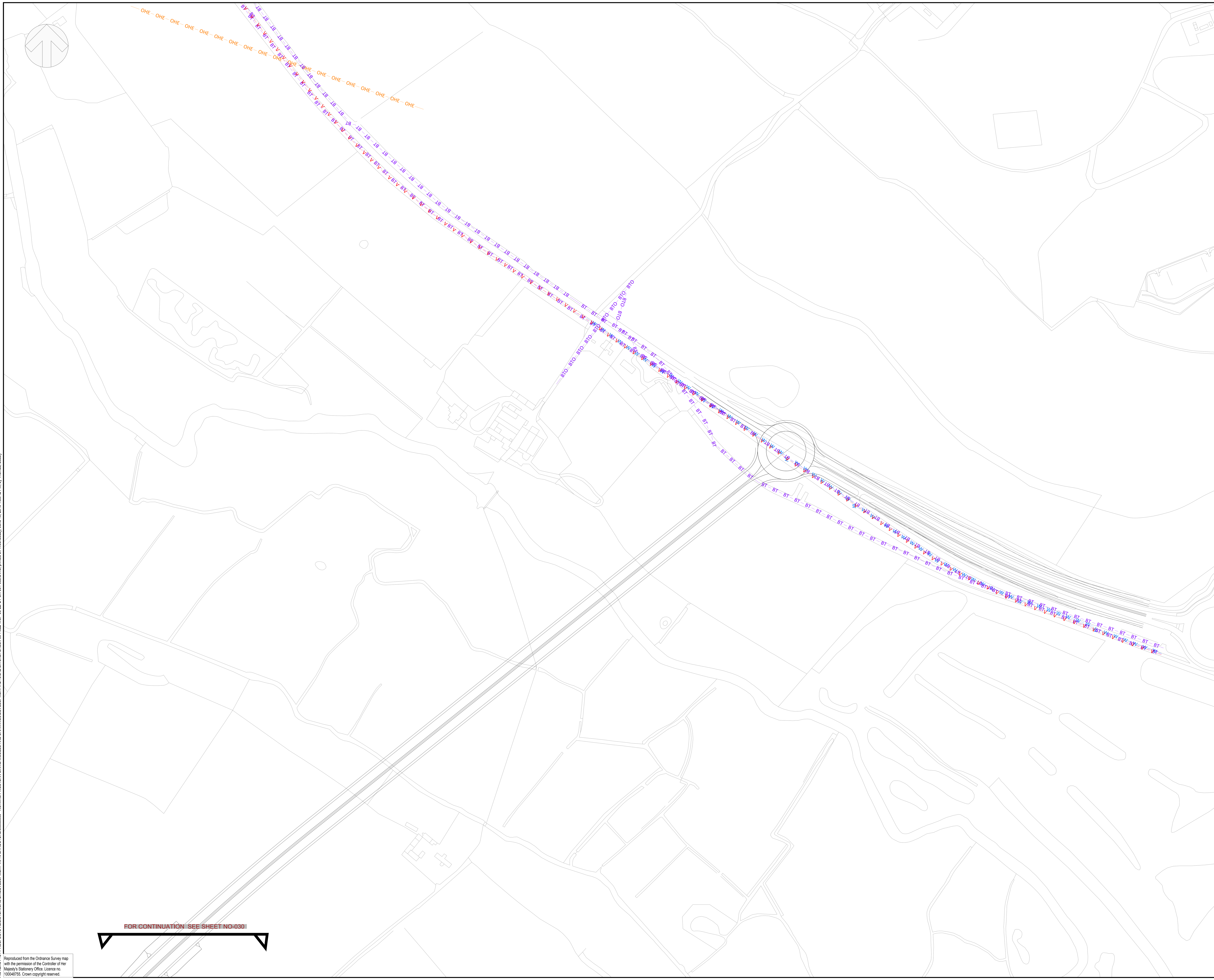
TITLE:
EXISTING UTILITY PLAN
(ROUTE OPTION D)
SHEET 5 OF 5

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19
DRAWING No: 1922-WSP-00-ZZ-UT-SK-028			REV: P01



FOR CONTINUATION SEE SHEET NO-030

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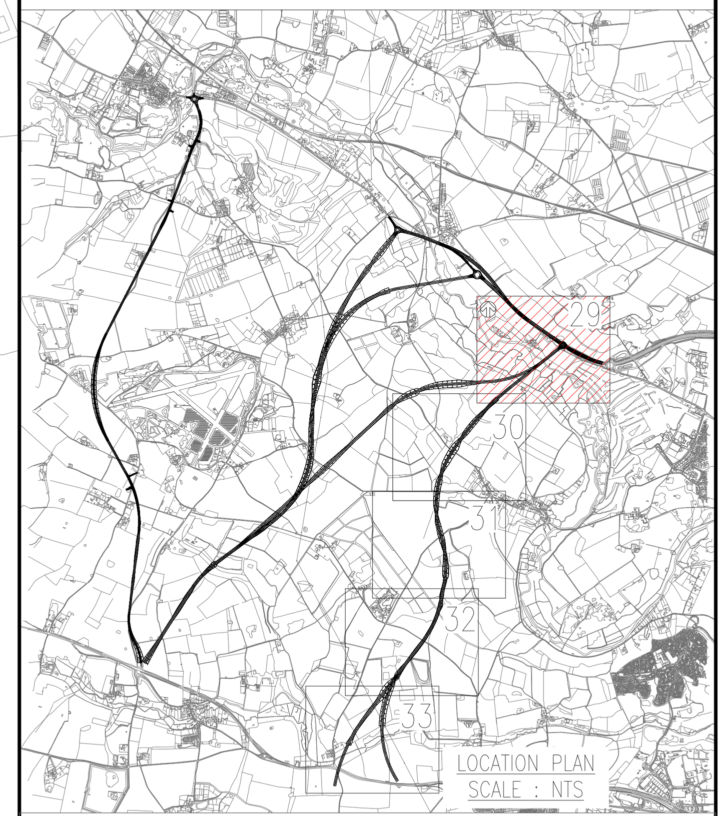

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/03/2019	BT	FIRST ISSUE	-	-

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ARCHITECT: -

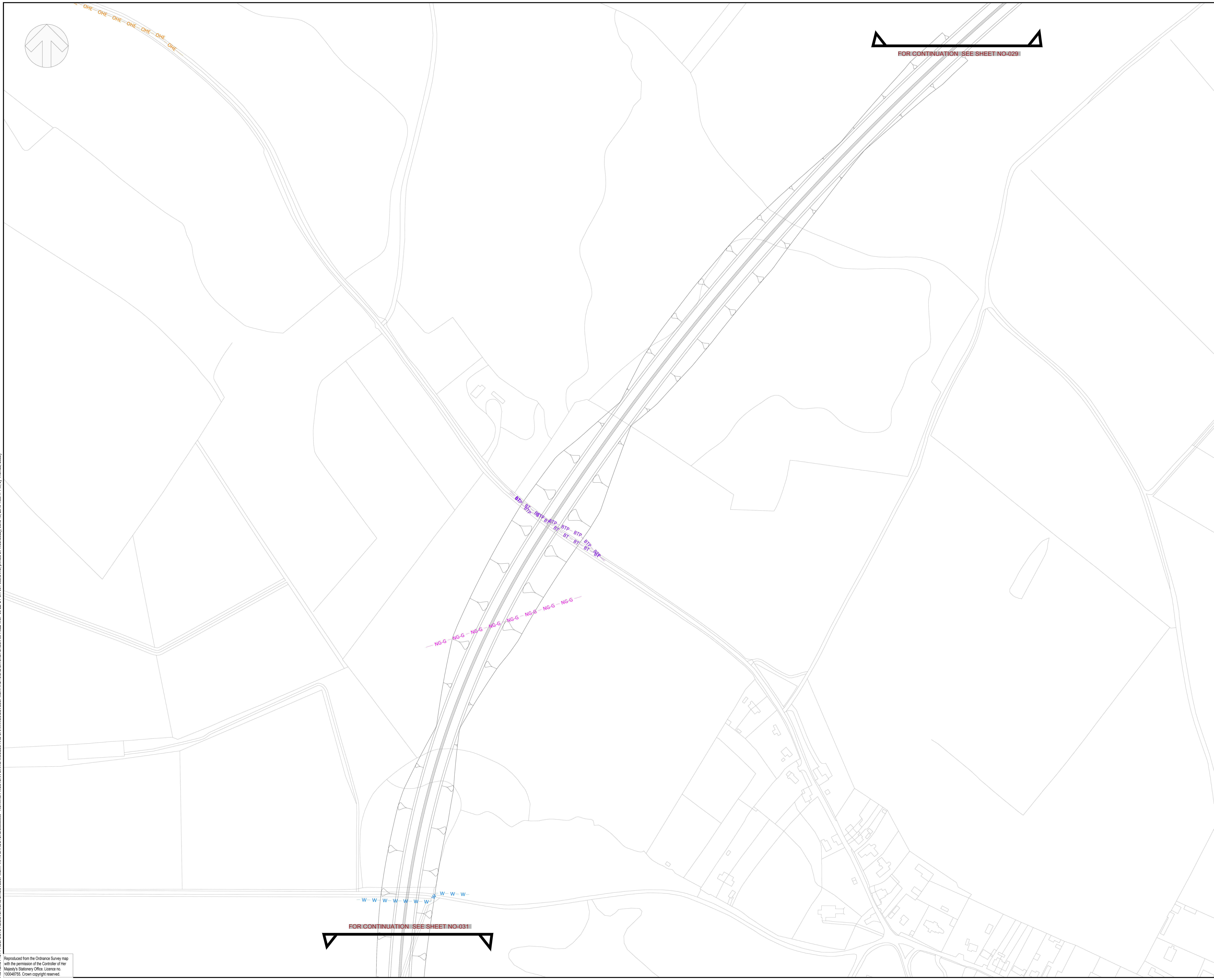
SITE/PROJECT: NORWICH WESTERN LINK

TITLE: EXISTING UTILITY PLAN (ROUTE OPTION D-1) SHEET 1 OF 5

SCALE @ A1: 1:2000	CHECKED: AS		APPROVED: AP
PROJECT NO: 70041922	DESIGNED: -	DRAWN: BT	DATE: April 19

DRAWING No: 1922-WSP-00-ZZ-UT-SK-029 REV: P01

File name P:\01 PROSPECTS REGISTER\CRC\UK\DEVELOPMENT INFRASTRUCTURE\00000000 - NORWICH WESTERN LINK\E MODELS AND DRAWINGS\DEVELOPMENT\AUTOCAD\SK SKETCHES\70041922-WSP-00-ZZ-UT-SK-001-033.DWG, printed on Wednesday, June 19, 2019 1:53:12 PM, by Thomas, Bobby



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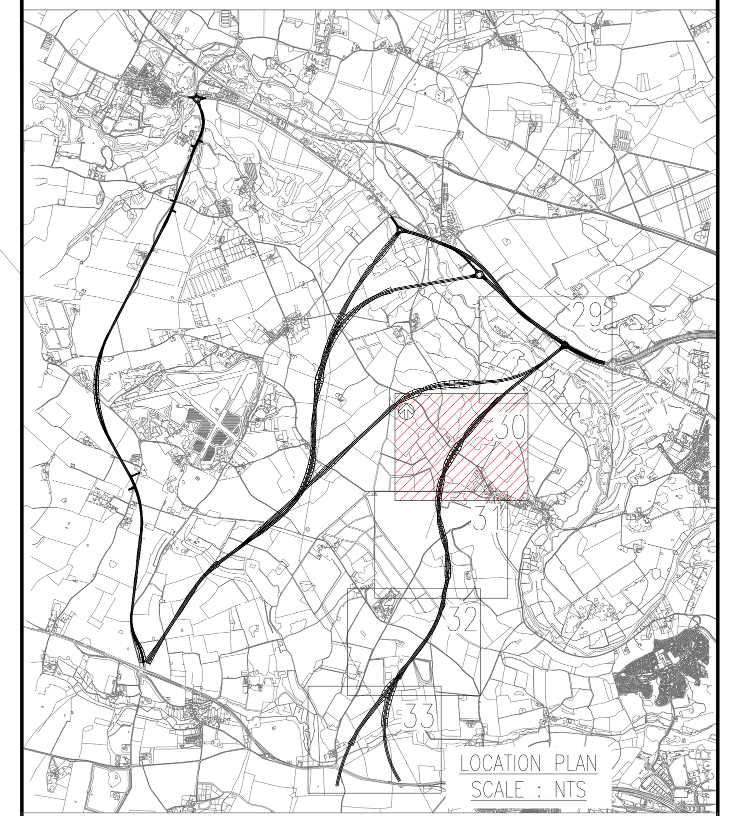

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	
WATER	W W W W
WATER ABANDONED	WA WA WA
FOUL SEWER	FS FS FS
BT	BT BT BT
BT OVERHEAD	BTO BTO BTO
BT PLANNED	BTP BTP BTP
ELECTRICITY	E E E E
ELECTRICITY OVERHEAD	OHE OHE
VIRGIN	V V V V
NATIONAL GRID GAS	NG-G NG-G

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EXISTING UTILITY PLAN
(ROUTE OPTION D-1)
SHEET 2 OF 5

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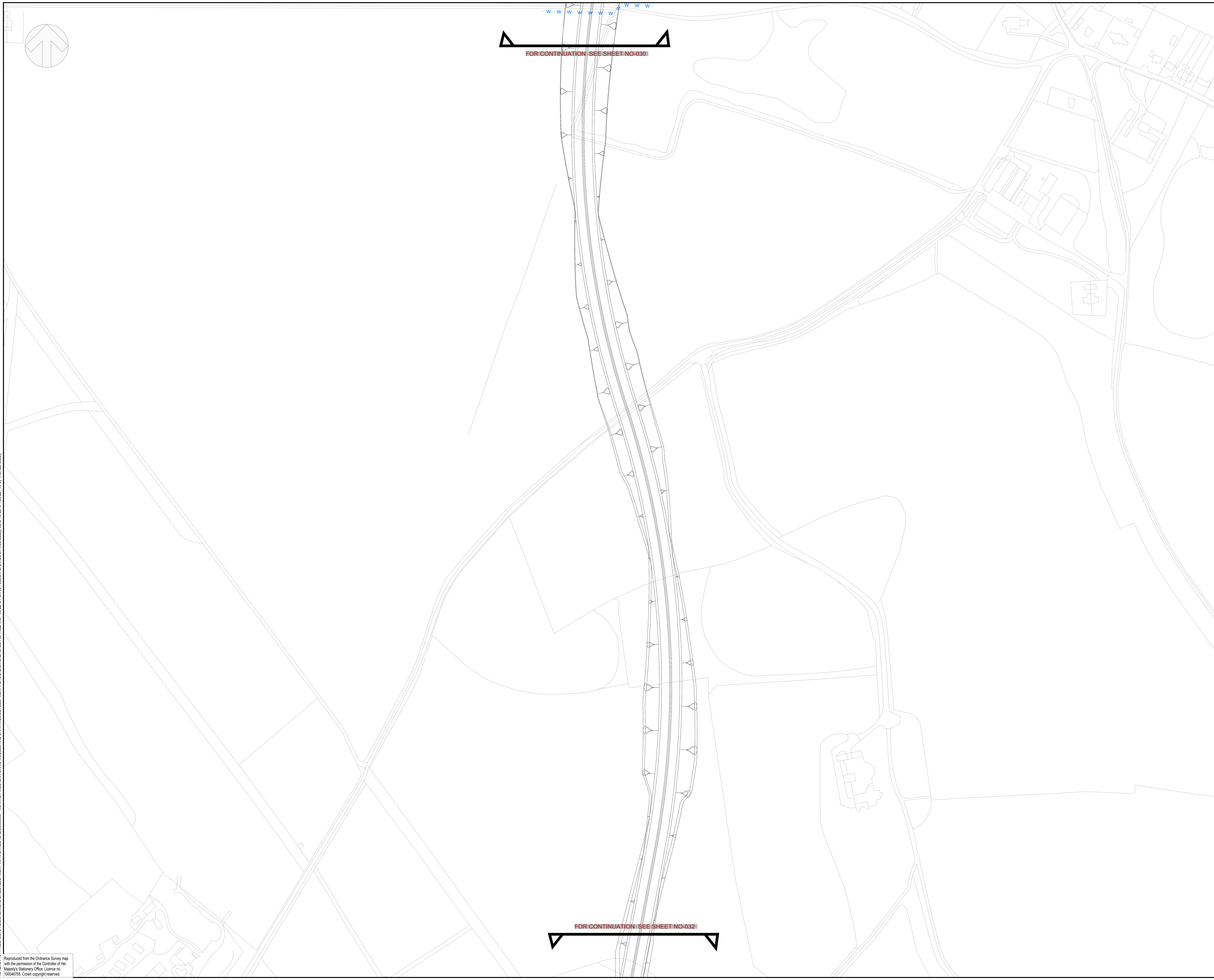

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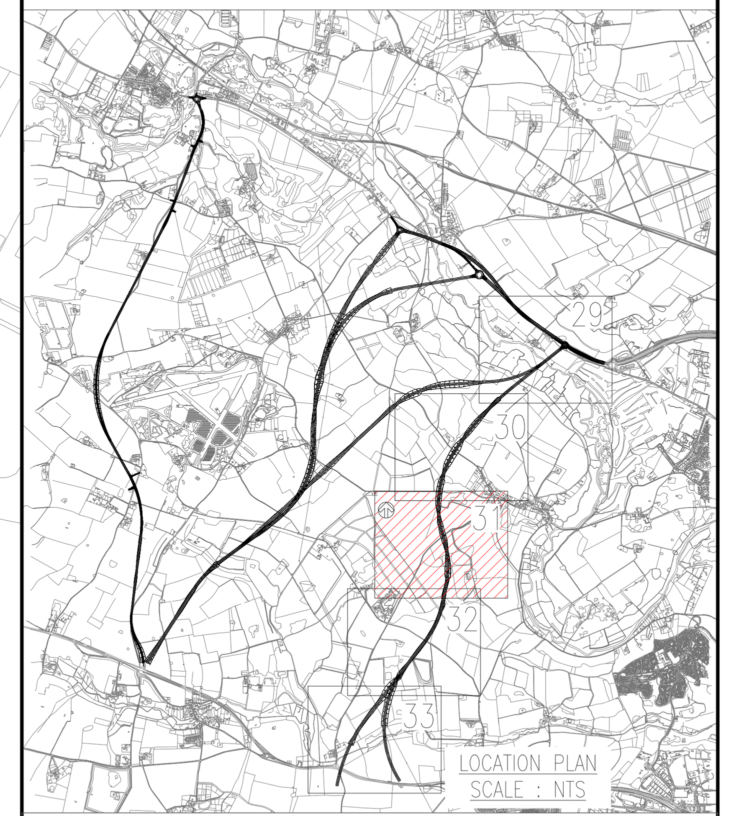

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LEGEND

PROPOSED A47 ALIGNMENT (HIGHWAY ENGLAND)	▬ ▬
WATER	– W – W – W – W –
WATER ABANDONED	– WA – WA – WA –
FOUL SEWER	– FS – FS – FS –
BT	– BT – BT – BT –
BT OVERHEAD	– BTO – BTO – BTO –
BT PLANNED	– BTP – BTP – BTP –
ELECTRICITY	– E – E – E – E –
ELECTRICITY OVERHEAD	– OHE – OHE –
VIRGIN	– V – V – V – V –
NATIONAL GRID GAS	– NG-G – NG-G –

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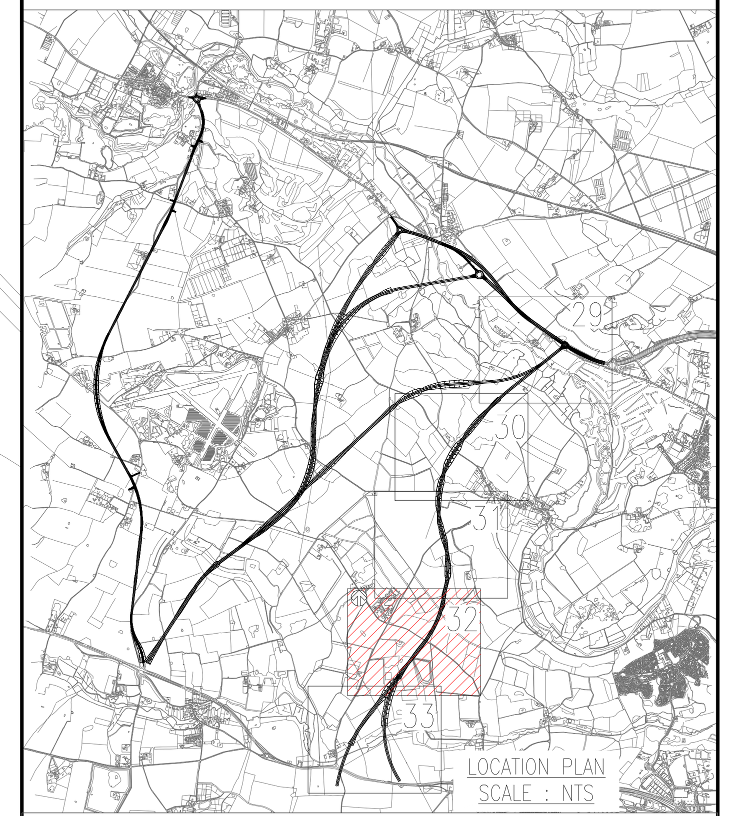

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FOUL SEWER	— FS — FS — FS —
BT	— BT — BT — BT —
BT OVERHEAD	— BTO — BTO — BTO —
BT PLANNED	— BTP — BTP — BTP —
ELECTRICITY	— E — E — E — E —
ELECTRICITY OVERHEAD	— OHE — OHE —
VIRGIN	— V — V — V — V —
NATIONAL GRID GAS	— NG-G — NG-G —

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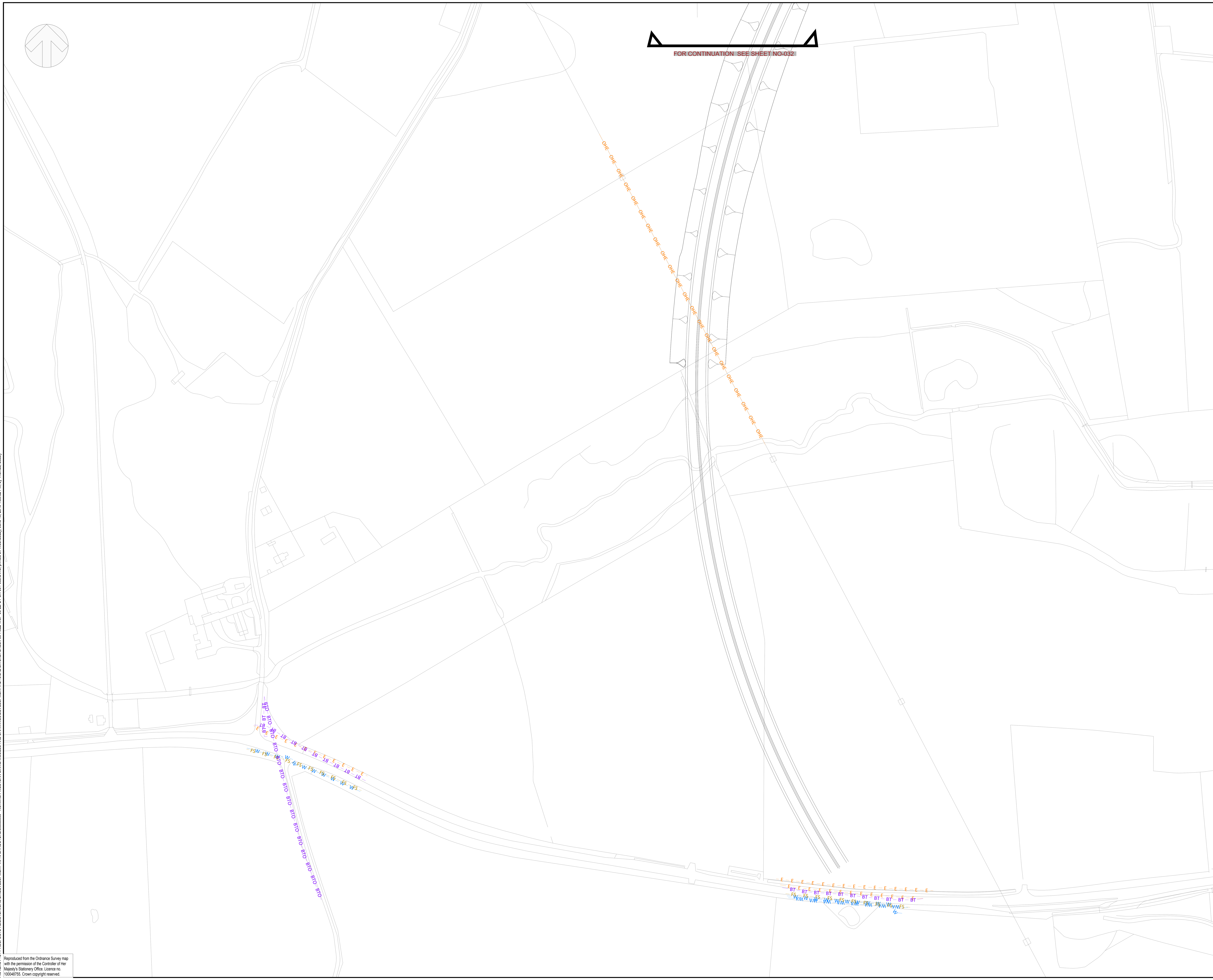

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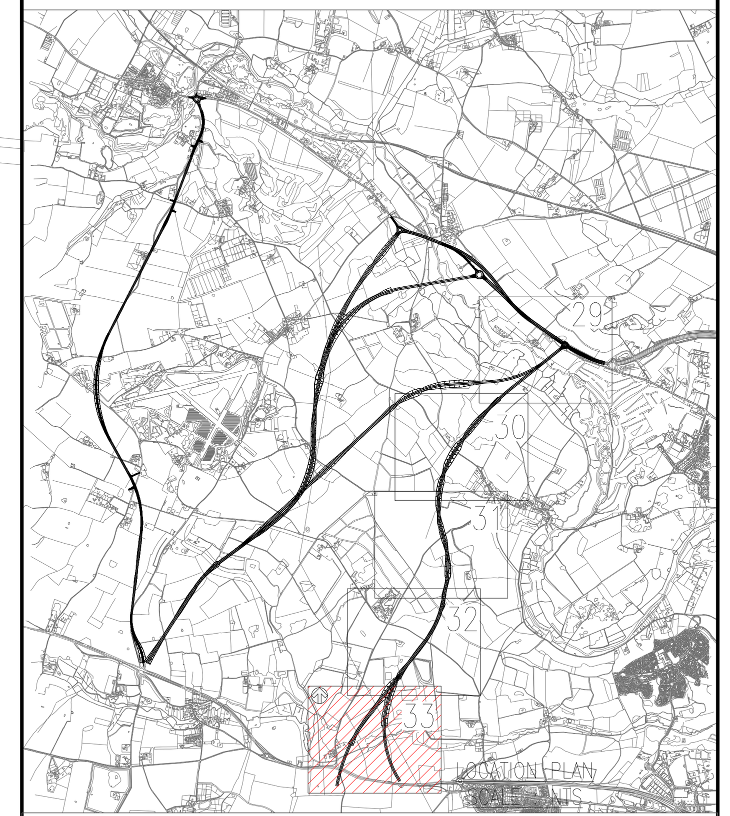

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Appendix C

GEOTECHNICAL DESK STUDY

Norfolk County Council

NORWICH WESTERN LINK

Geotechnical Desk Study – OSR Extract

70041922-WSP-GE- 001- P01
APRIL 2019

CONFIDENTIAL

Norfolk **County Council**

NORWICH WESTERN LINK

Geotechnical Desk Study – OSR Extract

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70041922

OUR REF. NO. 70041922-WSP-GE- 001- P01

DATE: APRIL 2019

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft			
Date	16/04/2019			
Prepared by	G. Spizuoco			
Signature				
Checked by	D. Lee			
Signature				
Authorised by	A. Chmoulian			
Signature				
Project number	70041922			
Report number	70041922-WSP-GE- 001- P01			
File reference				

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 SCOPE OF THE REPORT

This report presents the findings of the geotechnical desk study undertaken to review and identify potential geotechnical constraints and risks associated with the proposed developed options. It includes:

- Collation and review of the available existing historical geotechnical information within the area of study;
- Review and assessment of the anticipated geology and ground conditions;
- Preliminary engineering assessment and recommendations for design;
- A summary of geotechnical risk and recommendations.

This report does not aim to provide Archaeological, Ecological and Environmental data or assessment, which will be reported separately.

1.2 AREA OF STUDY LOCATION

Norwich performs a regional role in delivering growth and as a major employment, shopping and service centre, and a focus for transportation. Following the completion of the Northern Distributor Road (NDR), which was subsequently designated as an A-Road in the route hierarchy (A1270) and named Broadland Northway, there have been calls to complete the 'missing link' between the A47 and A1067.

The focus of this study is the north-west area of Norwich, known as the Norwich Western Quadrant (NWQ). The broad study area includes the key radial routes of the A47 trunk road, the A1074 (Dereham Road), and the A1067 (Drayton High Road / Fakenham Road).

The study area encompasses the western fringe of Norwich and settlements, including; Bawburgh, Marlingford, Honingham, Hellesdon, Drayton, Taverham, Costessey, New Costessey, Ringland, Hockering, Weston Green, Weston Longville, North Tuddenham, Primrose Green, Lenwade, Alderford, Marton, Upgate, Felthorpe, Thorpe Marriot, Horsford, Elsing and Lyng.

The Scheme location is shown in Figure A.1 in Annex A.

WSP has been commissioned by Kent County Council to undertake feasibility studies for Norwich Western link between A1067 and the A47. Four options have been shortlisted at this stage (see Figure 1-1):

- Option A
- Option B
- Option C
- Option D

1.3 SCHEME OPTIONS OVERVIEW

In this section a general description of each Option is presented. Figure 1-1 shows the proposed Option locations.

Figure 1-1 - Options location Plan

1.3.1 OPTION A

Option A comprises a single carriageway upgrade of the B1535 and a section of the A1067. This Option links to the A47 at the Wood Lane junction north of Honingham and joins the A1067 via a new junction at Lenwade. The existing bridge across the River Wensum at Attlebridge is expected to be incorporated into the alignment and therefore does not require a new crossing of the River. This option does not cross the river Tud to the south.

1.3.2 OPTION B

This Option consists of the construction of a new dual carriageway route and a dual carriageway upgrade of a section of the A1067. The new route is to the east of Weston Longville and links to the A47 at Wood Lane. Two alternatives are currently considered for the A1067 junction.

- A new junction west of Attlebridge which would be routed on the A1067 through the edge of the village and include widening of the existing River Wensum bridge.
- The construction of a new 660 metres viaduct crossing the River Wensum and joining the A167 to the east of Attlebridge.

1.3.3 OPTION C

Option C comprises a new dual carriageway route and a short section of dual carriageway upgrade of the A1067. It is intended that the new route links to the A47 at Wood Lane and would be located approximately halfway between Weston Longville and Ringland. A new 720m long viaduct is intended to cross the River Wensum flood plain and join the A1067 at a new junction. Moreover, around 400m of the A1067 would be upgraded to dual carriageway.

1.3.4 OPTION D

Option D would consist of a new dual carriageway and a short section of the dual carriageway upgrade of the A1067. The new route would pass to the west of Ringland and then cross the River Wensum on a 660m long viaduct. It would join the A1067 at a new junction and around 440m of the A1067 would be upgraded to dual carriageway. Two alternatives are currently considered for the A47 junction due to Highways England's plans to dual the section of the A47 between North Tuddenham and Easton.

- Possible connection to junction located near Blind Lane and Taverham Road, this links the Option to the A47 further east crossing the River Tud on 120m long viaduct.
- Possible connection near the current Easton roundabout. This would connect to the currently unconfirmed A47 duel carriageway widening. This option would require a new viaduct crossing of the River Wensum flood plain.

1.4 PREVIOUS STUDIES

Background information on the scheme options for the Norwich Western Link have been obtained from previous reports as summarised in Table 1-1.

Table 1-1 – Previous Studies

Document	Date	Document Reference	Produced by
Norwich Western Link Project: Technical Report	June 2016	1071962	Mouchel
Norwich Western Link Project: Preliminary Wensum Valley Bridge Optioneering Report	May 2017	Draft	Mouchel
Norwich Western Link: Technical Report	October 2017	62240378	WSP

2 SOURCE OF INFORMATION & DESK STUDY

2.1 AVAILABLE INFORMATION

This Desk Study Report has been prepared based on the information from the following sources:

2.1.1 British Geological Survey

- British Geological Survey (BGS) (1975), Geology Map, Norwich, England and Wales Sheet 161. Solid and Drift Geology. 1:50 000.
- British Geological Survey (BGS) (2014), Geology Map, Aylsham, England and Wales Sheet 147. Solid and Drift Geology. 1:50 000.BGS Norwich Sheet Memoir 161 (England and Wales), Geology of the country around Norwich.
- BGS Geology of Britain digital viewer. (https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html)

2.1.2 Envirocheck

The information received as part of the Envirocheck Report covers the four route Options and comprises data covering;

- Geology
- Hydrology
- Hydrogeology
- Land Use
- Ground Stability
- Historical development
- UXO Survey

The Envirocheck reports discussed in this Desk Study have been broken down into seven separate reports that cover the 4 scheme Options (A, B, C, D). The seven reports are titled as 'Lines' or 'Polys' depending whether they follow a Line section of the option or a Polygon area (Option B and D), where each is further divided in sections called 'Slices' , which cover a 9km^2 area. A summary of the Envirocheck reports for each Option is shown in Table 2-1.

Table 2-1 - Summary of Envirocheck Reports

Option	Line/Poly	Slice	Datasheet Report Reference	Centre Coordinates	
				Easting	Northing
Option A	Line 1	A	192634933_1_1-NWL Line 1-A	609730	312680
	Line 1	B	192634933_1_1-NWL Line 1-B	609500	315260
	Line 1	C	192634933_1_1-NWL Line 1-C	610900	316500
	Line 1	D	192634933_1_1-NWL Line 1-D	610010	317780
	Line 1	E	192634933_1_1-NWL Line 1-E	611080	317900
Option B	Line 2	A	192634933_1_1-NWL Line 2-A	609850	312380
	Line 2	B	192634933_1_1-NWL Line 2-B	611280	312960
	Line 2	C	192634933_1_1-NWL Line 2-C	610350	314150
	Line 2	D	192634933_1_1-NWL Line 2-D	611730	314830

Option	Line/Poly	Slice	Datasheet Report Reference	Centre Coordinates	
				Easting	Northing
	Line 2	E	192634933_1_1-NWL Line 2-E	611860	316440
	Poly 6	A	192634933_1_1-NWL Poly 6-A	611960	316050
	Poly 6	B	192634933_1_1-NWL Poly 6-B	613560	316280
	Poly 6	C	192634933_1_1-NWL Poly 6-C	612240	317500
	Poly 6	D	192634933_1_1-NWL Poly 6-D	613340	317350
	Line 5	A	192634933_1_1-NWL Line 5-A	613850	315670
	Line 5	B	192634933_1_1-NWL Line 5-B	615250	315440
	Line 5	C	192634933_1_1-NWL Line 5-C	613380	316920
Option C	Line 2	A	192634933_1_1-NWL Line 2-A	609850	312380
	Line 2	B	192634933_1_1-NWL Line 2-B	611280	312960
	Line 3	A	192634933_1_1-NWL Line 3-A	611470	313450
	Line 3	B	192634933_1_1-NWL Line 3-B	611710	314690
	Line 3	C	192634933_1_1-NWL Line 3-C	613610	315250
	Line 4	E	192634933_1_1-NWL Line 4-E	614550	315850
Option D	Poly 7	A	192634933_1_1-NWL Poly 7-A	612160	311160
	Poly 7	B	192634933_1_1-NWL Poly 7-B	612380	312550
	Line 4	A	192634933_1_1-NWL Line 4-A	612490	311860
	Line 4	B	192634933_1_1-NWL Line 4-B	612920	313790
	Line 4	C	192634933_1_1-NWL Line 4-C	614390	314800
	Line 4	D	192634933_1_1-NWL Line 4-D	613370	315710
	Line 4	E	192634933_1_1-NWL Line 4-E	614550	315850

Further details of the Envirocheck Reports for each option are provided in Annex B. The full Envirocheck Reports are not included as appendices within this report and are referenced as standalone documents.

The UXO reports are separated into the same seven Line and Poly reports as detailed above. A summary of the UXO reports for each option is shown in Table 2-2.

Table 2-2 - Summary of UXO Report

Option	Line/Poly	Report Reference	Centre Coordinates	
			Easting	Northing
Option A	Line 1	194238740_1_ NWL Line 1	609837	315255
Option B	Line 2	194238740_1_ NWL Line 2	610823	314082
	Line 5	194238740_1_ NWL Line 5	613969	315908
	Poly 6	194238740_1_ NWL Poly 6	612596	316439
Option C	Line 2	194238740_1_ NWL Line 2	610823	314082
	Line 3	194238740_1_ NWL Line 3	612627	314714
	Line 4	194238740_1_ NWL Line 4	613309	313834
Option D	Line 4	194238740_1_ NWL Line 4	613309	313834
	Poly 7	194238740_1_ NWL Poly 7	612136	311533

In addition to the above, the following sources have been used for gathering general information):

- Defra Magic Maps (https://magic.defra.gov.uk)_ (Hydrogeology)
- Environmental Agency (Hydrology)

2.1.3 Statutory Services

- The Statutory Services information is reported separately from this report.

2.1.4 Construction Industry Research and Information Association (CIRIA)

- CIRIA, (2002). Engineering in Chalk, C574.

3 AREA OF STUDY DESCRIPTION

3.1 TOPOGRAPHY.

Towards the south east there are some areas of steepened hill slopes along tributaries of the River Tud. Within the north east of the scheme the River Wensum lies within a wide floodplain area at the base of the valley, beyond this the ground level rises towards the town of Morton on the Hill and Royal Hill further to the east.

No site walkover has been conducted in the course of preparation of this report, due to access restrictions.

3.2 GEOLOGY

The site lies across two British Geological Survey (BGS) maps, Sheet 147 to the north and Sheet 161 to the south, which are shown in Figures A.2 and A.3 in Annex A. The geological names presented on the maps are not consistent as Sheet 161 was produced in 1975 and sheet 147, which uses the latest naming terminology, was published in 2014. All geological descriptions in this report referred to the latest BGS terminology.

The BGS 1:50,000 Geological Maps Sheets for the Norwich area and the existing ground investigation information indicate that the proposed scheme Options are underlain by the following sequence of geologies (starting from the top);

- Made Ground
- Alluvium
- Colluvium
- River Terrace Gravel
- Crag Deposits
- Glaciofluvial sands and gravels (Sheringham Cliff Formation)
- Till Members (Sheringham Cliff Formation)
- Lowestoft Formation
- Cretaceous Upper Chalk.

A combined map of the BGS Sheets 147 and 161 is presented in Figure 3-1, taken from the BGS digital database (Contains British Geological Survey materials ©UKRI 2019). The Division of the two maps is indicated by the green line and a distinct difference in the geology can be seen by the Lowestoft Till (light blue) abruptly stopping at the division between the two sheets. The changes between the two geological maps are considered to be due to the better availability of data and updated geological interpretation.

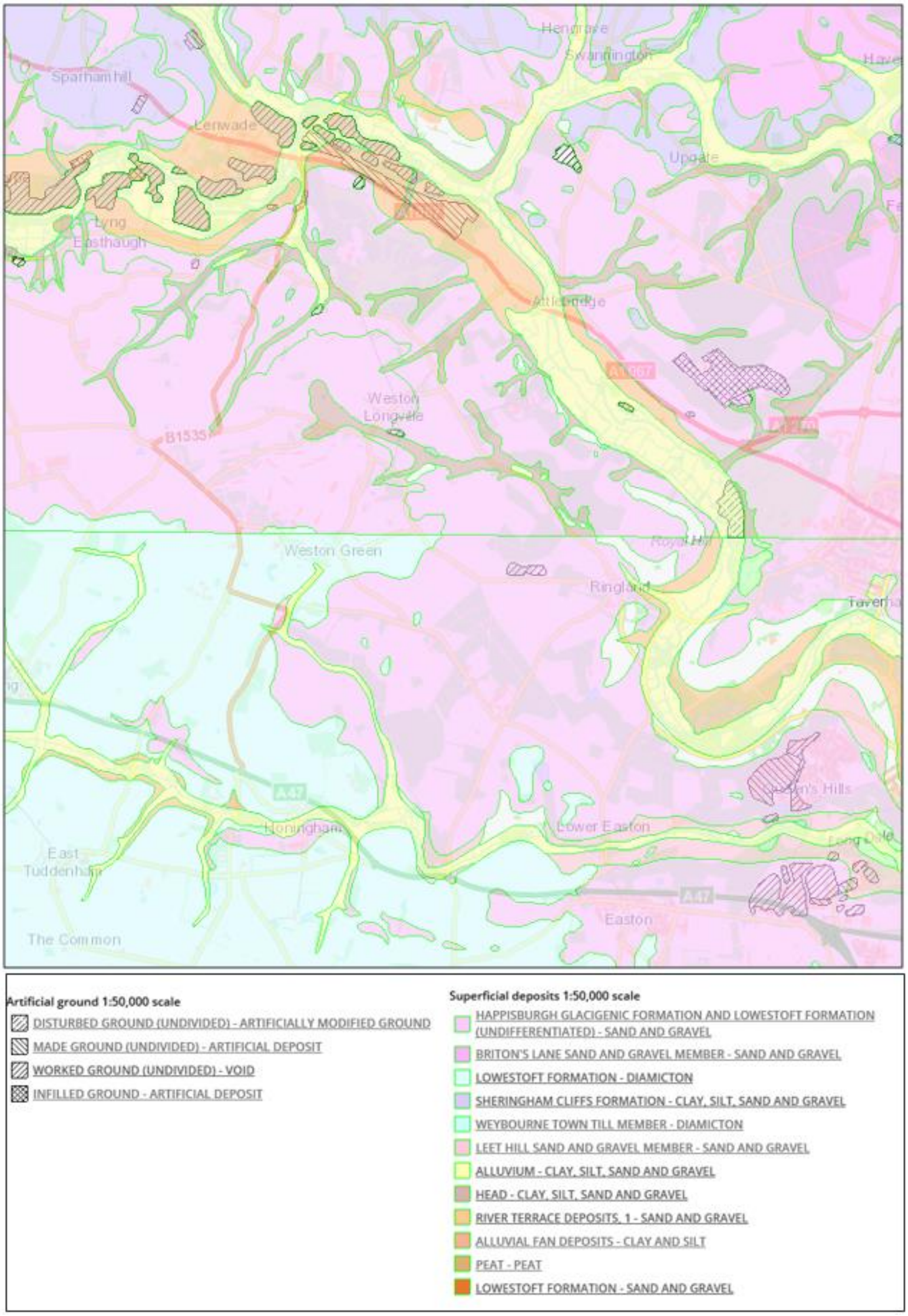

Figure 3-1 - Combined Geological Map - BGS Database (Contains British Geological Survey materials ©UKRI 2019)

Descriptions of the geology within the scheme extents, based on the available geological mapping and memoir information, are presented below.

3.2.1 MADE GROUND

Made Ground is shown to be present within the area of study, predominantly between the villages of Lenwade and Morton on the Hill, which is in the proximity of the junction between Option A and the A1067. It is described in the Envirocheck data as either Made Ground (undivided) or Worked Ground (Undivided). The material descriptions of both the Made and Worked ground are not provided in the Envirocheck data. The location of the Made Ground can be seen in Figure 3-1 to the north of the scheme.

3.2.2 ALLUVIUM

Alluvium is shown on the BGS maps to be present within both the River Wensum and River Tud valleys. This deposit is fluvial in origin and normally consists of soft to firm normally consolidated, compressible silty clay. The BGS memoir states that the Alluvium may also contain layers of silt, sand, peat and basal gravel. Within the area of the Study the Alluvium is commonly underlain by the gravels of the River Terrace Deposits. All four options extend to areas where Alluvial Deposits are expected, however only Options B, C and D include a river crossing.

3.2.3 COLLUVIUM

Colluvium (typically referred to as Head) is shown on the BGS maps to be present within the area of study. The Colluvium generally comprises gravelly and clayey sand and sandy clay, depending on the upslope source and its distance from it. These deposits are formed by solifluction and/or hillwash and are normally poorly sorted and stratified.

3.2.4 RIVER TERRACE DEPOSITS

River terrace gravels outcrop along the River Wensum valley to the north of the scheme extent. The superficial deposit of the river terrace gravels overlie the solid bedrock of the Upper Chalk, as indicated on the BGS cross section shown in Figure A.4 in Annex A. The River Terrace Deposits are typically described as Sand and Gravels with local lenses of silts, clay or peat.

3.2.5 GLACIOFLUVIAL SAND AND GRAVEL (SHERINGHAM CLIFF FORMATION)

The Glaciofluvial sands and gravels are outwash deposits derived from the local Tills and Glacial Moraines and generally comprise fine to coarse sands with flint gravel and occasional shell fragments. The Glaciofluvial Deposits are undifferentiated, often post-date the Lowestoft Till or fall between the Weybourne Town and Bacton Green Tills Members (of the Sheringham Cliffs Formation), or are encountered as layers within these deposits or as a boundary layer separating them. Within the site extents the Glaciofluvial deposits are included as the lower layers of the Sheringham Cliffs Formation that overlies the Lowestoft Formation.

3.2.6 TILL MEMBERS (SHERINGHAM CLIFF FORMATION)

Two Till Members, the Weybourne Town and Bacton Green tills, are described as being part of the Sheringham Cliff Formation. The two tills are noted as being separate from the underlying Lowestoft Till and are typically encountered as sandy gravels of chalk and flint in a clay matrix that are interlayered with the sand and gravel Glaciofluvial deposits. As shown on the BGS section (Figure A.4 in Annex A) the layering is locally contorted and typically described as chaotic.

3.2.7 LOWESTOFT FORMATION (CHALKY BOULDER CLAY)

The Lowestoft Formation (previously the Lowestoft Till & Chalky Boulder Clay) is shown on the BGS map to be mostly present west of the area of the study. BGS memoir quotes that this formation varies from a deeply weathered sandy, reddish brown flinty clay in which chalk fragments occur only below the main zone of weathering, to a slightly weathered, stiff, brownish, grey flinty clay, with chalk fragments extending almost to the top of the layer. The till is characterised by its chalk and flint content, where the chalk and flint are of various colours. It is described to be tenacious and poorly permeable.

3.2.8 CRAG DEPOSITS

The Crag Group may be encountered within the area of study. The BGS map shows that the Wroxham Crag Formation outcrops just to the north of the river Wensum and east of Lenwade, immediately overlaying the Upper Chalk formation. It comprises a variable series of sands (Crag (Granular)), laminated clays (Crag (Cohesive)) and pebbly gravels.

3.2.9 WHITE CHALK SUBGROUP

Chalk underlies the whole area of study. Within the river valleys the Chalk is shown on the BGS Geological maps to outcrop on the slopes and along the base of the valleys, in the north and south of the scheme. The BGS memoir of the Norwich area describes the Chalk as a soft, white, friable limestone. The upper chalk formation is rich in flints, which occur in bands as irregular nodules and commonly incorporate fossil remains. The top surface of the Chalk stratum is generally planar with an elevation between 10.00 and 20.00m above OD.

3.3 HYDROLOGY

Within the Norwich Western Link options area of study there are two separate water courses; the River Wensum to North and the River Tud to South. Figure 3-2 shows the flood map for the area, which shows the probability of river and sea flooding. The Option A alignment falls mostly on a flood plain area (Flood Zone 1), with the exception of a small section in the vicinity to the junction to A1067 and at the River Wensum crossing in Attlebridge that is within the Flood Zone 3. Options B, C and D cross the River Wensum flood plain (Zone 3) in the north, with Option D also crossing the River Tud flood plain (Zone 3) to the south. The surrounding lands to both river courses are categorised as Flood Zone 2 and Flood Zone 3 which hereinafter described:

- Flood Zone 1 equates to an annual probability of flooding less than 1 in 1000 (0.1%) of river or sea flooding.
- Flood Zone 2 equates to an annual probability of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) for fluvial flood risk and 1 in 200 (0.5%) for tidal flood risk.
- Flood Zone 3 is assessed as having a greater than 1 in 100 (>1%) annual probability of fluvial flooding or a greater than 1 in 200 (>0.5%) annual probability of tidal flooding.

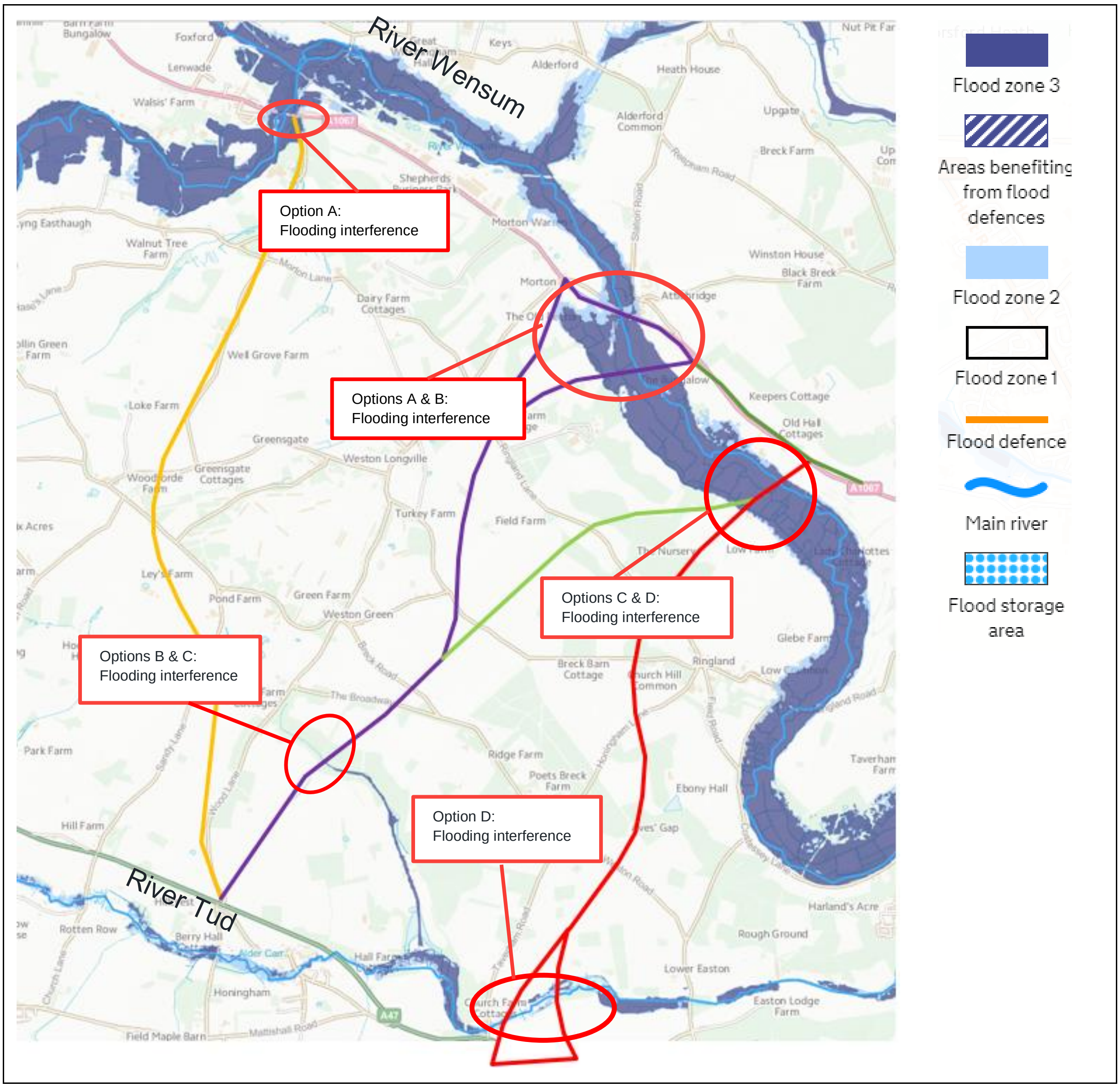

Figure 3-2 - Flood Map (Source: Environmental Agency)

3.4 HYDROGEOLOGY

The Envirocheck report classifies the Upper Chalk formation as a Principal Aquifer. These are described by the Environment Agency as "layers of rock or drift deposits that have high level of water storage". Although the formation is highly porous that allows a water to flow within the strata (greater than 30 per cent), the groundwater flow takes place predominantly through fissures in the rock.

The overlying granular drift deposits Glaciofluvial sand and Gravel are designated as a Secondary A Aquifer, which are "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". The formation has been little used for water supply, probably due to the difficulties of sinking and completing wells in such unconsolidated sediments. Within the area of study a Secondary B Aquifer presence is also shown within the these deposits. The Terrace deposits have "predominantly lower permeability layers, which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering".

The Lowestoft Formation deposits have been designated as a Secondary Undifferentiated aquifer. This classification occurs where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. As a source of water supply the Lowestoft Formation is considered to be of minor importance.

3.5 HISTORICAL DEVELOPMENT OF THE PROPOSED OPTIONS AREA

The area of study to the north, is located within the River Wensum flooding valley and the River Tud valley to the South. All the shortlisted options would pass through farmland and woodland, crossing country lanes and roads within the local network. No significant land use changes or developments have been observed over the researched period.

The area around Norwich, not specific to the site extents, are recorded to have had extensive mining and quarrying works for industrial purpose. These include clays for brick production, gravels for aggregates and Chalk for lime production. The locations of disused and closed extraction sites are indicated on the historic mapping and detailed in the Envirocheck reports. The BGS Memoir for Norwich states that the extraction of Chalk from the local area was undertaken by means of mining and underground tunnels, as well as being excavated from exposed Chalk on hillsides, where the method of 'pillar and stall' would be common. This practice was undertaken in various ages, but probably ranged from the Neolithic to Roman periods and are therefore unrecorded.

A summary of historical maps reviewed for this desk study are presented in Table 3-1. A full summary of the available historic mapping is attached in Annex C.

Table 3-1 – Summary of available historical maps

Map	Scale	Year
Norfolk	1:10,560	1883-1886
Norfolk	1:10,560	1907-1908
Norfolk	1:10,560	1938-1952
Ordnance Survey Plan	1:10,000	1957-1959
Ordnance Survey Plan	1:10,000	1973-1976
Ordnance Survey Plan	1:10,000	1982
10k Raster Mapping	1:10,000	2000
10k Raster Mapping	1:10,000	2006
10k Raster Mapping	1:10,000	2019

The following changes have been noted during the reviewed period:

- Pits for material extraction are located within the area of study. Once the extraction activities had ceased, the areas were filled to form farmland, woodland or ponds. Details and reference of the Mining sites are presented in Section 3.8;
- Within the area of study an area of land, located near Attlebridge, between the shortlisted Option A and B, was used as an Airfield for the Royal Air Force during WW2. RAF Attlebridge was opened in 1941 and was operational throughout the war before closing in 1950. Its presence is first shown on the historical map dated 1952 (Norfolk, scale 1:10,560) where it is described as disused. OS Plans dated 1975-1976 review suggests that area has been developed for an extensive poultry rearing operation at a later time. 10k Raster Mapping dated 2019 shows that part of the old airfield area has been assigned to a solar farm;
- A1067 Fakenham Road development north of the area of study (OS Plan, scale 1:10,000 dated 1975-1976);
- A47 Highway road construction south of the area of study (OS Plan, scale 1:10,000 dated 1975-1976);
- Electricity transmission lines and pylons appear in a north south alignment (dated 1975-1976);
- A1270 Broadland Northway construction including two roundabouts linking to the A1067 Fakenham Road (10k Raster Mapping dated 2019);
- Wensum Valley Golf Centre constructed (10k Raster Mapping dated 2019).

3.6 EXISTING MAN-MADE FEATURES

The extent of all of the Study (including all Options considered in this Report) cover an approximate area of 25km^2, between the A1067 in the north and the A47 to the south, as shown on Figure A.1 in Annex A.

In addition to the historical developments detailed in Section 3.5 the following Man-Made features are present within the scheme extents;

- Towns; Lenwade, Hockering, Morton, West Longville, Weston Green, Honingham, Attlebridge, Ringland, Easton and Tavernham.
- Main and Secondary Roads (>4m); A47, A1067, B1535, Ringland Ln, Paddy's Lane, Marl Hill Road
- Named Roads (less than 4m wide); Morton Lane, Rectory Road, Sandy Lane, The Boadway, Breck Road, Honingham Lane, Taverham Road and Ringland Road.
- Utilities; Overhead power lines, National Grid Pipeline, The old Airfield solar and Wind Farm.
- Attractions; Dinosaur Adventure park, Weston Park Golf Club, Weston Equestrian Centre and Wensum Valley Hotel Golf and Country Club

The Envirocheck records indicate that a National Grid pipeline crosses the site in a north east to south west orientation. Details of from the Envirocheck reports are presented in Table 3-2.

Table 3-2 - Envirocheck Gas Pipeline Summary

Envirocheck Structure Name	Item Name	Structure Description	Easting	Northing	Line Ref	Slice	Distance from site	Option(s)
Gas Pipeline	FM03 - Bacton to Roudham Heath	900mm diameter - Active - Owned By National Grid	610053	312393	1	A	138	A
			609994	312296	2	A	89	B,C
			610840	313244	2	B	89	B,C
			612118	314134	2	D	89	B,C
			611411	313597	3	A	272	C
			612049	314095	3	B	272	C
			613922	314787	3	C	272	C
			612697	314284	4	B	0	D
			614206	315017	4	C	0	D
			614726	315310	4	E	0	D
			614304	315098	5	A	134	A,B
			615192	315506	5	B	134	A,B

From the mapping provided in the Envirocheck reports the Gas Pipeline is shown to cross Option D only, at a location to the north west of the town of Ringland.

3.7 UNEXPLODED ORDNANCE (UXO)

A preliminary assessment of the Unexploded Ordinance (UXO) risk for all the Norwich Western Link proposed options has been undertaken and the findings are presented in Annex E. The reports identify that at locations along Option A, Option B and C, due to their proximity to the old Airfield, require a detailed UXO threat and risk assessment. The old Airfield (RAF Attlebridge) has been assessed as being likely to contain WWI and WWII ordnance and would warrant further action to be undertaken.

No other areas of potential UXO hazards are identified within the scheme extents.

3.8 MINING AND QUARRYING

Table 3-3 is a summary of the BGS Recorded Mineral Sites within 250m of the shortlisted option extents. Further details of the Envirocheck report information of mining and quarrying is included in Annex D. A global map of the Mining and Quarrying locations, produced from the Envirocheck records, is included as Figure A.10 in Annex A.

Table 3-3 – BGS Recorded Mineral Sites

Location Ref	Option in proximity	Map ID	Name	Type	Status	Commodity	Estimated distance from site (m)	Location (NGR)
1	A	Line 1 - Slice A - 1	Old Covert Marl Pit	Opencast	Ceased	Common Clay and Shale	0	609663, 313174
2	A, B, C	Line 1 - Slice A - 2	Honingham Pit	Opencast	Ceased	Common Clay and Shale	72	609835, 312191
3	A	Line 1 - Slice A - 3	Honingham Pit	Opencast	Ceased	Common Clay and Shale	96	609605, 312422
4	A	Line 1 - Slice A - 4	Honingham Pit	Opencast	Ceased	Common Clay and Shale	101	609536, 312603
5	A	Line 1 - Slice A - 5	Honingham Pit	Opencast	Ceased	Common Clay and Shale	138	609877, 312531
6	A, B, C	Line 1 - Slice A - 6	Honingham Pit	Opencast	Ceased	Common Clay and Shale	157	609822, 312097
7	A	Line 1 - Slice A - 7	Sandy Lane Marl Pit	Opencast	Ceased	Common Clay and Shale	249	609408, 313174
8	A	Line 1 - Slice B - 1	Hungate Common Pit	Opencast	Ceased	Sand and Gravel	25	609375, 315492
9	A	Line 1 - Slice B - 2	Well Grove Gravel Pit	Opencast	Ceased	Chalk	35	609700, 316456
10	A	Slice B - 2	Well Grove Gravel Pit	Opencast	Ceased	Sand and Gravel	35	609700, 316456
11	A	Line 1 - Slice B - 3	Hungate Common Pit	Opencast	Ceased	Sand and Gravel	79	609433, 315504
12	A	Line 1 - Slice D - 1	Lenwade Bridge Gravel Pit	Opencast	Ceased	Sand and Gravel	118	610400, 318360
13	A	Line 1 - Slice D - 2	Lenwade Plantation Marl Pit	Opencast	Ceased	Common Clay and Shale	136	610553, 318055

Location Ref	Option in proximity	Map ID	Name	Type	Status	Commodity	Estimated distance from site (m)	Location (NGR)
14	A	Line 1 - Slice D - 3	Weston Hall Marl Pit	Opencast	Ceased	Chalk	203	610085, 317760
15	B, C	Line 2 - Slice A - 1	Honingham Pit	Opencast	Ceased	Common Clay and Shale	37	609877, 312531
16	A ,B, C	Line 2 - Slice A - 2	Honingham Pit	Opencast	Ceased	Common Clay and Shale	72	609835, 312191
17	A ,B, C	Line 2 - Slice A - 3	Honingham Pit	Opencast	Ceased	Common Clay and Shale	157	609822, 312097
18	B, C	Line 2 - Slice A - 4	Old Covert Marl Pit	Opencast	Ceased	Common Clay and Shale	175	609981, 312928
19	B, C	Line 2 - Slice A - 5	Honingham Pit	Opencast	Ceased	Common Clay and Shale	201	609605, 312422
20	B, C	Line 2 – Slice C - 1	Mousewood Farm Clay Pit	Opencast	Ceased	Common Clay and Shale	189	610345, 313428
21	B	Line 2 – Slice D - 1	High House Pit	Opencast	Ceased	Common Clay and Shale	0	611627, 315365
22	B	Line 2 – Slice D - 2	High House Pit	Opencast	Ceased	Common Clay and Shale	111	611727, 315009
23	B	Line 2 – Slice D - 3	High House Pit	Opencast	Ceased	Common Clay and Shale	153	611780, 315107
24	C	Line 3 - Slice C - 1	Rose Carr Marl Pit	Opencast	Ceased	Chalk	130	613295, 315398
25	D	Line 4 - Slice A - 1	Brickkiln Plantation Pit	Opencast	Ceased	Common Clay and Shale	92	612469, 312346
26	D	Line 4 - Slice B - 1	Blackbreck Plantation Gravel Pit	Opencast	Ceased	Sand and Gravel, Chalk	50	612971, 314030

Location Ref	Option in proximity	Map ID	Name	Type	Status	Commodity	Estimated distance from site (m)	Location (NGR)
27	D	Line 4 - Slice B - 2	Langrow Lane Marl Pit	Opencast	Ceased	Chalk	78	613007, 314639
28	A, B, C, D	Line 4 – Slice E - 1	Attlebridge Hall Marl Peat	Opencast	Ceased	Chalk	63	614187, 315709
29	A, B, C, D	Line 5 - Slice A - 1	Attlebridge Hall Marl Peat	Opencast	Ceased	Chalk	22	614187, 315709
30	A, B, C, D	Line 5 - Slice A - 1	Attlebridge Hall Marl Peat	Opencast	Ceased	Chalk	105	613398, 316489
31	B	Poly 6 – Slice A - 1	Scotchwood Hills Marl Pit	Opencast	Ceased	Chalk	0 (within the polygon area)	612325, 316472
32	B	Poly 6 – Slice A - 2	Scotchwood Hills Marl Pit	Opencast	Ceased	Chalk	0 (within the polygon area)	612306, 316519
33	B	Poly 6 – Slice A - 3	Morton Hall Marl Pit	Opencast	Ceased	Chalk	75	612463, 316148
34	A, B, C, D	Poly 6 – Slice B - 1	Attlebridge Hall Marl Peat	Opencast	Ceased	Chalk	122	613398, 316489
35	D	Poly 7 - Slice A - 1	Church Farm Pit	Opencast	Ceased	Common Clay and Shale	0 (within the polygon area)	612019, 311141
36	D	Poly 7 - Slice A - 2	Blind Lane Pit	Opencast	Ceased	Common Clay and Shale	121	611917, 310907
37	D	Poly 7 - Slice A - 3	Harman'S Grove Pit	Opencast	Ceased	Chalk	140	612468, 311759

The presence of multiple historic mines and pits located within the site extents presents a risk for the scheme. Limited information is known about the pits construction or the filling works undertaken. Some locations are also identified as being unfilled and remain as ponds, with no details on the depth of the excavation. There are a total of 37 mine and pit locations that are known within the site extents and there is the potential risk of further unrecorded locations being present. All material extraction sites are recorded as being Opencast mines, as deep unknown excavations they represent a greater risk to the scheme, which is further discussed in Section 5.

3.9 GROUND STABILITY

The potential geological risk ranges along the proposed routes have been widely identified and classified in the Envirocheck Report as follows:

- Potential for Collapsible Ground Stability Hazard – Very low
- Potential for Compressible Ground Stability Hazard – Moderate
- Potential for Ground Dissolution Stability Hazard – High
- Potential for Landslide Ground Stability Hazard – Very low, Low
- Potential for Running Sand Ground Stability Hazard - Low
- Potential for Shrinking or Swelling Clay Ground Stability Hazard – Very low, Low.

The presence of potentially erodible rocks, i.e. Chalk, have been identified as a potential hazard at locations within the scheme extents. The presence of this material raises the risk that numerous dissolution features may be encountered during construction. It is recommended that further investigation be undertaken to identify the presence of potential difficult ground conditions and potential for localised subsidence, to mitigate risks during the construction phase.

The location of the high risk areas are showed in the Envirocheck Ground Stability Data in Annex D. A summary of the relevant map references is reported in Table 3-4.

Table 3-4 – Potential for Ground Dissolution Stability Hazard

Map ID (Line Number, Slice Letter)	Hazard Level on site	Hazard Level in the vicinity of the site	Option
NWL Line 3 – Slice C	High	High	C
NWL Line 4 – Slice D	High	Moderate	D
NWL Line 4 – Slice E	High	NA	D
NWL Line 5 – Slice A	High	Moderate	A, B, C, D
NWL Line 6– Slice A	High	Moderate	B
NWL Line 6– Slice B	High	NA	B

4 GROUND CONDITIONS

4.1 INTRODUCTION

This section summarises the anticipated ground conditions within the area of study, based on the historical boreholes records obtained from BGS online database.

A list of the historical boreholes logs covering the area of study is presented in Annex F. Figure 4-1 shows the historical boreholes location plan and the section lines approximately representing the anticipated ground conditions along the individual Options. Detailed maps showing the historic borehole locations are included on Drawings 70041922-WSP-GE-SK-001-01 through to 70041922-WSP-GE-SK-001-06.

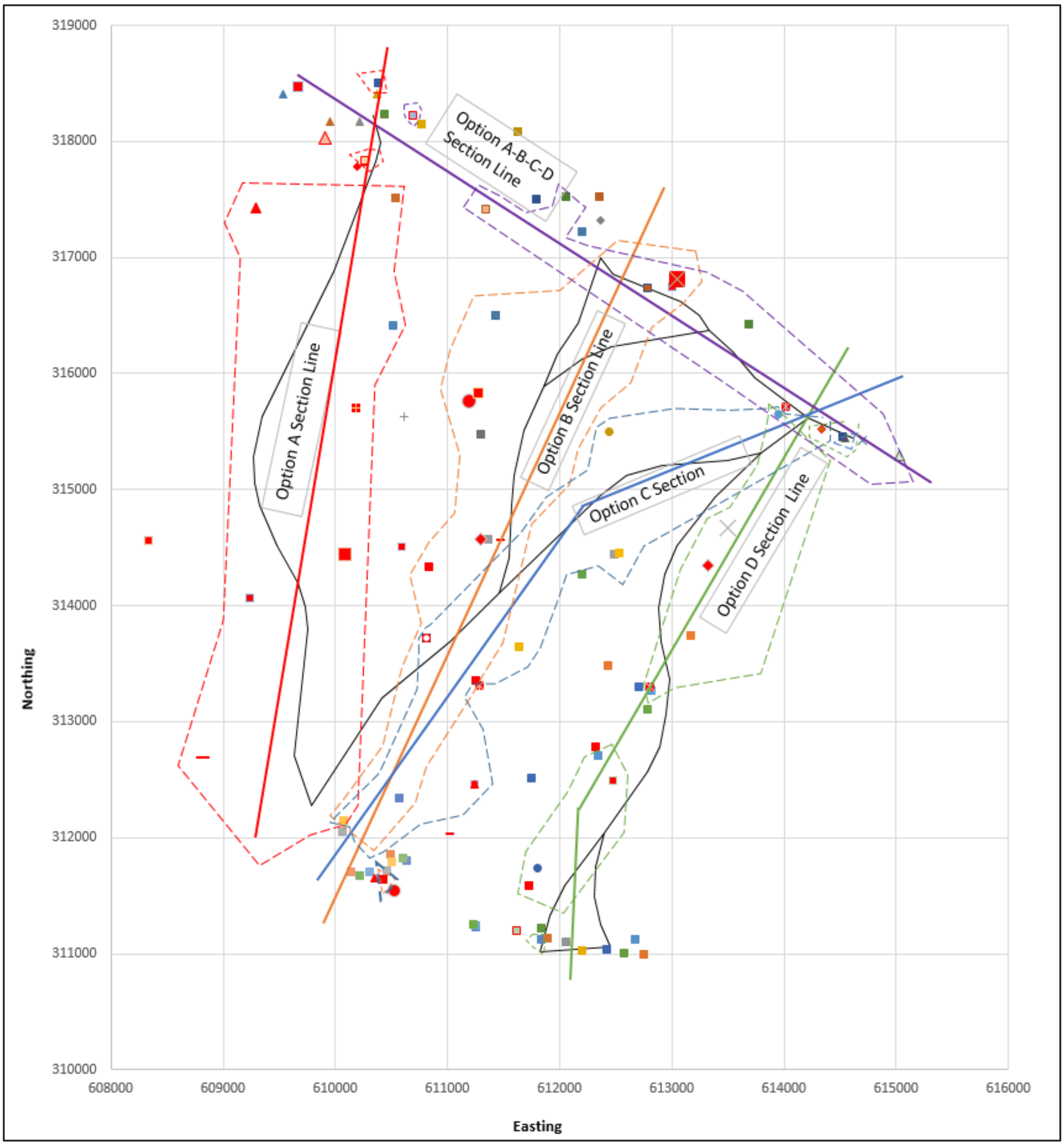

Figure 4-1 – Plan Showing Locations of the BGS Historical Boreholes

Descriptions of the soil deposits encountered in historical boreholes are summarised hereinafter.

4.1.1 ALLUVIUM

No alluvial deposits were recorded in the available historical borehole logs. However, alluvium is likely to be encountered locally within the river Wensum and river Tud valleys as indicated on the BGS maps. The alluvial deposits are likely to comprise soft cohesive materials at locations with the schemed where the proposed bridges and viaducts are to be located.

4.1.2 COLLUVIUM

No Colluvium was recorded in the reviewed historical borehole logs. However, this drift deposits might be encountered locally at the base of the surrounding valley slopes. As detailed in Section 2, this material is likely to comprise a mixture of the local geologies from the valley formation.

4.1.3 RIVER TERRACE DEPOSITS

River Terrace Deposits were encountered in historical investigations along the West - East alignment within the river Wensum valley area. The deposits are generally dominated by fine to coarse sub-angular flint gravel, with traces of fine sub-rounded quarts and layers of medium to fine, with some coarse, sands and flints.

4.1.4 GLACIOFLUVIAL SAND & GRAVEL

Glaciofluvial deposits were observed in historical investigations along the shortlisted option areas. This formation is locally encountered in alternation with Tills (Boulder Clay) and comprises:

- fine sub-angular gravel with sub-rounded flint and occasional hard chalk;
- fine sand with medium sub-angular to sub-rounded flint.

4.1.5 TILL MEMBERS

Tills were encountered in historical investigations and is generally described as soft to firm silty, sandy, chalky clay with fine to coarse round chalk gravel and occasional flint cobbles. The tills encountered within alternating layers with the Glaciofluvial Sand and Gravels are possibly the Weybourne Town Till and the Bacton Green Till Members, as indicated on the BGS Sections presented in Figure A.4 (Annex A). A base layer of Till of the Lowestoft formation is also shown to be present, but specific classification of the Till layers cannot be made without further investigation and review of the geotechnical parameters. Therefore, all Till encountered is referred to as Till Members.

4.1.6 CRAG DEPOSITS

Crag deposits were encountered in the historical investigations, predominantly in small outcrops, within the eastern section of the area of study. This formation comprises mainly soft clayey silty Sand and flint gravel.

4.1.7 UPPER CHALK

The local bedrock for the whole area of study consists of the upper chalk formation. This formation was encountered in all adequately deep historical boreholes. The logs describe the bedrock to be soft to firm chalk that is locally rich in flint content.

4.2 OPTION A – GEOLOGICAL SECTION

The anticipated ground conditions for the proposed Option A have been inferred considering:

- No 10 Historical Boreholes along the North – South alignment;

A geological section for Option A is presented in Figure A.5 in Annex A.

Table 4-1 – Option A: BGS Historical Boreholes, North – South Alignment

Alignment	Borehole ID	Depth [m]	Coordinates [E,N]
North - South	TG11NW2	12.19	610380,31850
	TG11NW60 (tg11NW83)	44.20	610200,317780
	TG11NW3	20.60	610540,317510
	TG01NE51	30.10	609290,317430
	TG11NW4	15.24	610510,316420
	TG11NW71	43.90	610180,315700
	TG11SW48	51.81	610080,314440
	TG01SE7	106.68	609240,314070
	TG01SE71	42.70	608820,312690
	TG11SW118	10.00	610070,313150

Table 4-2 – Option A: Summary of Ground Conditions, North – South Alignment

Strata	Type	Thickness [m]
Alluvium	Cohesive	Not encountered
River Terrace Deposits	Granular	3.05 – 11.30
Glaciofluvial Sand & Gravel	Granular	1.50 – 21.32
Till Members – Chalky Boulder Clay	Cohesive	0.90 – 11.28
Crag Deposits	Granular	Not encountered
Upper Chalk	Bedrock	N/A

4.3 OPTION B – GEOLOGICAL SECTION

The anticipated ground conditions for the proposed Option B have been inferred considering:

- No 17 Historical Boreholes along the North – South alignment.

A geological long section for Option B is presented in Figure A.6 in Annex A.

Table 4-3 - Option B: BGS Historical Boreholes, North – South Alignment

Alignment	Borehole ID	Depth [m]	Coordinates [E,N]
North - South	TG11NW77	48.77	613050,316810
	TG11NW53	33.83	613000,316750
	TG11NW14	10.36	612780,316740
	TG11NW9	24.38	611430,316500
	TG11NW50	49.84	611280,315820
	TG11NW97	60.96	611200,315760
	TG11NW15	20.07	612440,315500
	TG11NW10	15.24	611300,315480
	TG11SW121	41.45	611470,314560
	TG11SW6	19.80	611360,314570
	TG11SW122	54.90	611290,314570
	TG11SW54	53.65	610830,314330
	TG11SW59/B	121.92	610810,313720
	TG11SW129	64.53	611250,313350
	TG11SW3	17.40	610570,312340
	TG11SW118	10.00	610070,312150
	TG11SW53	24.38	610430,311640

Table 4-4 - Option B: Summary of Ground conditions, North – South Alignment

Strata	Type	Thickness [m]
Alluvium	Cohesive	Not encountered
River Terrace Gravel	Granular	3.05 – 9.50
Glaciofluvial Sand & Gravel	Granular	0.90 – 41.14
Till Members – Chalky Boulder Clay	Cohesive	1.20 – 15.69
Crag Deposits	Granular	4.57 – 12.19
Upper Chalk	Bedrock	N/A

4.4 OPTION C – GEOLOGICAL SECTION

The anticipated ground conditions for the proposed Option C have been inferred considering:

- No 12 Historical Boreholes along the North – South alignment.

A geological long section for Option B is presented in Figure A.7 in Annex A.

Table 4-5 - Option C: BGS Historical Boreholes, North – South Alignment

Alignment	Borehole ID	Depth [m]	Coordinates [E,N]
North - South	TG11NW99	20.45	614337,315519
	TG11NW25	14.90	614540,315450
	TG11NW20	10.05	613950,315650
	TG11NW15	20.72	612440,315500
	TG11SW11	18.89	612530,314450
	TG11SW7	18.28	611640,313650
	TG11SW59/B	121.92	610810,313720
	TG11SW129	64.53	611250,313350
	TG11SW37B	53.84	611240,312460
	TG11SW3	17.37	610570,312340
	TG11SW118	10.00	610070,312150
	TG11SW53	24.38	610430,311640

Table 4-6 - Option C: Summary of Ground conditions, North – South Alignment

Strata	Type	Thickness [m]
Alluvium	Cohesive	Not encountered
River Terrace Deposits	Granular	9.10
Glaciofluvial Sand & Gravel	Granular	5.20 – 27.40
Till Members – Chalky Boulder Clay	Cohesive	2.44 – 10.00
Crag Deposits	Granular	8.00
Upper Chalk	Bedrock	N/A

4.5 OPTION D – GEOLOGICAL SECTION

The anticipated ground conditions for the proposed Option D have been inferred considering:

- No 12 Historical Boreholes along the North – South alignment.

A geological long section for Option B is presented in Figure A.8 in Annex A.

Table 4-7 - Option D: BGS Historical Boreholes, North – South Alignment

Alignment	Borehole ID	Depth [m]	Coordinates [E,N]
North - South	TG11NW99	20.45	614337, 315519
	TG11NW100	17.50	614522, 315459
	TG11NW25	14.90	614540, 315450
	TG11SW16	20.40	613500, 314670
	TG11SW130	80.00	613320, 314350
	TG11SW17	7.60	613170, 313740
	TG11SW100	65.00	612800, 313300
	TG11SW13	23.10	612340, 312710
	TG11SW39	48.77	612470, 312490
	TG11SW9	21.9	611800, 311740
	TG11SW41	35.38	611720, 311590
	TG11SW36	16.76	611830, 311120

Table 4-8 - Option D: Summary of Ground conditions, North – South Alignment

Strata	Type	Thickness [m]
Alluvium	Cohesive	Not encountered
River Terrace Gravel	Granular	Not encountered
Glaciofluvial Sand & Gravel	Granular	1.80 – 36.58
Till Members – Chalky Boulder Clay	Cohesive	2.10 – 15.39
Crag Deposits	Granular	2.70 – 8.00
Upper Chalk	Bedrock	N/A

4.6 A1067 - GEOLOGICAL SECTION (NORTHERN BOUNDARY)

The anticipated ground conditions along the A1067 geological section has been inferred considering:

- No 15 historical Boreholes along the West – East alignment.

This comprises a part of the studied Options A and B

A geological long section for the A1067 alignment is presented in Figure A.9 in Annex A.

Table 4-9 - A1067: BGS Historical Boreholes, West – East Alignment

Alignment	Borehole ID	Depth [m]	Coordinates [E,N]
West- East	TG11NW63	48.20	610690,318220
	TG11NW83?	44.20	610200,317780
	TG11NW8	8.83	611340,317420
	TG11NW13	24.38	612050,317520
	TG11NW14	10.36	612780,316740
	TG11NW77	48.80	613050,316810
	TG11NW53	33.80	613000,316750
	TG11NW19	24.38	613690,316430
	TG11NW20	10.05	613950,315650
	TG11NW29	33.53	614020,315710
	TG11NW99	20.45	614337,315519
	TG11NW100	17.50	614522,315459
	TG11NW25	14.90	614540,315450
	TG11NW101	12.50	614693,315419
	TG11NE41	24.38	615030,315290

Table 4-10 – A1067: Summary of Ground conditions, West – East Alignment

Strata	Type	Thickness [m]
Alluvium	Cohesive	Not encountered
River Terrace Deposits	Granular	3.05 – 9.10
Glaciofluvial Sand & Gravel	Granular	2.13 – 14.00*

Strata	Type	Thickness [m]
Till Members – Chalky Boulder Clay	Cohesive	1.20 – 19.20
Crag Deposits	Granular	2.00 – 8.00
Upper Chalk	Bedrock	N/A
*potential buried channel within chalk identified, in TG11NW77. Grey sand filling channel with thickness of 25.90m – depth removed from summary above		

4.7 SOIL CHEMISTRY

The following are BGS estimations for the soil chemistry within the area of study for all Options, provided in the Envirocheck Reports.

- Arsenic concentrations are less than 15 mg/kg;
- Cadmium concentrations are less than 1.8 mg/kg;
- Chromium concentrations range between 20 mg/kg and 60 mg/kg.
- Lead concentration are less than 100 mg/kg.
- Nickel concentrations are less than 15 mg/kg. However, concentrations ranged between 15 -30 mg/kg along the Option C alignment.

5 PRELIMINARY ENGINEERING ASSESSMENT

5.1 DESIGN IMPLICATIONS OF EACH SOIL TYPE

Presented below is a summary of the geotechnical considerations for each soil type that are anticipated to be encountered along the proposed Norwich Western Link scheme, for all options.

5.1.1 MADE GROUND

Made Ground was not encountered in any historic borehole within the scheme extents, however, it is indicated on the BGS maps that it is likely to be present along the banks of the river Wensum, at locations of historic quarrying. This stratum poses geotechnical risks due to the unknown nature of the material, as well as the possible presence of soft spots (areas of low strength soils e.g. due to decomposing waste, loose soils or soft clays) and the presence of contamination. Made Ground could also contain hard materials (e.g. dumped cemented materials, obstructions etc.). The nature and depth of Made Ground around structures or below any highway earthworks would need to be verified during a ground investigation and considered during the design phase of the project.

5.1.2 ALLUVIUM

No alluvial deposits were encountered in the historic borehole logs, however the presence of the deposit is indicated in the BGS mapping along the river and tributary valleys within the site. The BGS memoir stipulates that Alluvium is 'normally consolidated, generally composed of silt or clay, with high compressibility exacerbated by peat beds'. The deposits may be just over 1m thick, but can be up 5m thick around Norwich. Typically, the deposits are characterised by low bearing capacity and poor foundation conditions due to high and/or uneven settlement. Running sand conditions may be encountered in excavations below the water table, which may require immediate support. Alluvium will adversely affect the buildability and long-term performance of structures and earthworks.

5.1.3 COLLUVIUM

Colluvium deposits are noted on the BGS mapping as being present in the river valleys. The deposits are typically comprised of unconsolidated sediment of the upslope source and can include a variable mixture of poorly stratified material that is difficult to define. The deposits can have the potential risk of remaining undetected in locations where slopes are being re-profiled, which can lead to defects and unstable earthworks.

5.1.4 RIVER TERRACE DEPOSITS

The River Terrace Gravels comprise well consolidated, coarse granular material in which the module of elasticity is relatively high. Therefore, it's unlikely that this material can influence the total settlements, however, as this strata is overlaid by relatively soft Alluvium, different deformation behaviour can effect the differential settlement.

5.1.5 GLACIOFLUVIAL SAND & GRAVEL

The Glaciofluvial deposit are expected to be the predominate superficial geology within the scheme extents. The strata is typically granular, rich in flint and chalk gravel content and is expected to provide a relatively competent subgrade material, where deformability will be low. The strata, however, was found in the historic borehole logs, to be interbedded with local Till Members that presents the risk of differential settlement occurring, as well as the risk of potential soft spots (areas of low strength soils) being present within the granular strata.

5.1.6 TILL MEMBERS

The Till Members deposits encountered were described as soft to firm variable deposits of silty, sandy, chalky clay with chalk gravel that lies within alternating layers with the Glaciofluvial Sand and Gravels as indicated on the BGS section and historic borehole logs. The interbedded nature of the strata raises the risks of differential settlement occurring for shallow founded structures within the scheme.

5.1.7 UPPER CHALK

Upper Chalk was encountered underlying the superficial deposits within the site and is noted to outcrop at several locations along the river valleys to the north and south. The Upper Chalk within the site is characterised as having low strength, which permitted the extensive quarrying in the region. The following characteristics of Chalk have been identified as potential risks within the scheme;

- Stability issues due to weathered fracturing, dissolution features, mining/quarrying and voids filling with unsuitable material.
- The presence of reworked Chalk within the scheme remaining undetected, either occurring naturally or as a result of earthworks in intact Chalk, leading to stability issues.
- Areas of Chalk that are a major aquifer within the region, having exposed outcrops along the river valleys, close to the proposed scheme.

Chalk is the major aquifer for potable water in the UK and has therefore to be treated sensitively in this respect. There is an onus on all engineering projects to ensure that the aquifer is adequately protected during any form of engineering construction practice.

5.2 CUTTINGS

The requirement for cutting earthworks within the scheme options is limited and mostly confined to the areas between the river valleys. It is understood that the cuttings could possibly be up to 7m deep. It is expected that cuttings will be excavated within variable and interblended Glaciofluvial Strata and Till Members, but can also include Made Ground, Crag, Chalk and locally Alluvium.

It is expected that Glacial deposits will be possible to reuse in the construction of embankments. Made Ground and Alluvium are unlikely to be possible to reuse. Chalk may potentially be reused in the construction embankments, depending on the degree of weathering of the existing deposit, groundwater levels and site constraints.

The slopes of the cuttings could at the moment be assumed to have to be excavated at gradients between 1v:2.5h and 1v:3h, depending on the ground profile. This will be confirmed after completion of the project-specific ground investigation.

5.3 EMBANKMENTS

The general embankment earthworks, away from the river valley crossings can potentially be constructed on the top of the existing natural soil foundation, where it is comprised of competent glacial deposits.

Where the proposed embankments are to cross areas of poor quality local ground and/or poorly compacted Made Ground, ground improvement will be required.

The approach embankments for the river crossings, included in the proposed Options B, C and D, are anticipated to be within the lower valley regions of the Wensum and Tud rivers. The superficial deposits of the Alluvium and Colluvium local to these regions raises the risk of instability and settlement of embankment earthworks. An increased risk to the proposed earthworks within these areas can be expected from their location within a high flooding risk zone. Depending on the height of the bridge approach embankments these may have to be constructed either on piled foundations or using some ground improvement technique.

5.4 FOUNDATIONS FOR STRUCTURES

Bridge and viaducts are to be located in the lower valley areas where the Upper Chalk bedrock is shown in the BGS maps to be present at shallow depths, underlying the superficial deposits of the Alluvium and Terrace Gravels, as well as being exposed at surface level in some areas.

Considering that the river crossings have to pass through an SAC, where the effect of structures has to be minimised, these structures are likely to be supported on piles. Designs of the piled foundations in Chalk will follow the guidance of CIRIA Report C574.

5.5 EXISTING GEOTECHNICAL PROBLEMS

No existing geotechnical problems, in addition to the geotechnical considerations for each soil type as detailed in Section 5.1, are known to be present within the scheme extents.

5.6 EFFECTS OF MAN-MADE FEATURES

The mining and quarrying of Chalks, Terrace Gravel and Boulder Clays has in the past taken place extensively within the site extents. Most mineral extraction locations are recorded, but details of the depth and extents of the excavations are not know in detail. The unknown details of mines pose a subsidence and ground instability hazard and unrecorded mining locations have the potential to cause programme delays and additional investigation and design work. The BGS Memoir documents cases of the collapse of mining tunnels around Norwich city centre, although they are not specific to the scheme extents, they have the potential to cause considerable damage during and after construction.

The National Grid 'Bacton to Roudham Heath' gas pipeline is recorded to pass through the site, crossing the Option D alignment and running parallel, within 100m to Options B and C in the south of the scheme.

The location of disused RAF Attlebridge airfield, to Options A and B, has the potential risk for the presence of UXOs within the surrounding area.

6 RECOMMENDATIONS

- A number of risks have been identified in this Desk Study. A project specific Ground Investigation shall be required for the selected alignment option and for any structures, to establish the detailed ground conditions. This shall be designed in accordance with Eurocode 7.
- Piled foundations are recommended for sensitive structures traversing the river valleys, to achieve sufficient bearing capacity and to mitigate the effects of settlement.
- Chalk mining, sinkholes and dissolution features present a general risk for the development. The design shall take into consideration the associated risks and include the mitigation measures.
- Known quarrying locations within the vicinity of the chosen option should be investigated to determine potential hazards
- All works taking place within the river flood zones and the SAC area should be undertaken in accordance with a particular reference to the EA guidelines and shall be subject to the EA approvals.
- For all aspects of the design, including but not limited to the carriageway, highways structures and bridge piling should incorporate the prevention and mitigation measures for the protection of the primary Chalk aquifer within the scheme.
- A detailed UXO Desk Study shall be required for the selected Option, where the particular risks have been highlighted by the preliminary UXO Desk Study Reports.
- Utility information shall be required before any investigation works commence.

7 DRAWINGS AND PHOTOGRAPHS

DRAWING TITLE	REFERENCE	VERSION
LOCATIONS OF HISTORIC EXPLORATORY HOLES SHEET 01	70041922-WSP-GE-SK-001-01	P01
LOCATIONS OF HISTORIC EXPLORATORY HOLES SHEET 02	70041922-WSP-GE-SK-001-02	P01
LOCATIONS OF HISTORIC EXPLORATORY HOLES SHEET 03	70041922-WSP-GE-SK-001-03	P01
LOCATIONS OF HISTORIC EXPLORATORY HOLES SHEET 04	70041922-WSP-GE-SK-001-04	P01
LOCATIONS OF HISTORIC EXPLORATORY HOLES SHEET 05	70041922-WSP-GE-SK-001-05	P01
LOCATIONS OF HISTORIC EXPLORATORY HOLES SHEET 06	70041922-WSP-GE-SK-001-06	P01

8 REFERENCES

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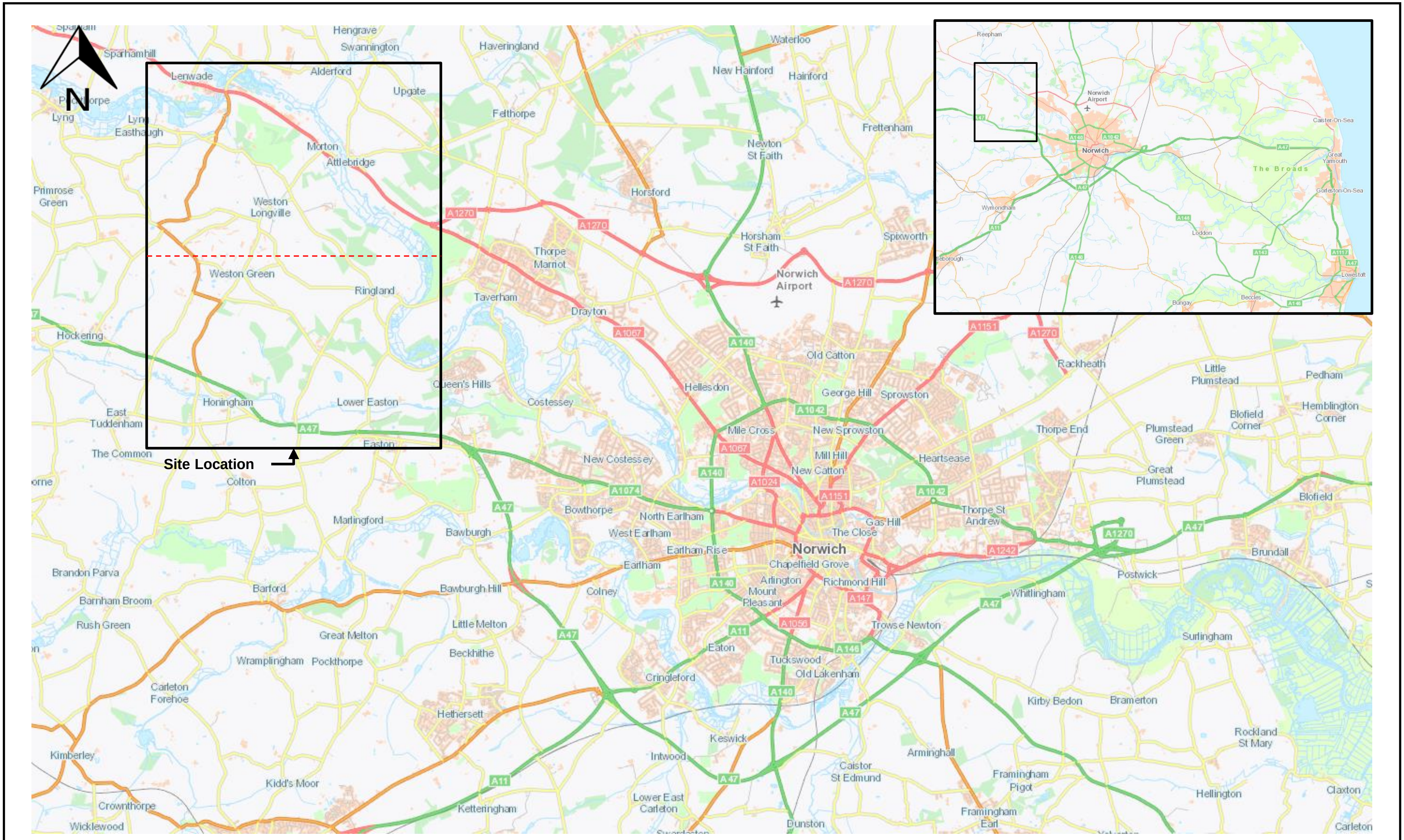
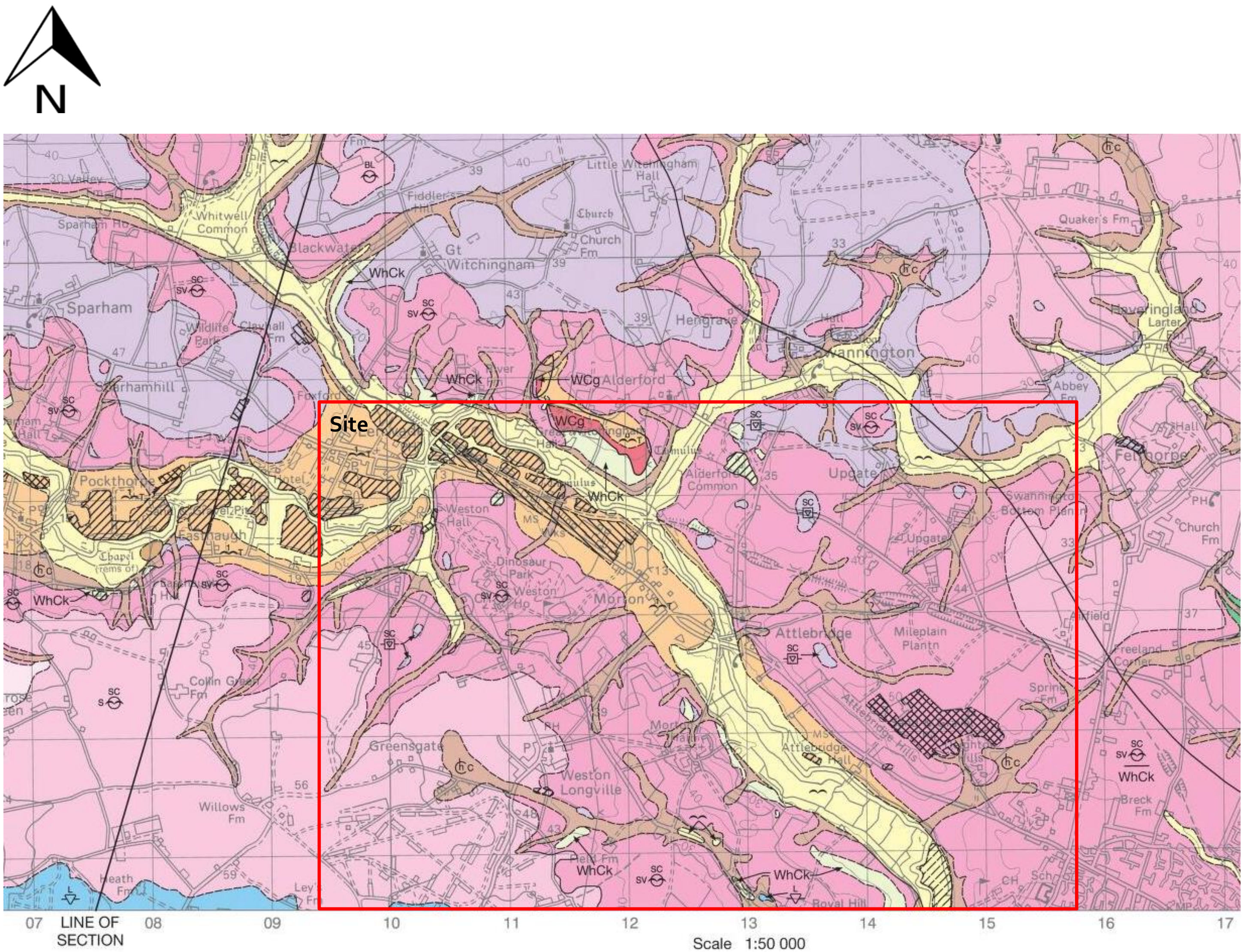
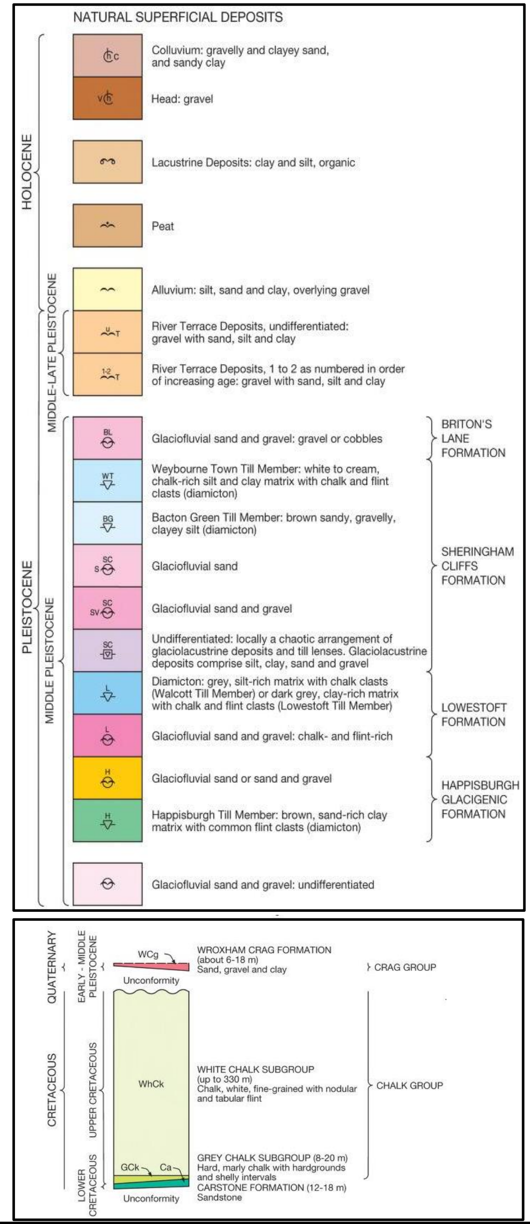
Annex A

FIGURES

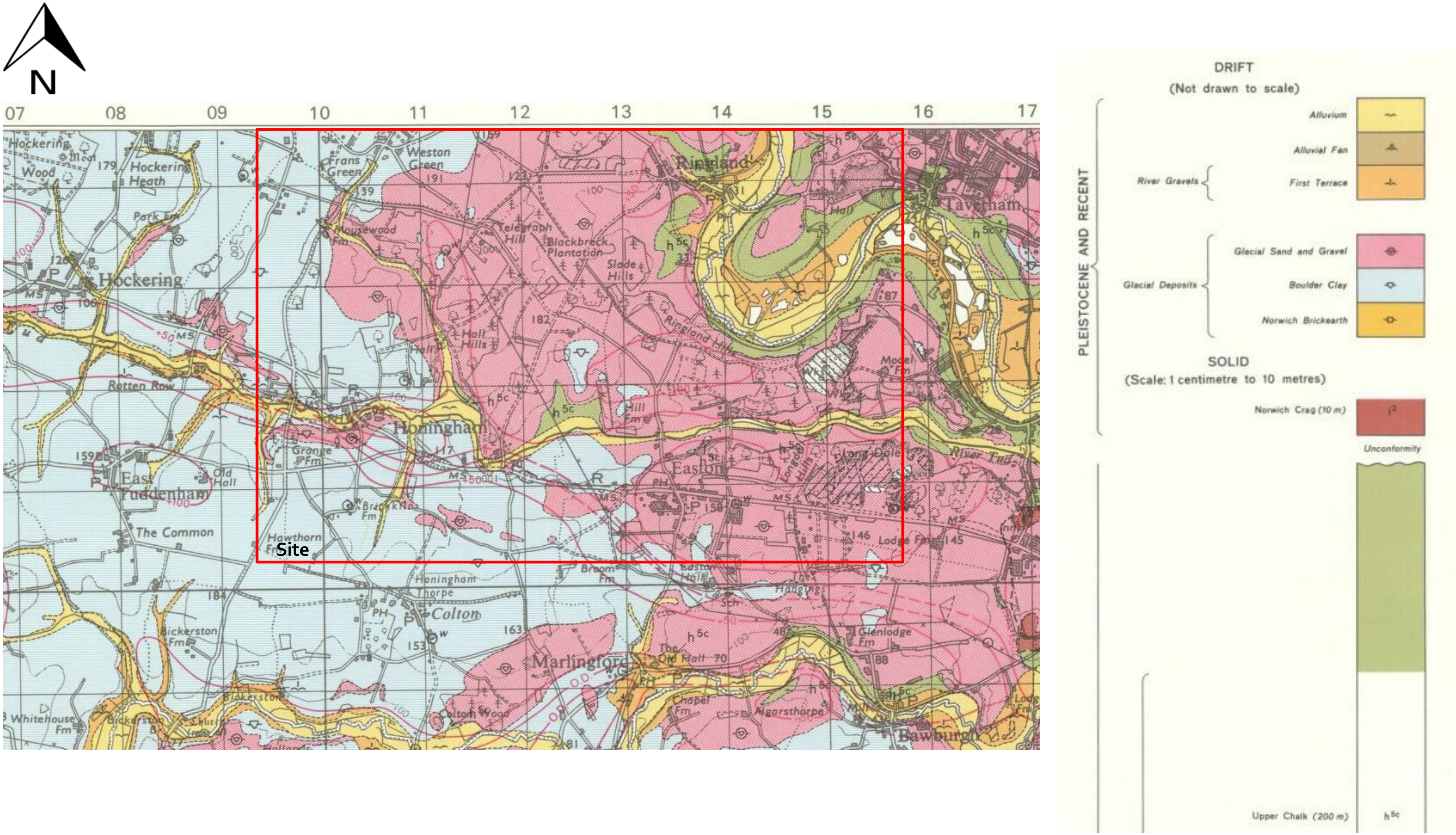


Norwich Western Link		Scale	NTS
Geotechnical Desk Study		Figure No.	Annex A.1
Site Location Plan		Drawn by	DL
		Checked by	AC



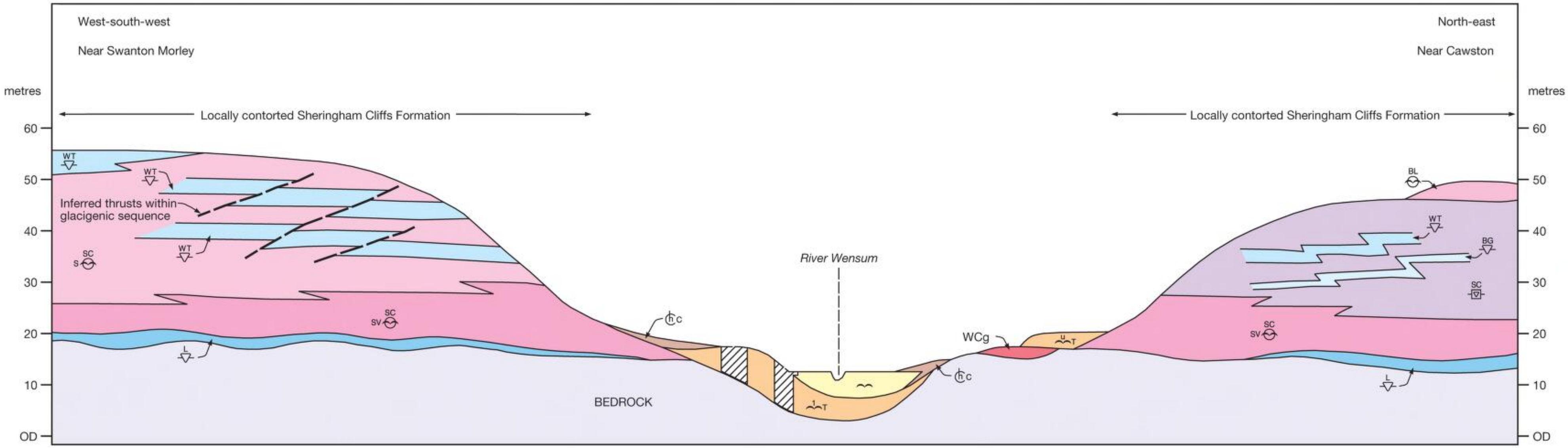


wsp	Norwich Western Link	Scale	NTS
	Geotechnical Desk Study	Figure No.	Annex A.2
	Site Location (Extract from BGS Map No. 147 (Aylsham, 1:50 000 Series))	Drawn by	DL
		Checked by	AC



wsp	Norwich Western Link	Scale	NTS
	Geotechnical Desk Study	Figure No.	Annex A.3
	Site Location (Extract from BGS Map No. 161 (Aylsham, 1:50 000 Series))	Drawn by	DL
		Checked by	AC

South centre of district



wsp	Norwich Western Link	Scale	NTS
	Geotechnical Desk Study	Figure No.	Annex A.4
	Site Location (Section Extract from BGS Map No. 147 (Aylsham, 1:50 000 Series))	Drawn by	DL
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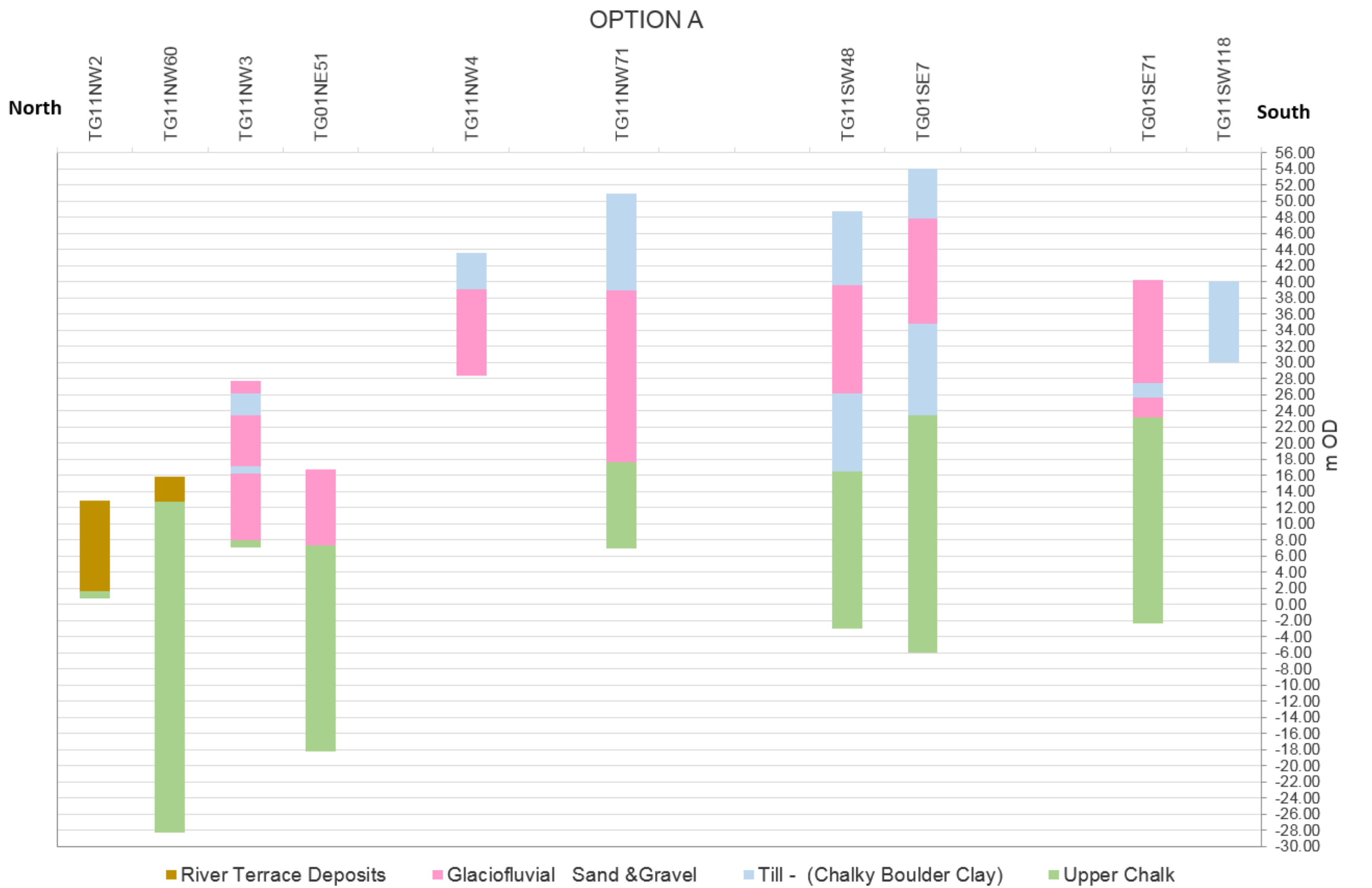
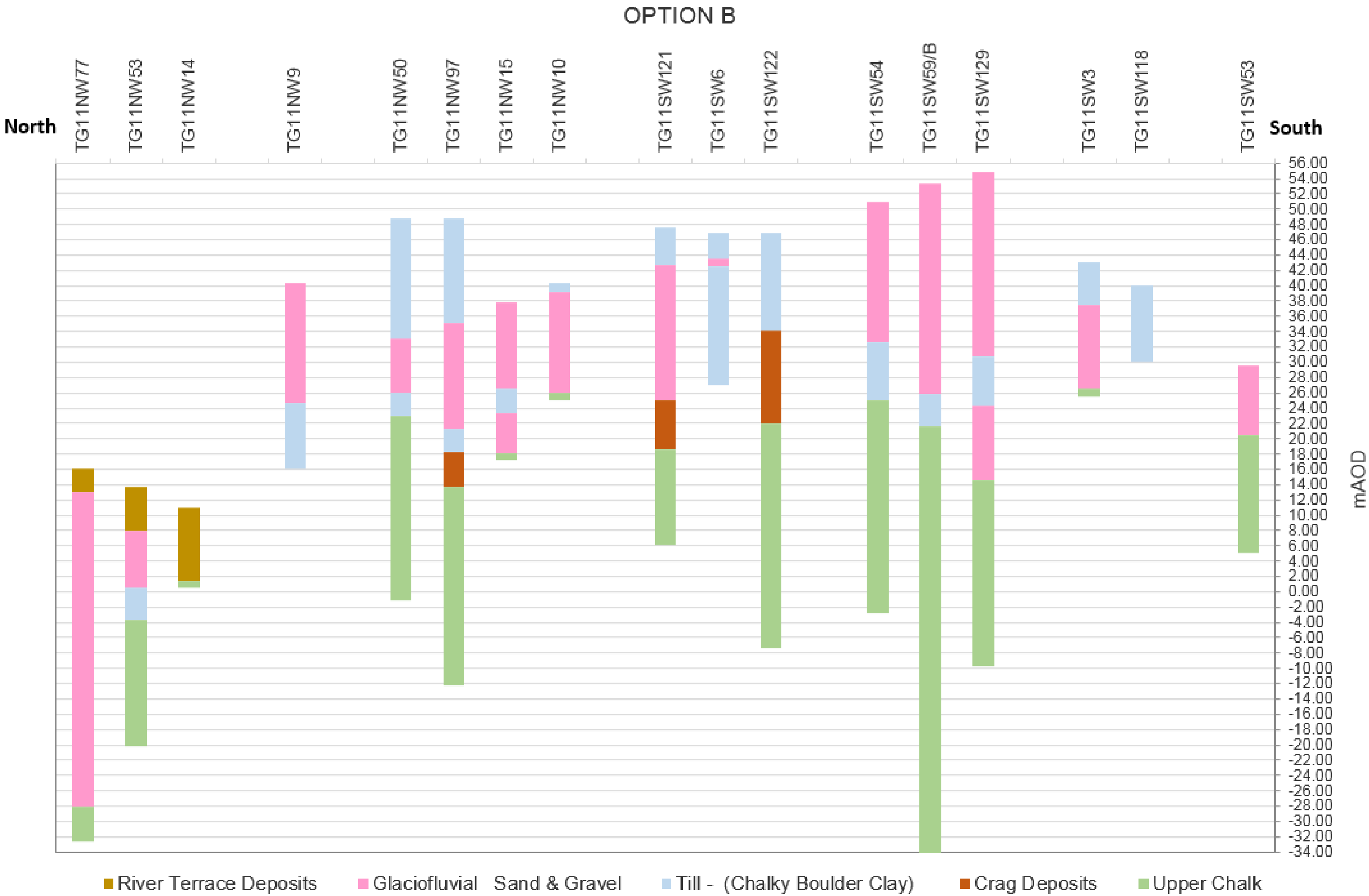
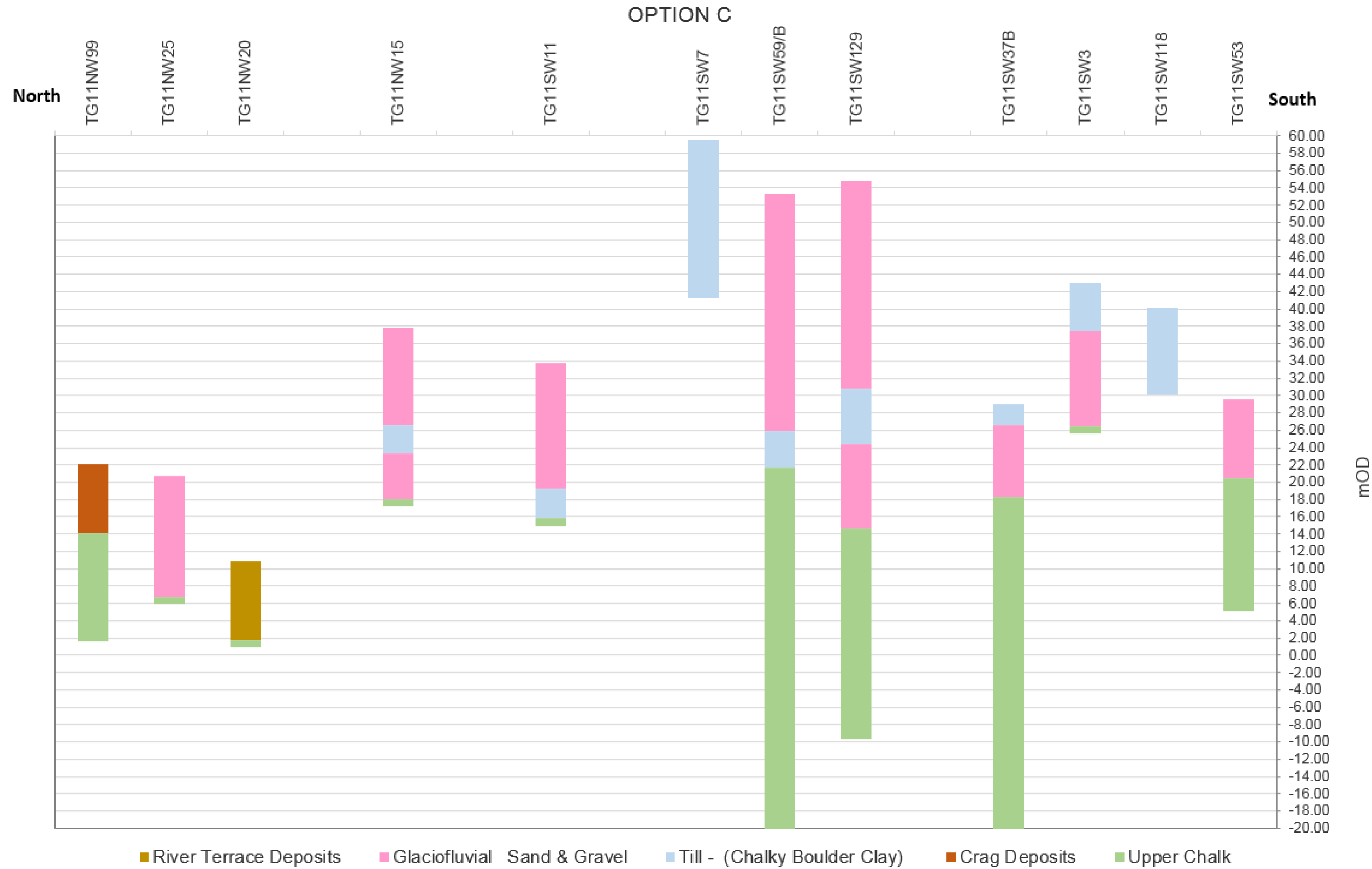


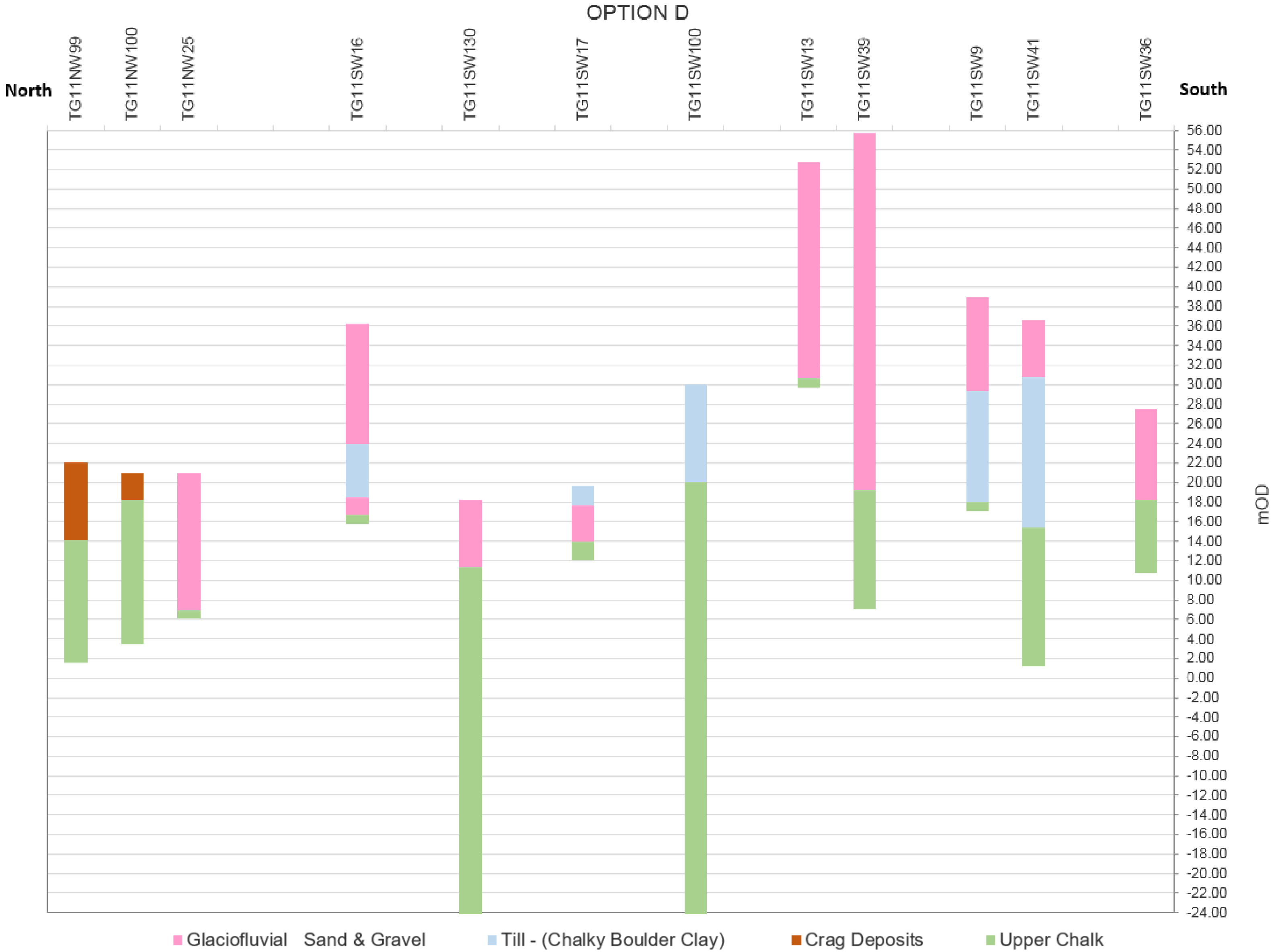
wsp	Norwich Western Link	Scale	NTS
	Geotechnical Desk Study	Figure No.	Annex A.5
	Geological Section – Option A	Drawn by	DL
		Checked by	AC



Norwich Western Link	Scale	NTS
Geotechnical Desk Study	Figure No.	Annex A.6
Geological Section – Option B	Drawn by	DL
	Checked by	AC



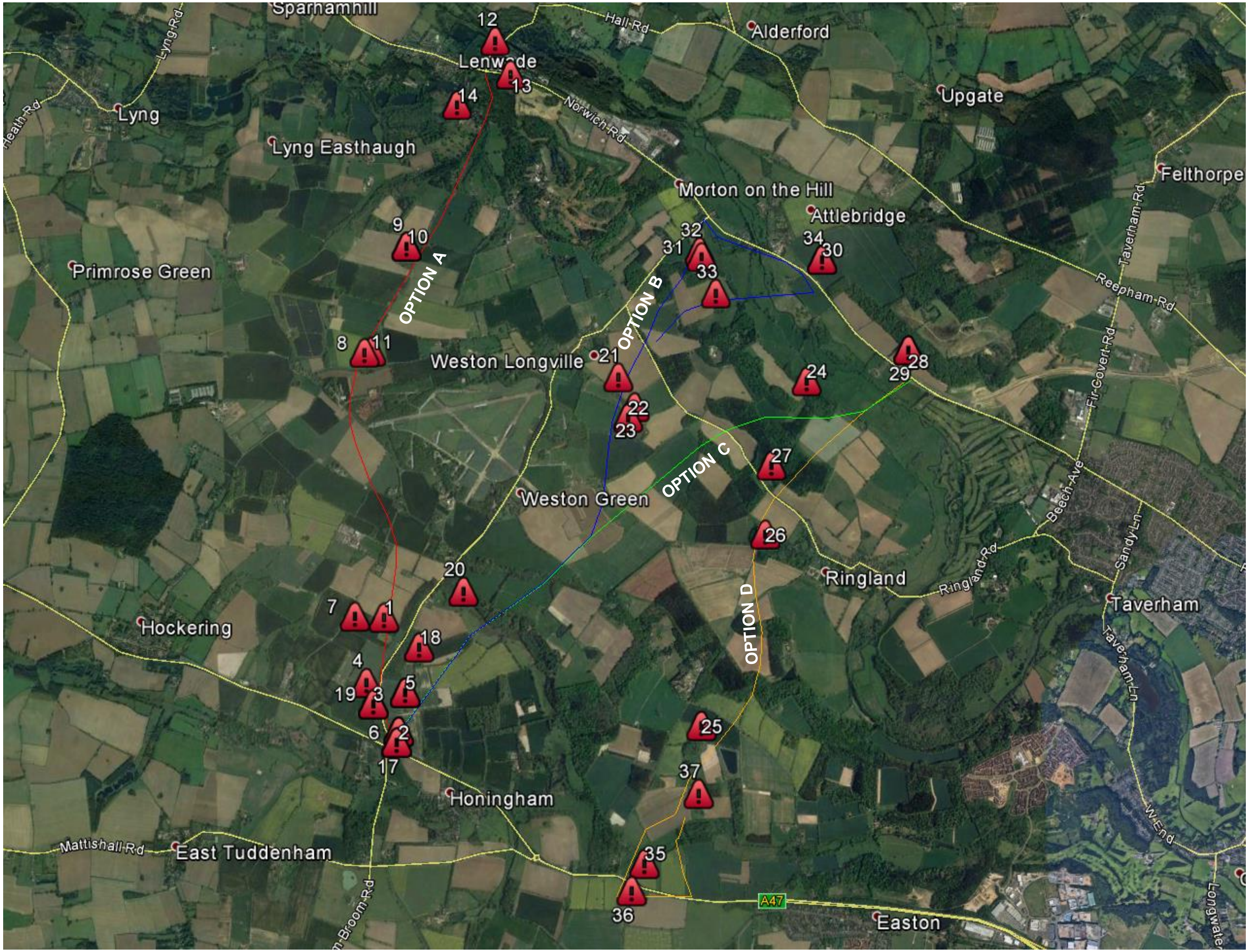
wsp	Norwich Western Link	Scale	NTS
	Geotechnical Desk Study	Figure No.	Annex A.7
	Geological Section – Option C	Drawn by	DL
		Checked by	AC



wsp	Norwich Western Link	Scale	NTS
	Geotechnical Desk Study	Figure No.	Annex A.8
	Geological Section – Option D	Drawn by	DL
		Checked by	AC

A1067 - GEOLOGICAL SECTION (NORTHERN BOUNDARY)

Norwich Western Link		Scale	NTS
Geotechnical Desk Study		Figure No.	Annex A.9
Geological Section – A1067 - Geological Section (northern Boundary)		Drawn by	DL
		Checked by	AC



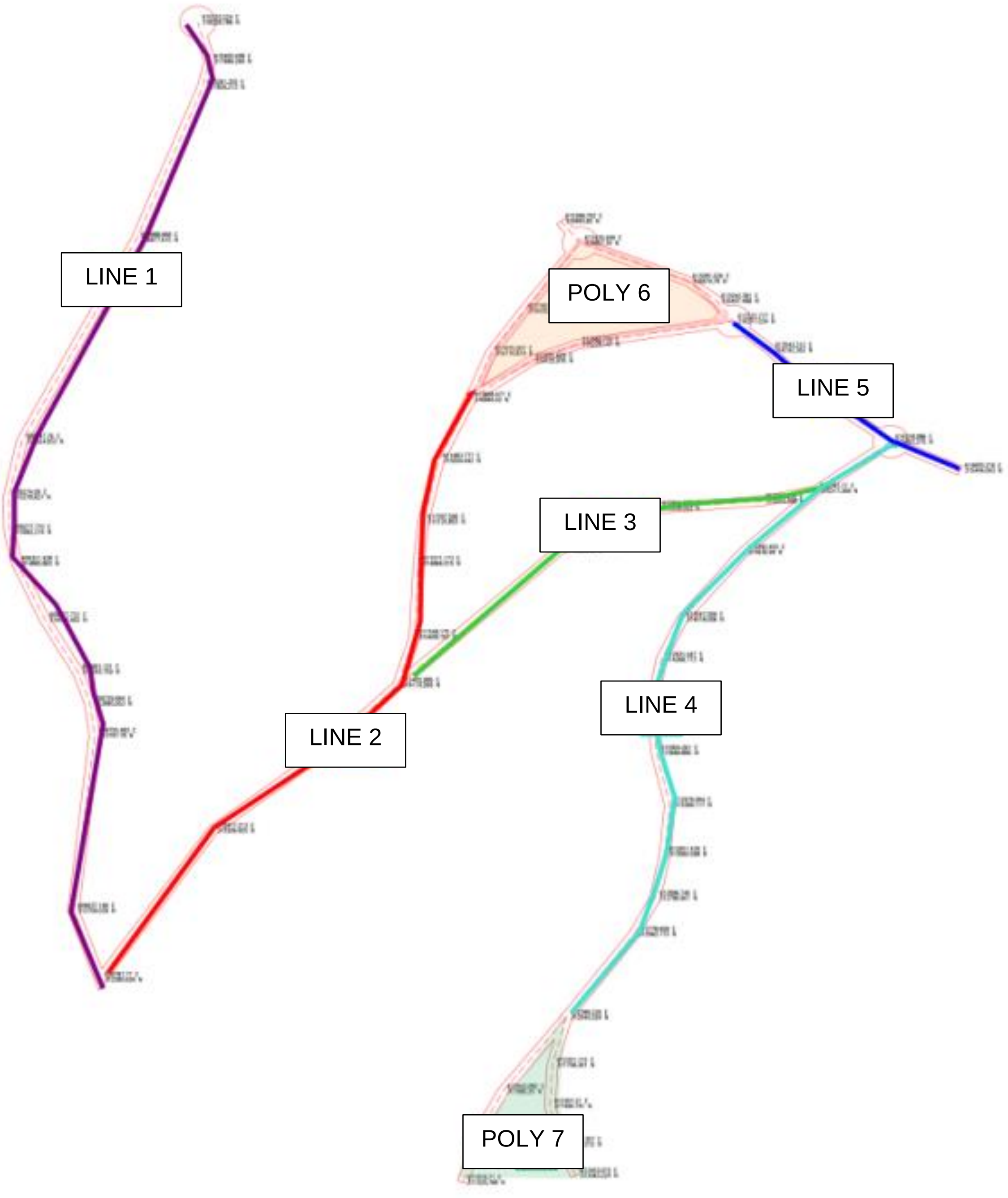
Norwich Western Link		Scale	NTS
Geotechnical Desk Study		Figure No.	Annex A.10
Mining and Quarrying Locations		Drawn by	DL
		Checked by	AC

Annex B

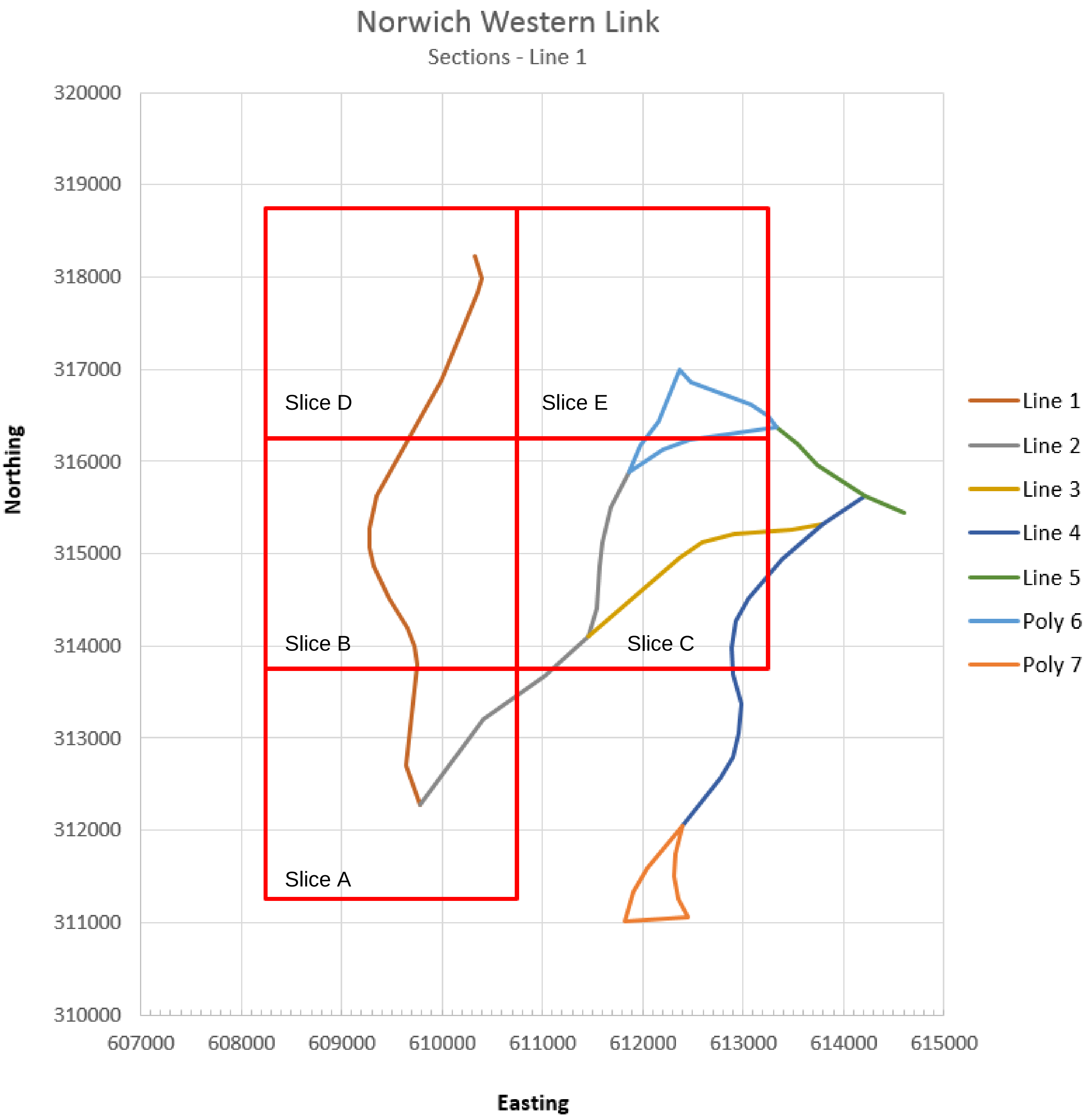
ENVIROCHECK REPORT SUMMARY

ANNEX B – ENVIROCHECK REPORT SUMMARY

Option	Line/Poly	Slice	Datasheet Report Reference	Centre Coordinates	
				Easting	Northing
Option A	Line 1	A	192634933_1_1-NWL Line 1-A	609730	312680
	Line 1	B	192634933_1_1-NWL Line 1-B	609500	315260
	Line 1	C	192634933_1_1-NWL Line 1-C	610900	316500
	Line 1	D	192634933_1_1-NWL Line 1-D	610010	317780
	Line 1	E	192634933_1_1-NWL Line 1-E	611080	317900
Option B	Line 2	A	192634933_1_1-NWL Line 2-A	609850	312380
	Line 2	B	192634933_1_1-NWL Line 2-B	611280	312960
	Line 2	C	192634933_1_1-NWL Line 2-C	610350	314150
	Line 2	D	192634933_1_1-NWL Line 2-D	611730	314830
	Line 2	E	192634933_1_1-NWL Line 2-E	611860	316440
	Poly 6	A	192634933_1_1-NWL Poly 6-A	611960	316050
	Poly 6	B	192634933_1_1-NWL Poly 6-B	613560	316280
	Poly 6	C	192634933_1_1-NWL Poly 6-C	612240	317500
	Poly 6	D	192634933_1_1-NWL Poly 6-D	613340	317350
	Line 5	A	192634933_1_1-NWL Line 5-A	613850	315670
	Line 5	B	192634933_1_1-NWL Line 5-B	615250	315440
	Line 5	C	192634933_1_1-NWL Line 5-C	613380	316920
Option C	Line 2	A	192634933_1_1-NWL Line 2-A	609850	312380
	Line 2	B	192634933_1_1-NWL Line 2-B	611280	312960
	Line 3	A	192634933_1_1-NWL Line 3-A	611470	313450
	Line 3	B	192634933_1_1-NWL Line 3-B	611710	314690
	Line 3	C	192634933_1_1-NWL Line 3-C	613610	315250
	Line 4	E	192634933_1_1-NWL Line 4-E	614550	315850
Option D	Poly 7	A	192634933_1_1-NWL Poly 7-A	612160	311160
	Poly 7	B	192634933_1_1-NWL Poly 7-B	612380	312550
	Line 4	A	192634933_1_1-NWL Line 4-A	612490	311860
	Line 4	B	192634933_1_1-NWL Line 4-B	612920	313790
	Line 4	C	192634933_1_1-NWL Line 4-C	614390	314800
	Line 4	D	192634933_1_1-NWL Line 4-D	613370	315710
	Line 4	E	192634933_1_1-NWL Line 4-E	614550	315850



Line and Poly location reference figure


Norwich Western Link
Sections - Line 1
Northing
Easting
320000
319000
318000
317000
316000
315000
314000
313000
312000
311000
310000
607000
608000
609000
610000
611000
612000
613000
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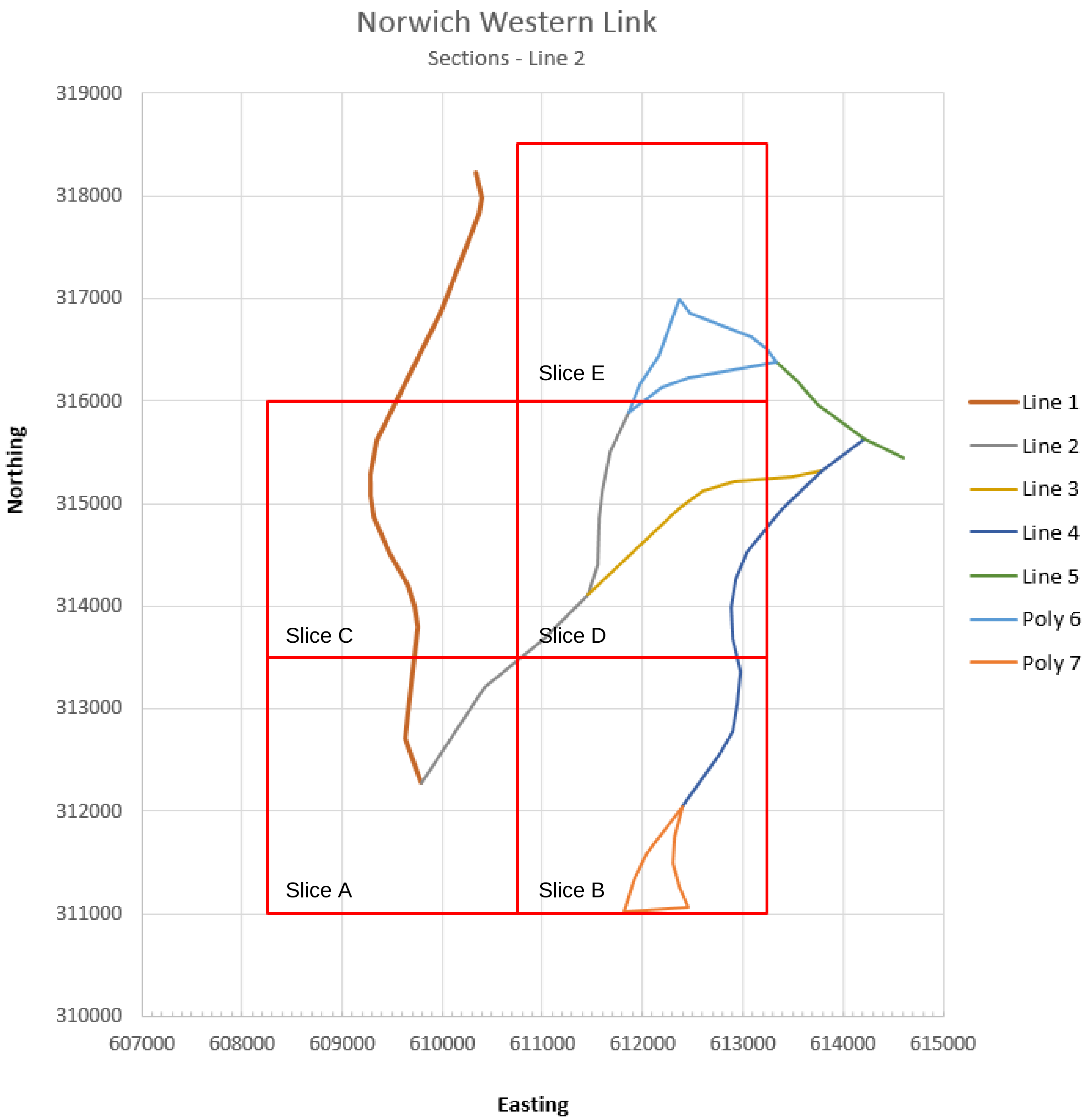
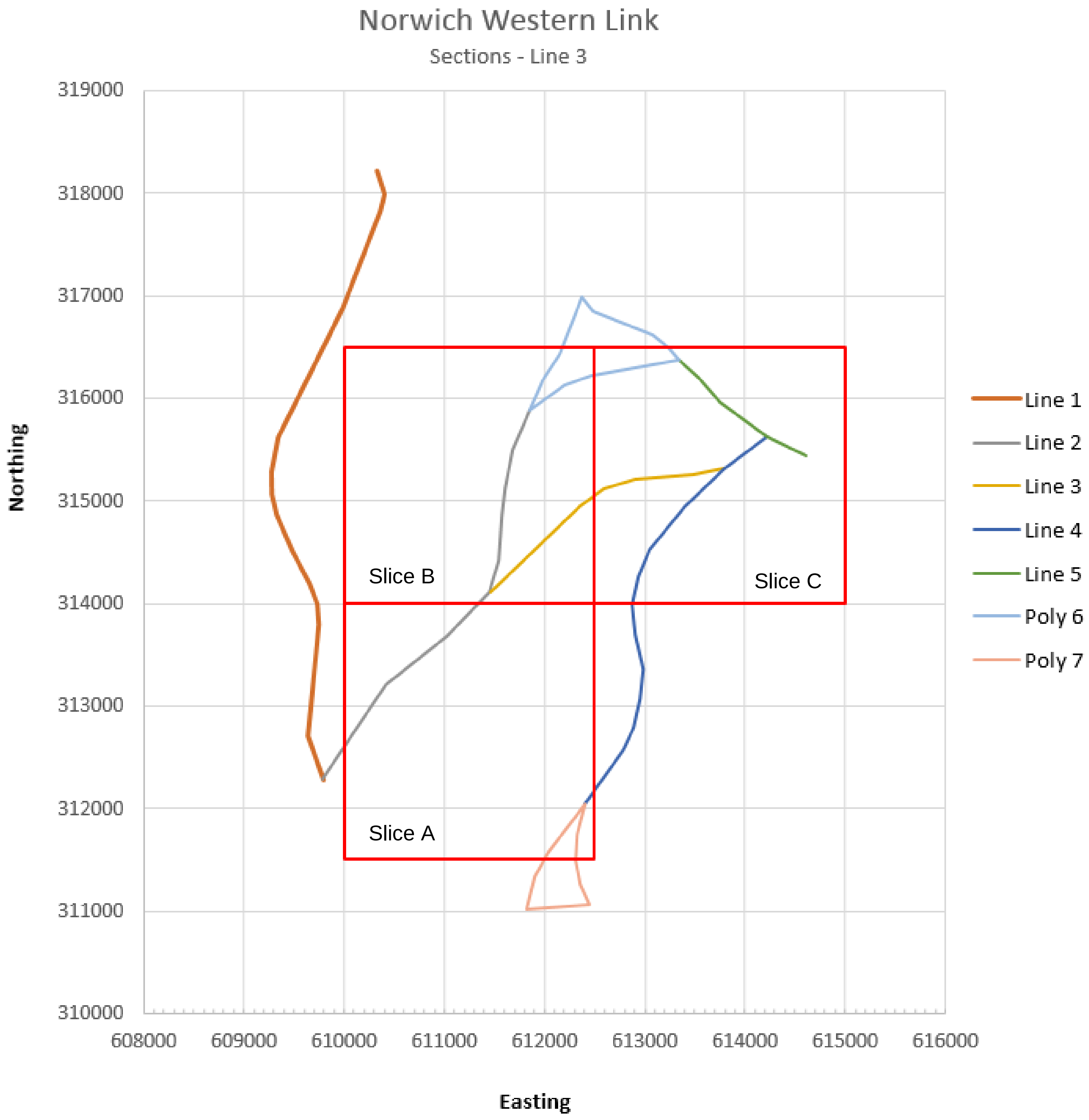
615000
Slice D
Slice E
Slice B
Slice C
Slice A
Line 1
Line 2
Line 3
Line 4
Line 5
Poly 6
Poly 7



Norwich Western Link
Sections - Line 2
319000
318000
317000
316000
315000
314000
313000
312000
311000
310000
Northing
607000
608000
609000
610000
611000
612000
613000
614000
615000
Easting
Slice E
Slice C
Slice D
Slice A
Slice B
Line 1
Line 2
Line 3
Line 4
Line 5
Poly 6
Poly 7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Sections - Line 3
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610000
611000
612000
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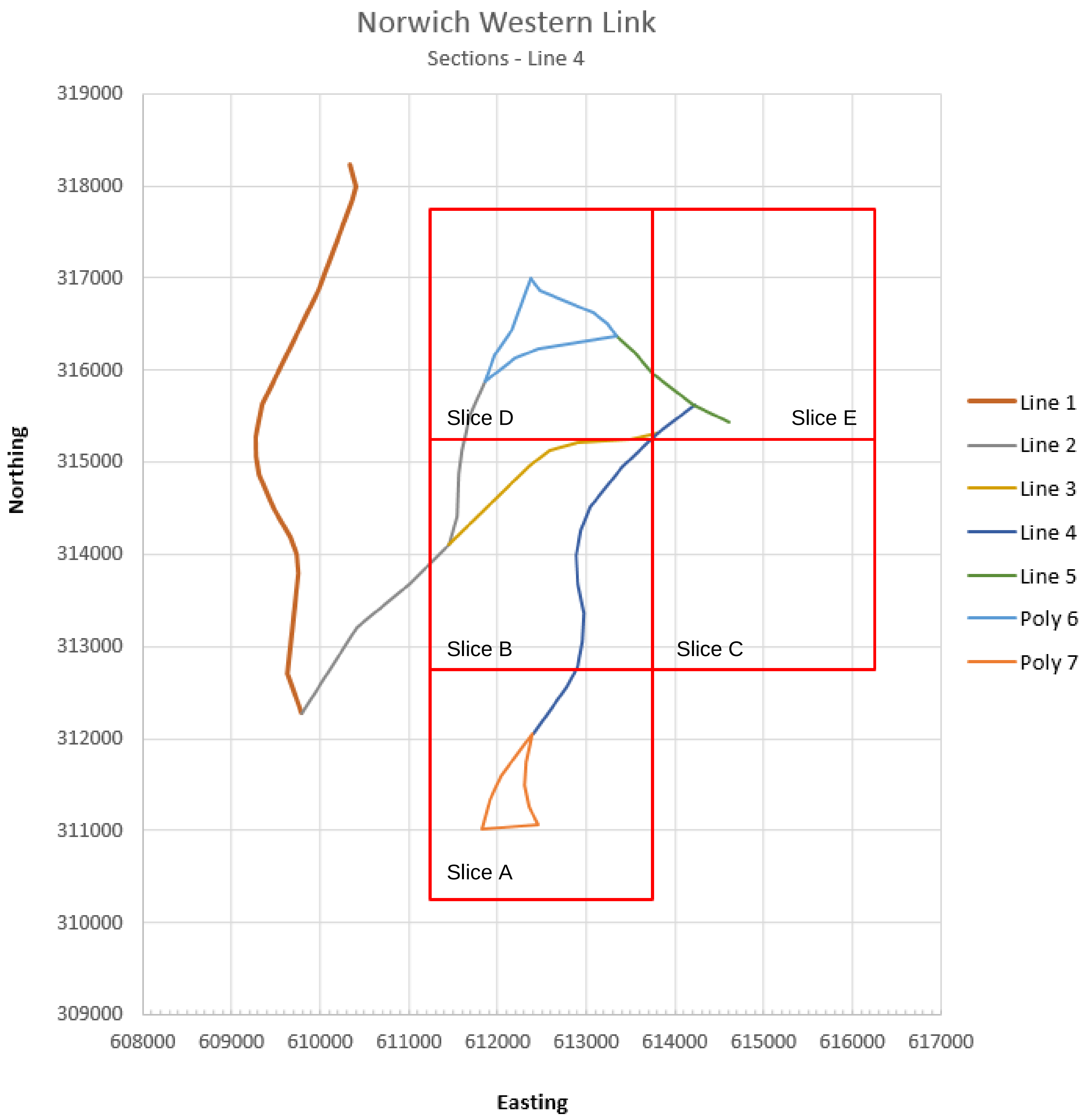
Slice B
Slice C
Line 1
Line 2
Line 3
Line 4
Line 5
Poly 6
Poly 7



Norwich Western Link
Sections - Line 4
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608000
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615000
616000
617000
Slice D
Slice E
Slice B
Slice C
Slice A
Line 1
Line 2
Line 3
Line 4
Line 5
Poly 6
Poly 7


Norwich Western Link
Sections - Line 5
Northing
Easting
320000
319000
318000
317000
316000
315000
314000
313000
312000
311000
310000
608000
609000
610000
611000
612000
613000
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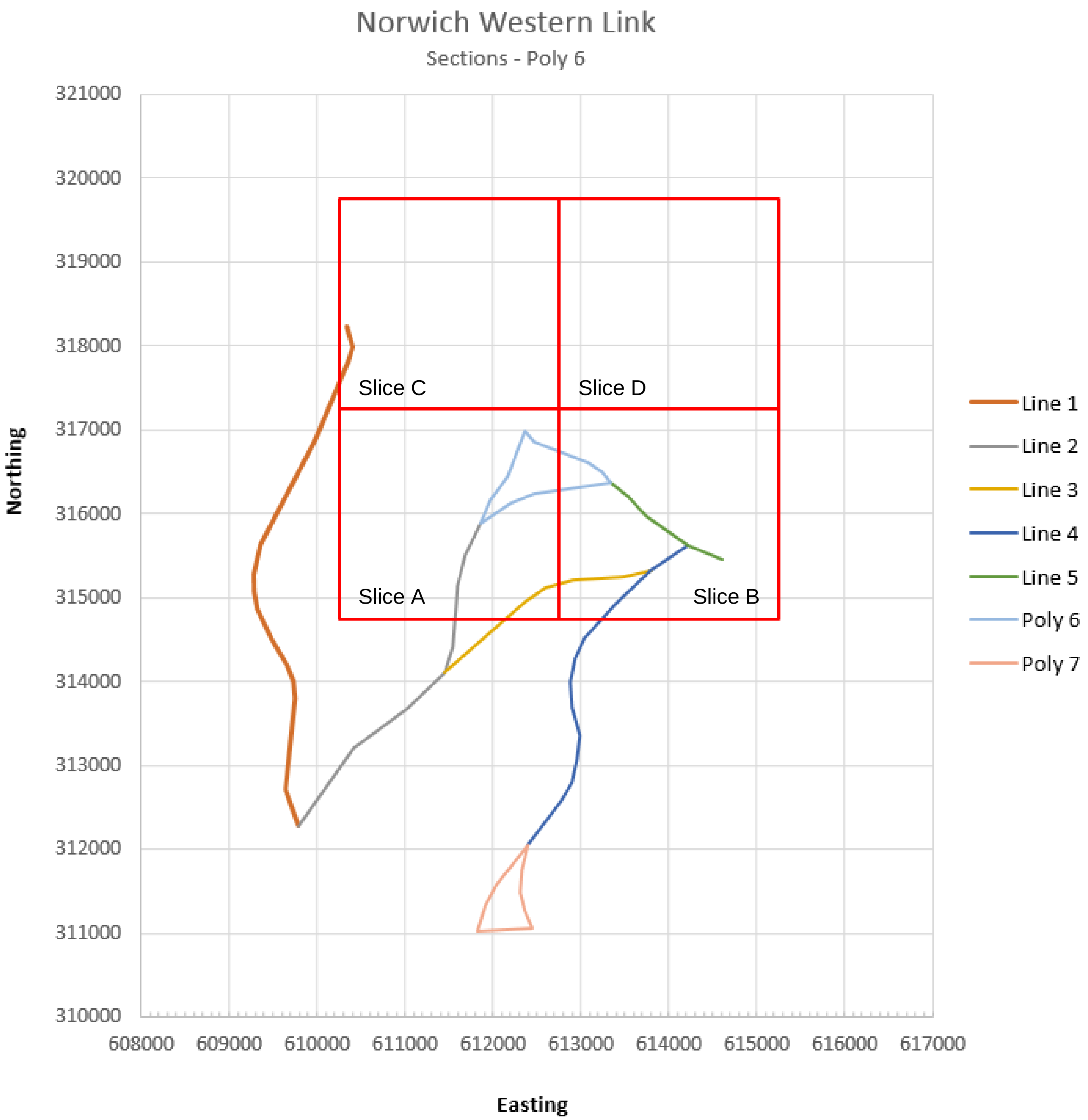
618000
Slice C
Slice A
Slice B
Line 1
Line 2
Line 3
Line 4
Line 5
Poly 6
Poly 7



Norwich Western Link
Sections - Poly 6
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Easting
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609000
610000
611000
612000
613000
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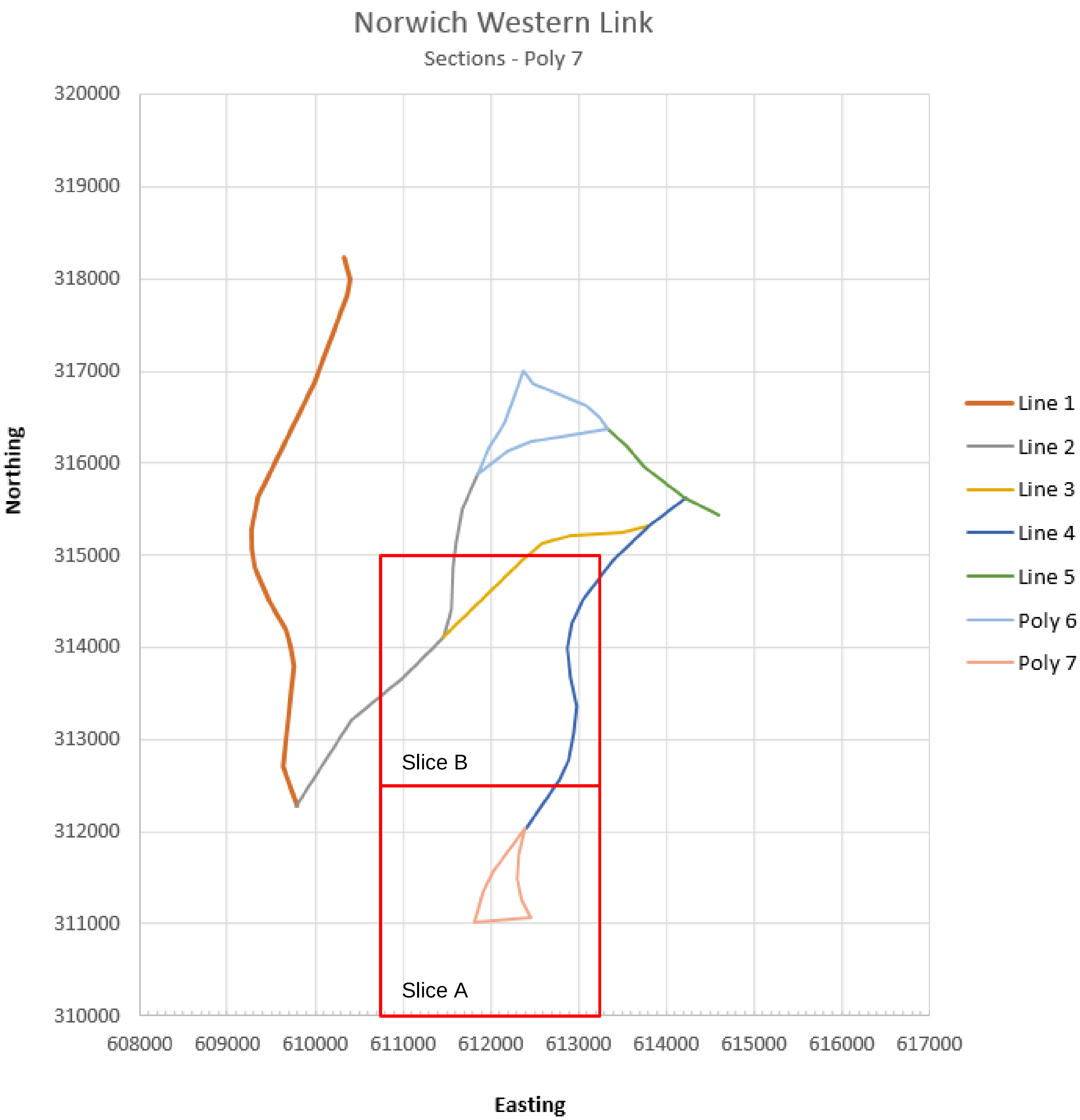
Slice C
Slice D
Slice A
Slice B
Line 1
Line 2
Line 3
Line 4
Line 5
Poly 6
Poly 7



Norwich Western Link
Sections - Poly 7
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609000
610000
611000
612000
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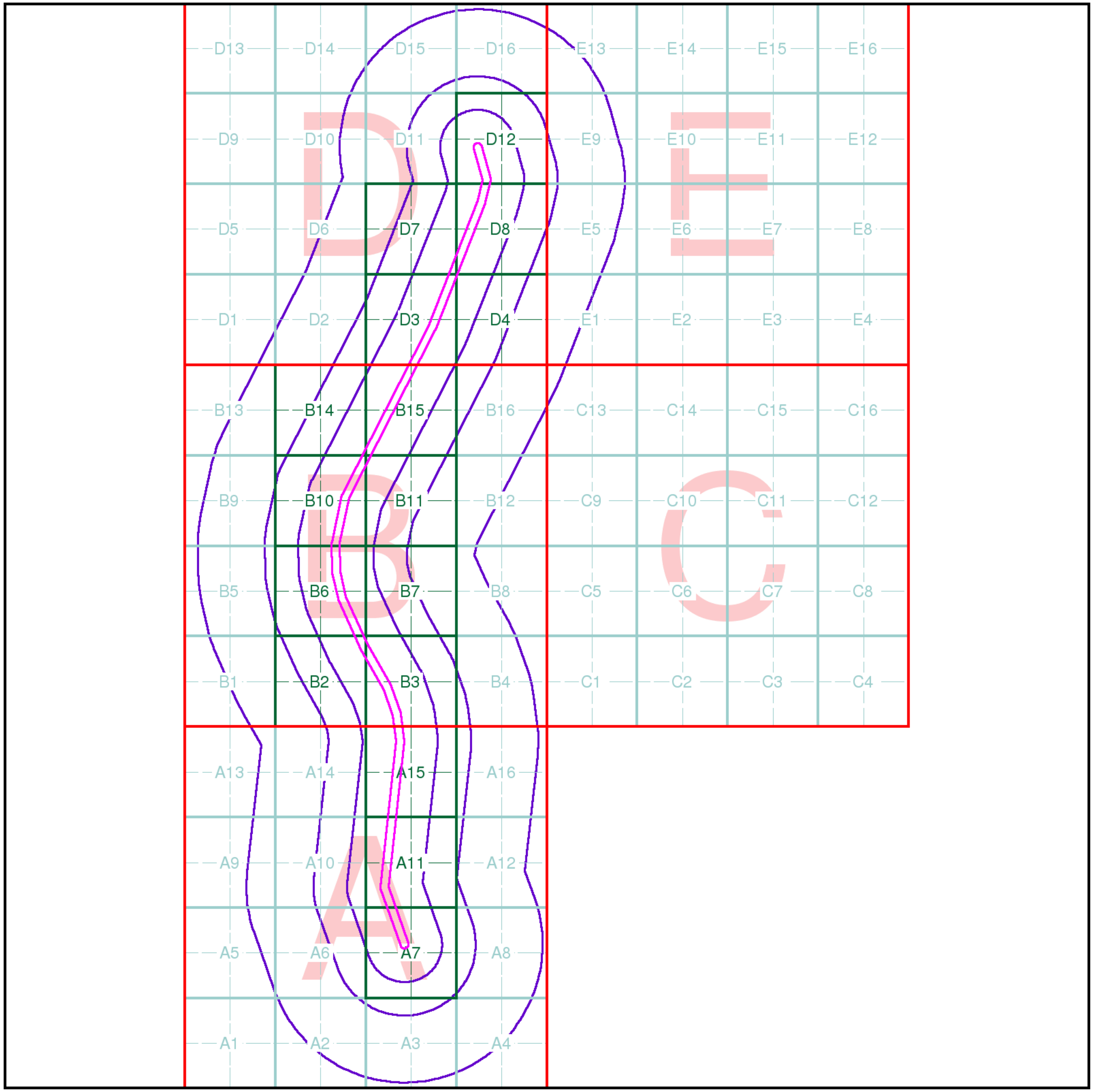
Line 4
Line 5
Poly 6
Poly 7



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A selection of organisations who provide data within this report:

Map data

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Environment Agency

NATURAL ENGLAND

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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number:	192634933_1_1
Customer Ref:	NWL Line 1
National Grid Reference:	609740, 315280
Site Area (Ha):	38.24
Search Buffer (m):	1000

Site Details

Site at 609837,315255

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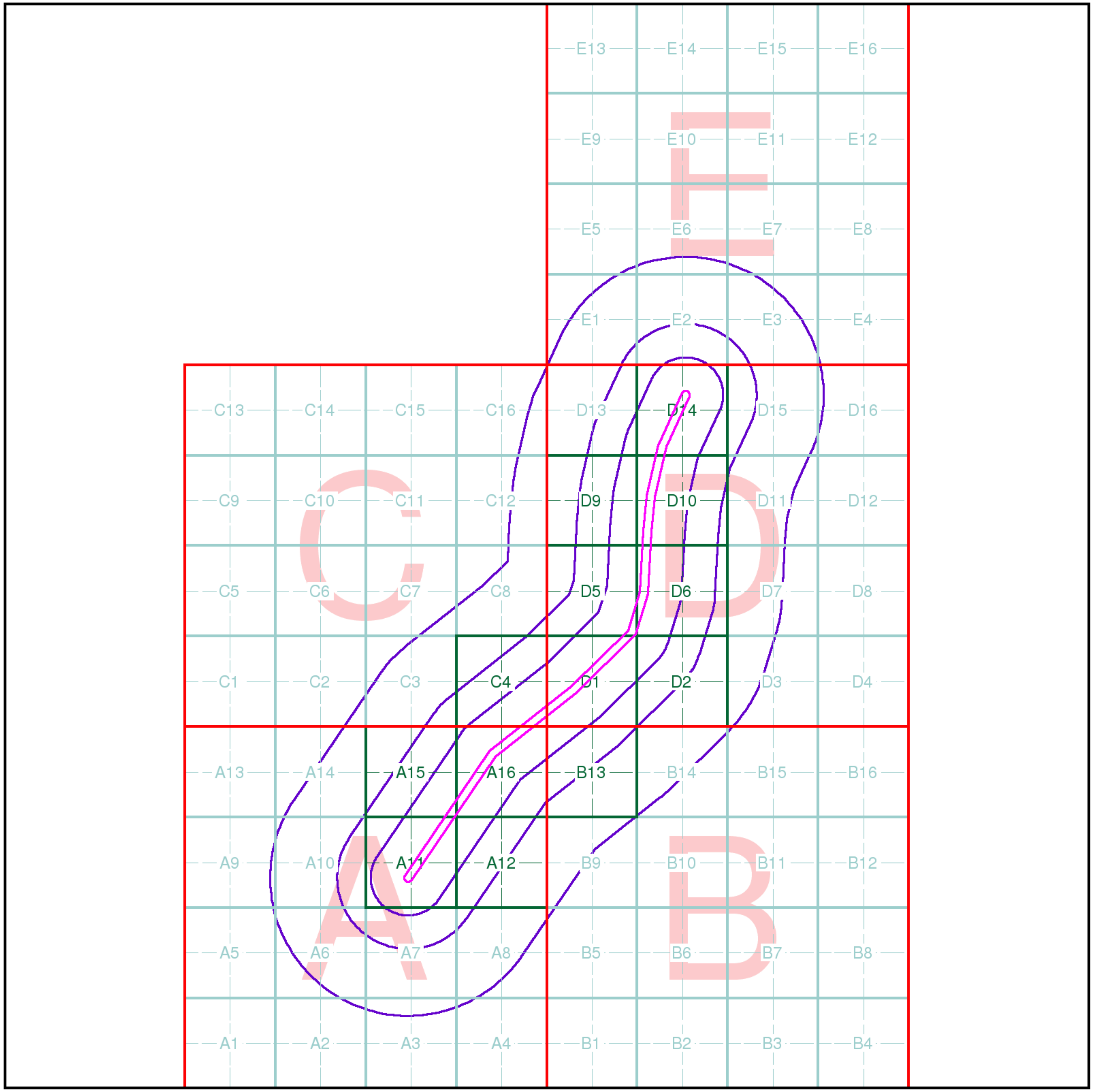

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Environment Agency

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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number: 192635488_1_1
Customer Ref: NWL Line 2
National Grid Reference: 611010, 313990
Site Area (Ha): 26.3
Search Buffer (m): 1000

Site Details

Site at 610823,314082

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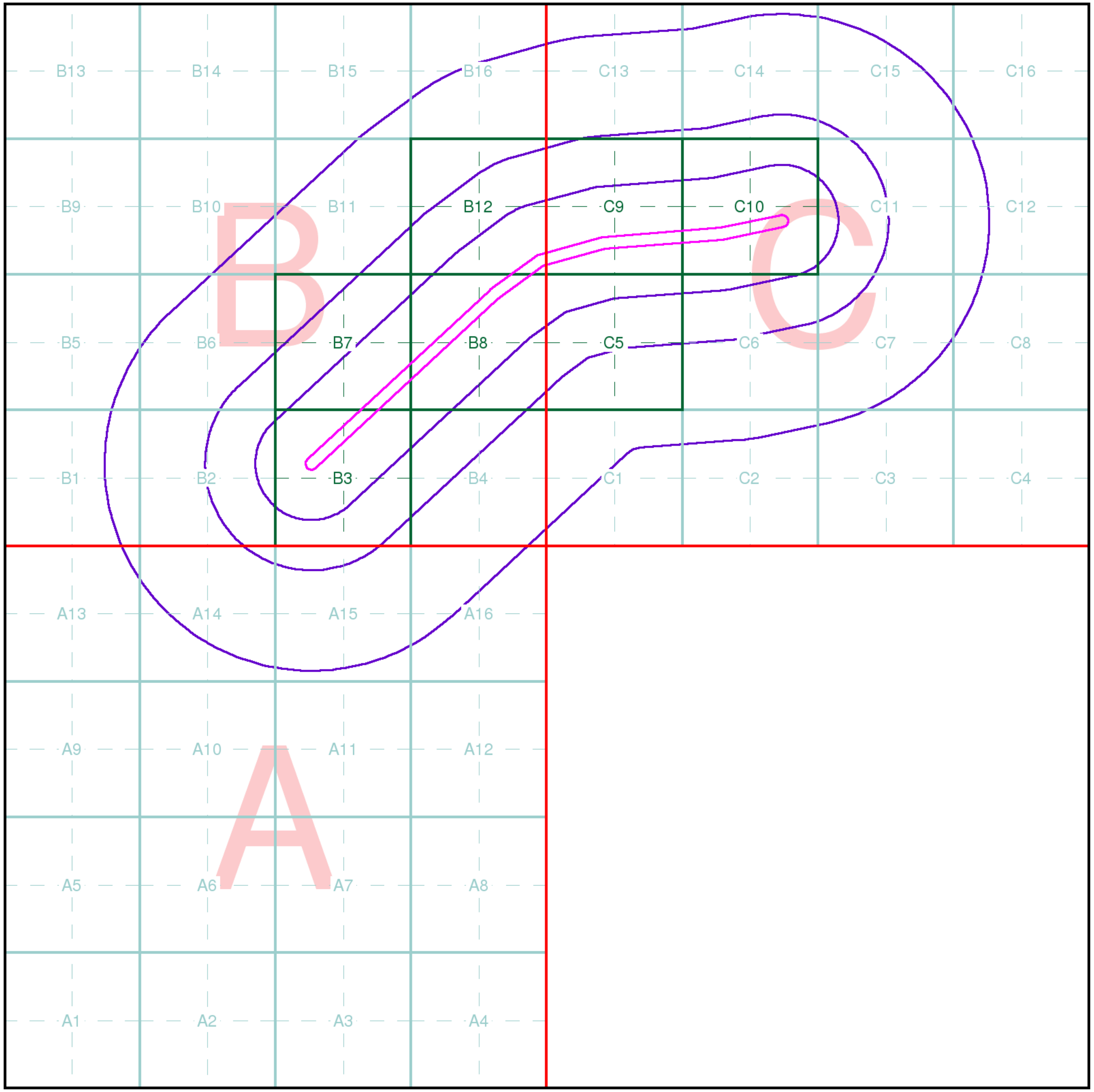

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Environment Agency

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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number: 192636688_1_1
Customer Ref: NWL Line 3
National Grid Reference: 612540, 314890
Site Area (Ha): 16.77
Search Buffer (m): 1000

Site Details

Site at 612627,314714

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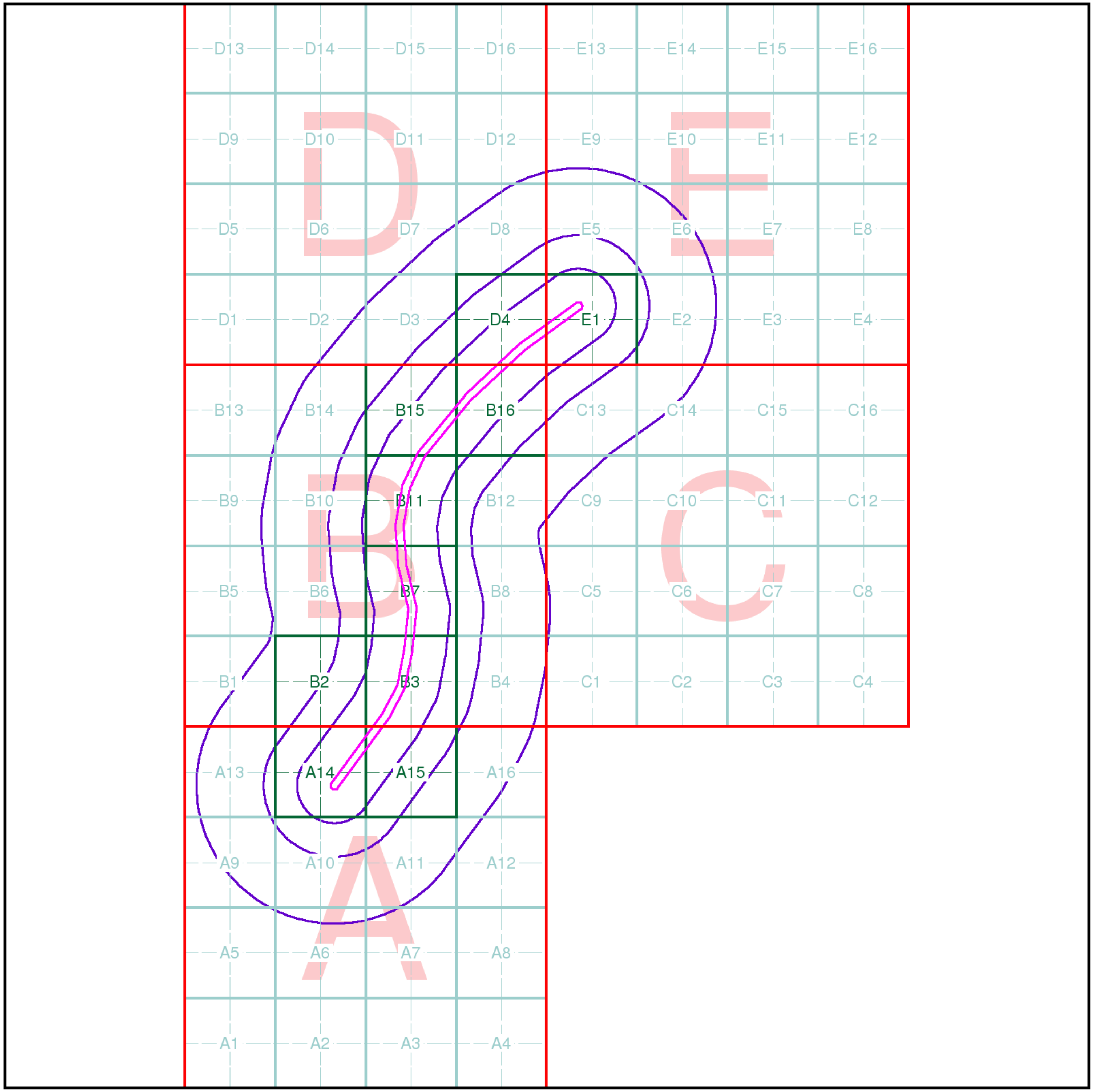

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Map data

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Environment Agency

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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number:	192638308_1_1
Customer Ref:	NWL Line 4
National Grid Reference:	613130, 313940
Site Area (Ha):	26.02
Search Buffer (m):	1000

Site Details

Site at 613309,313834

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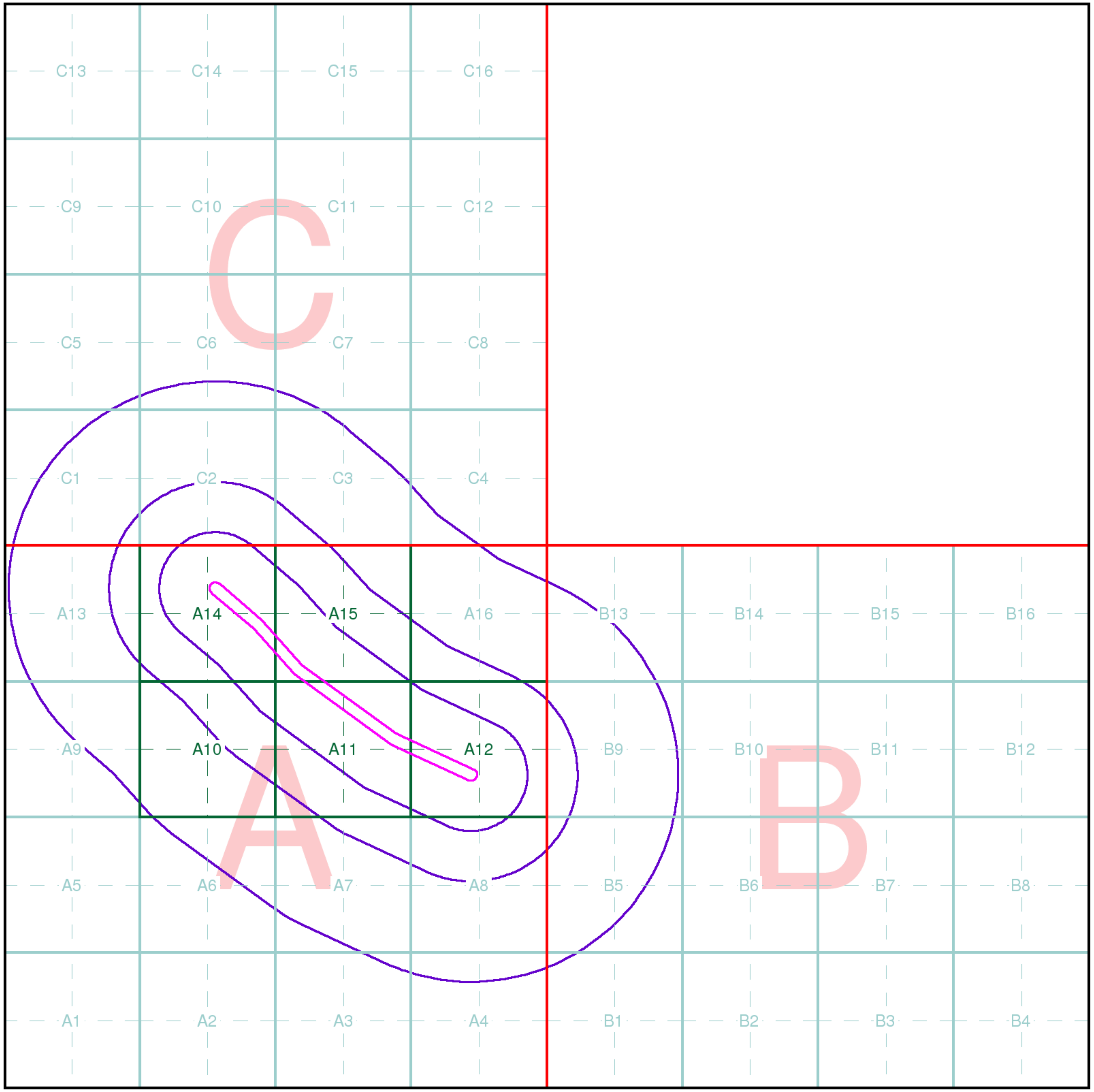

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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number:	192638994_1_1
Customer Ref:	NWL Line 5
National Grid Reference:	613940, 315860
Site Area (Ha):	9.82
Search Buffer (m):	1000

Site Details

Site at 613969,315908

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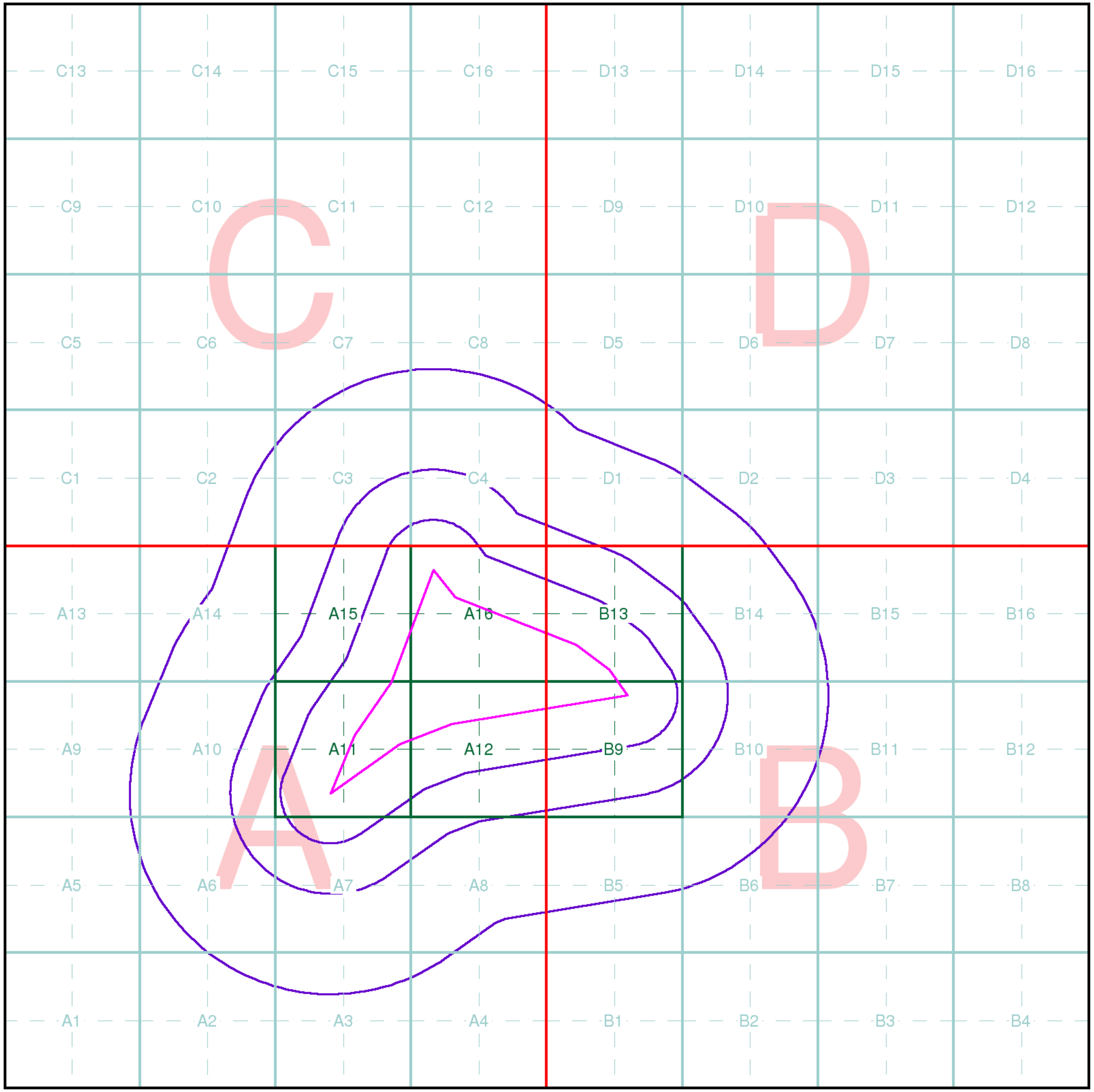

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Map data

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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number:	192639708_1_1
Customer Ref:	NWL Poly 6
National Grid Reference:	612560, 316460
Site Area (Ha):	57.53
Search Buffer (m):	1000

Site Details

Site at 612596,316439

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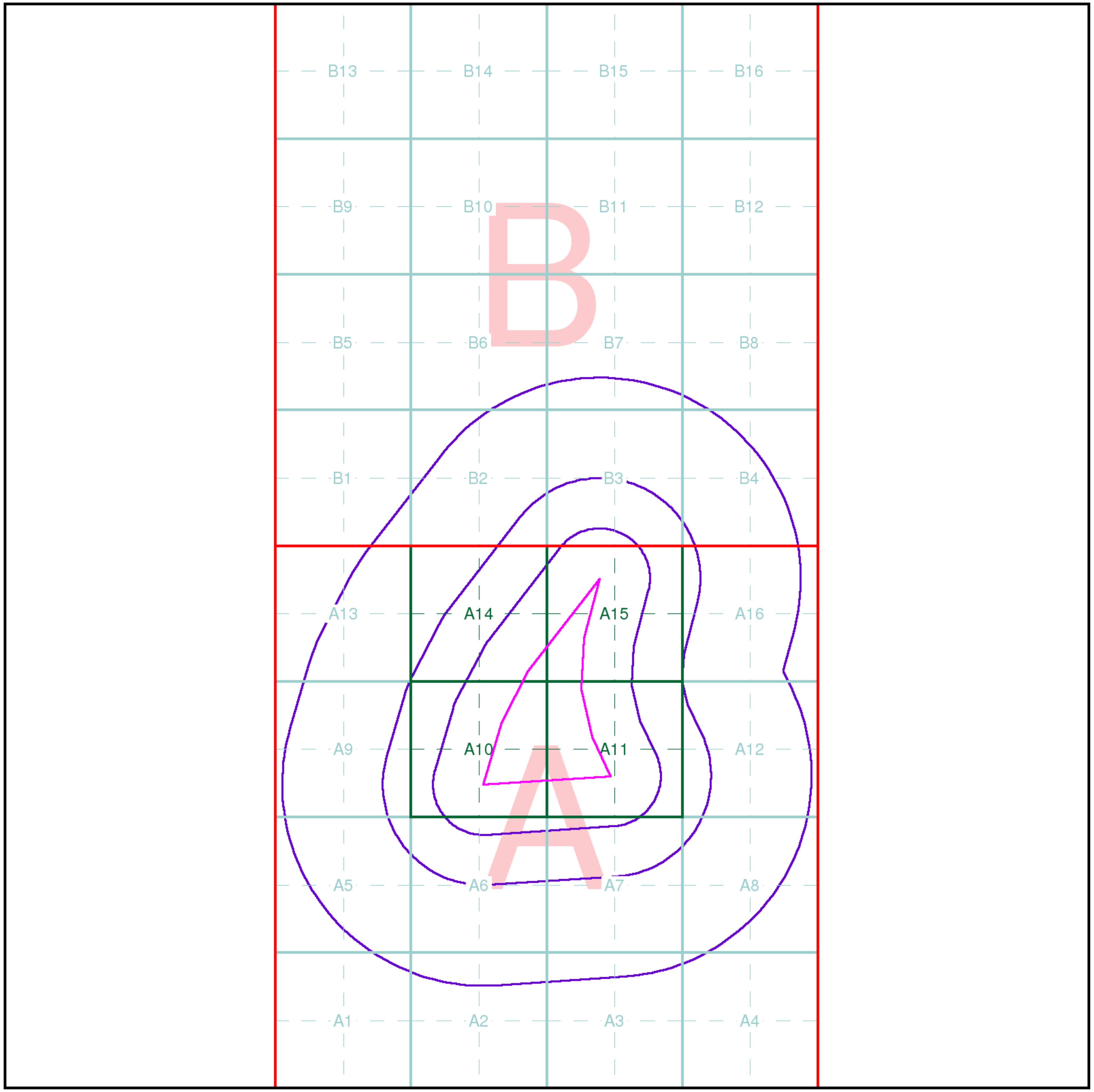

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Map data

British Geological Survey
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Client Details

Mr D Lee, WSP UK Ltd, 6 Devonshire Square, London, EC2M 4YE

Order Details

Order Number:	192640699_1_1
Customer Ref:	NWL Poly 7
National Grid Reference:	612150, 311360
Site Area (Ha):	29.71
Search Buffer (m):	1000

Site Details

Site at 612136,311533

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Annex C

HISTORIC MAPS SUMMARY

wsp

ANNEX C- HISTORIC MAPPING SUMMARY

MAP	Year	Line	Slice	Activity on site	Activity near the site
MAP	Year	Line	Slice	Activity on site	Activity near the site
Norfolk 1:10,560	1883 - 1885	1	A	Farmland, Lane	Farms, Farmland, Woodland: Odl Cover, Mousewood Farm)
			B	Farmland, lane,	Farmland, Quarries and Pits
			C	NA	NA
			D	Farmland, Woodland, Pasture Land, Lane	Woodland, Farmland, Pasture Land, Old Marl Pits
			E	NA	NA
Norfolk 1:10,560	1907	1	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	NA	NA
Norfolk 1:10,560	1952	1	A	No noted change	No noted change
			B	No noted change	An Airfield (disused) is shown to be located east of shortlisted Option A and south to Weston Longville
			C	NA	NA
			D	No noted change	Wetlands closely connected to the River Wensum
			E	NA	NA
OS Plan 1:10,000	1957-1959	1	A	No noted change	No noted change
			B	Details of the Airfield are shown on site	Details of the airfield are shown near the site.
			C	No noted change	No noted change
			D	No noted change	No noted change
			E	NA	NA
OS Plan 1:10,000	1975-1976	1	A	NA	No noted change
			B	NA	Sheds are shown along the disused airfield lanes.
			C	NA	NA
			D	No noted change	No noted change
			E	NA	NA
OS Plan 1:10,000	1982	1	A	No noted change	No noted change
			B	The Airfield shown on site is replaced by farmland	No noted change
			C	NA	NA
			D	NA	NA

MAP	Year	Line	Slice	Activity on site	Activity near the site
			E	NA	NA
10k Raster Mapping 1:10,000	2000	1	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	NA	NA
10k Raster Mapping 1:10,000	2006	1	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	NA	NA
10k Raster Mapping 1:10,000	2019	1	A	No noted change	No noted change
			B	No noted change	An L shaped depot is shown immediately around the disused Airfield area immediately next to the Option A location. Old Airfield Solar Farm installed
			C	Not applicable	Not Applicable
			D	No noted change	No noted change
			E	Not applicable	Not applicable

MAP	Year	Line	Slice	Activity on site	Activity in the vicinity of the site
Norfolk 1:10,560	1883 - 1885	2	A	Farmland, Woodland,	Farmland, Woodland
			B	NA	NA
			C	Farmland, Woodland	Farmland, Woodland (Robin's Nursery)
			D	Farmland, Woodland, Longrow Lane intersects the site	Farmland, Woodland, Pasture Land, Farms, All Saints Church (west of the line), St Margarret church east of the line.
			E	NA	NA
Norfolk 1:10,560	1907	2	A	No noted change	No noted change
			B	NA	NA

MAP	Year	Line	Slice	Activity on site	Activity near the site
			C	No noted change	No noted change
			D	No noted change	No noted change
			E	NA	NA
Norfolk 1:10,560	1952	2	A	No noted change	No noted change
			B	NA	NA
			C	No noted change	Airfield disused west of the shortlisted Option B
			D	No noted change	No noted change
			E	NA	NA
OS Plan 1:10,000	1957-1959	2	A	No noted change	No noted change
			B	NA	NA
			C	No noted change	No noted change
			D	No noted change	No noted change
			E	NA	NA
OS Plan 1:10,000	1975-1976	2	A	Slip road at the A47 and Wood Lane Junction constructed	A47 South of the proposed route constructed
			B	NA	NA
			C	No noted change	No noted change
			D	Electricity transmission line and pylons are shown. Langrow Lane name changed to Ringland Lane	Electricity transmission line. Details (sheds) of the disused airfield are shown west of the line option.
			E	NA	NA
OS Plan 1:10,000	1982	2	A	No noted change	No noted change
			B	NA	NA
			C	No noted change	No noted change
			D	No noted change	No noted change
			E	NA	NA
10k Raster Mapping 1:10,000	2000	2	A	No noted change	No noted change
			B	NA	NA
			C	No noted change	No noted change
			D	No noted change	No noted change
			E	NA	NA
10k Raster Mapping 1:10,000	2006	2	A	No noted change	No noted change
			B	NA	NA
			C	No noted change	No noted change
			D	No noted change	No noted change

MAP	Year	Line	Slice	Activity on site	Activity near the site
			E	NA	NA
10k Raster Mapping 1:10,000	2019	2	A	No noted change	No noted change
			B	NA	NA
			C	No noted change	No noted change
			D	No noted change	No noted change
			E	NA	NA

MAP	Year	Line	Slice	Activity on site	Activity in the vicinity of the site
Norfolk 1:10,560	1883 - 1884	3	A	NA	NA
			B	Farmlands, Woodlands, Pasture Land, Longrow Lane	Farmlands, Woodlands, Pasture Land, Gravel pit
			C	Farmlands, Woodlands, Pasture Land, Draining Channels	Farmlands, Woodlands, Pasture Land, Draining Channels
Norfolk 1:10,560	1907-1908	3	A	NA	NA
			B	No noted change	No noted change
			C	No noted change	No noted change
Norfolk 1:10,560	1938-1952	3	A	NA	NA
			B	No noted change	No noted change
			C	No noted change	No noted change
OS Plan 1:10,000	1957-1959	3	A	NA	NA
			B	No noted change	No noted change
			C	No noted change	No noted change
OS Plan 1:10,000	1973-1976	3	A	NA	NA
			B	Electricity transmission line and pylons are shown. Langrow Lane name changed to Ringland Lane	Electricity transmission line. Details (sheds) of the disused airfield are shown west of the line option. The Gravel pit is disused
			C	No noted change	No noted change
OS Plan 1:10,000	1982	3	A	NA	NA
			B	No noted change	No noted change
			C	No noted change	No noted change
10k Raster	2000	3	A	NA	NA

MAP	Year	Line	Slice	Activity on site	Activity near the site
Mapping 1:10,000					
			B	No noted change	No noted change
			C	No noted change	No noted change
10k Raster Mapping 1:10,000	2006	3	A	NA	NA
			B	No noted change	No noted change
			C	No noted change	No noted change
10k Raster Mapping 1:10,000	2019	3	A	NA	NA
			B	No noted change	No noted change
			C	No noted change	No noted change

MAP	Year	Line	Slice	Activity on site	Activity near the site
Norfolk 1:10,560	1883 - 1886	4	A	Farmlands, Woodlands, Pasture Land	Farmlands, Woodlands, Pasture Land, Sand Pit west of the line
			B	Farmlands, Woodlands, Pasture Land	Farmlands, Woodlands, Pasture Land, Farms
			C	NA	NA
			D	Draining channels, Farmlands,	Draining Channels, Farmlands
			E	Farmland, Fakenham Road	Farmland, Woodland
Norfolk 1:10,560	1907-1908	4	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	No noted change	No noted change
Norfolk 1:10,560	1938-1952	4	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	No noted change	No noted change
OS Plan 1:10,000	1957-1959	4	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	NA	NA
			E	No noted change	No noted change

MAP	Year	Line	Slice	Activity on site	Activity near the site
OS Plan 1:10,000	1975-1976	4	A	No noted change	Sand Pit disused and converted in woodland and farmland. Electricity transmission line south of the proposed line.
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	A1076 Fakenham Road link at Attlebridge upgraded/constructed
			E	A1067 Fakenham Road upgraded/constructed	A1076 Fakenham Road upgraded/constructed
OS Plan 1:10,000	1982	4	A	No noted change	No noted change
			B	NA	NA
			C	NA	NA
			D	NA	NA
			E	No noted change	No noted change
10k Raster Mapping 1:10,000	2000	4	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	No noted change	No noted change
10k Raster Mapping 1:10,000	2006	4	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	No noted change	No noted change
10k Raster Mapping 1:10,000	2019	4	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	No noted change	No noted change
			E	No noted change	A1270 Broadland Northway construction and roundabouts, Wensum Valley Golf east of the proposed line

MAP	Year	Line	Slice	Activity on site	Activity near the site
MAP	Year	Line	Slice	Activity on site	Activity near the site
Norfolk 1:10,560	1883 - 1886	5	A	Fokenaham Road, Farmland	Woodland, Farmland, draining channels
			B	NA	
			C	NA	
Norfolk 1:10,560	1907-1908	5	A	No noted change	No noted change
			B	NA	NA
			C		
Norfolk 1:10,560	1938-1952	5	A	No noted change	No noted change
			B	NA	NA
			C	NA	NA
OS Plan 1:10,000	1957-1959	5	A	No noted change	No noted change
			B	NA	NA
			C	NA	NA
OS Plan 1:10,000	1975-1976	5	A	A1067 Fakenham Road upgraded/constructed	No noted change
			B	NA	NA
			C	NA	NA
OS Plan 1:10,000	1982	5	A	Map not Present	Map not Present
			B	NA	NA
			C	NA	NA
10k Raster Mapping 1:10,000	2000	5	A	No noted change	No noted change
			B	NA	NA
			C	NA	NA
10k Raster Mapping 1:10,000	2006	5	A	No noted change	No noted change
			B	NA	NA
			C	NA	NA
10k Raster Mapping 1:10,000	2019	5	A	No noted change	A1270 Broadland Northway construction and roundabouts, Wensum Valley Golf course constructed South east of the proposed line Option D
			B	NA	NA
			C	NA	NA

MAP	Year	Line	Slice	Activity on site	Activity near the site
MAP	Year	Line	Slice	Activity on site	Activity near the site
Norfolk 1:10,560	1883 - 1884	6	A	Fokenaham Road, Farmland, Draining channel	Woodland, Farmland, draining channels
			B	Fokenaham Road, Farmland, Draining channel	Woodland, Farmland, draining channels
			C	NA	NA
			D	NA	NA
Norfolk 1:10,560	1907-1908	6	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	NA	NA
Norfolk 1:10,560	1938-1952	6	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	NA	NA
OS Plan 1:10,000	1957	6	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	NA	NA
OS Plan 1:10,000	1975-1976	6	A	A1067 Fakenham Road upgraded/constructed	A1067 Fakenham Road upgraded/constructed
			B	A1067 Fakenham Road upgraded/constructed	A1067 Fakenham Road upgraded/constructed
			C	NA	NA
			D	NA	NA
10k Raster Mapping 1:10,000	2000	6	A	No noted change	No noted change
			B	No noted change	No noted change
			C		
			D		
10k Raster Mapping 1:10,000	2006	6	A	No noted change	No noted change
			B	No noted change	No noted change
			C	NA	NA
			D	NA	NA
10k Raster Mapping 1:10,000	2019	6	A	No noted change	No noted change
			B	No noted change	No noted change

MAP	Year	Line	Slice	Activity on site	Activity near the site
			C	NA	NA
			D	NA	NA
MAP	**Year**	**Line**	**Slice**	**Activity on site**	**Activity near the site**
Norfolk 1:10,560	1883 - 1884	7	A	Lane, Farmland, Farms, River Tud	Farms, Woodland, Farmland, draining channels
			B		
Norfolk 1:10,560	1907-1908	7	A	No noted change	No noted change
			B		
Norfolk 1:10,560	1938-1952	7	A	No noted change	No noted change
			B		
OS Plan 1:10,000	1957	7	A	No noted change	No noted change
			B		
OS Plan 1:10,000	1975-1976	7	A	A47 constructed	A47 constructed
			B		
10k Raster Mapping 1:10,000	2000	7	A	No noted change	No noted change
			B		
10k Raster Mapping 1:10,000	2006	7	A	No noted change	Roundabout construction East of the proposed Option D
			B		
10k Raster Mapping 1:10,000	2019	7	A	No noted change	No noted change
			B		

Annex D

MINING AND GROUND STABILITY SUMMARY

ANNEX D – MINING AND GROUND STABILITY SUMMARY

Ground Stability Hazard	Line 1	Slice	on site	near site	Options
Potential for collapsible Ground Stability Hazard	1	A	Very Low	Very low	A
Potential for compressible Ground Stability Hazard	1	A	No Hazard	Moderate	A
Potential for Ground dissolution Stability Hazard	1	A	Very Low	Very Low	A
Potential for Landslide Ground stability Hazard	1	A	Very Low	Very Low	A
Potential for Running Sand Ground stability Hazard	1	A	Very Low	Low	A
Potential for Shrinking or Swelling clay Ground Stability Hazard	1	A	Low	Low	A
Potential for collapsible Ground Stability Hazard	1	B	Very low	Very low	A
Potential for compressible Ground Stability Hazard	1	B	No Hazard	Moderate	A
Potential for Ground dissolution Stability Hazard	1	B	Very low	Very low	A
Potential for Landslide Ground stability Hazard	1	B	Very low	Very low	A
Potential for Running Sand Ground stability Hazard	1	B	Low	Very low	A
Potential for Shrinking or Swelling clay Ground Stability Hazard	1	B	Ver low	low	A
Potential for collapsible Ground Stability Hazard	1	D	Very low	Very low	A
Potential for compressible Ground Stability Hazard	1	D	Moderate	Very low	A
Potential for Ground dissolution Stability Hazard	1	D	Low	Low	A
Potential for Landslide Ground stability Hazard	1	D	Very low	Low	A
Potential for Running Sand Ground stability Hazard	1	D	Low	Very low	A
Potential for Shrinking or Swelling clay Ground Stability Hazard	1	D	Very Low	Very low	A

Ground Stability Hazard	Line 2	Slice	on site	near site	Options
Potential for collapsible Ground Stability Hazard	2	A	Very low	No hazard	B,C
Potential for compressible Ground Stability Hazard	2	A	Moderate	Moderate	B,C
Potential for Ground dissolution Stability Hazard	2	A	Very low	NA	B,C
Potential for Landslide Ground stability Hazard	2	A	Very low	very low	B,C
Potential for Running Sand Ground stability Hazard	2	A	low	NA	B,C
Potential for Shrinking or Swelling clay Ground Stability Hazard	2	A	Low	NA	B,C
Potential for collapsible Ground Stability Hazard	2	C	Very low	NA	B,C
Potential for compressible Ground Stability Hazard	2	C	Moderate	NA	B,C
Potential for Ground dissolution Stability Hazard	2	C	Very Low	No Hazard	B,C
Potential for Landslide Ground stability Hazard	2	C	Low	NA	B,C
Potential for Running Sand Ground stability Hazard	2	C	Low	Low	B,C

Ground Stability Hazard	Line	Slice	on site	near site	Options
Potential for Shrinking or Swelling clay Ground Stability Hazard	2	C	Low	NA	B,C
Potential for collapsible Ground Stability Hazard	2	D	Very low	NA	B
Potential for compressible Ground Stability Hazard	2	D	No Hazard	NA	B
Potential for Ground dissolution Stability Hazard	2	D	Very low	Moderate	B
Potential for Landslide Ground stability Hazard	2	D	Very Low	low	B
Potential for Running Sand Ground stability Hazard	2	D	Low	low	B
Potential for Shrinking or Swelling Clay Ground Stability Hazard	2	D	low	low	B

Ground Stability Hazard	**Line**	**Slice**	**on site**	**near site**	**Options**
Potential for collapsible Ground Stability Hazard	3	B	VERY Low	NA	C
Potential for compressible Ground Stability Hazard	3	B	moderate	NA	C
Potential for Ground dissolution Stability Hazard	3	B	Low	NA	C
Potential for Landslide Ground stability Hazard	3	B	Low	NA	C
Potential for Running Sand Ground stability Hazard	3	B	low	low	C
Potential for Shrinking or Swelling clay Ground Stability Hazard	3	B	very low	NA	C
Potential for collapsible Ground Stability Hazard	3	C	Very low	No hazard	C
Potential for compressible Ground Stability Hazard	3	C	Moderate	Moderate	C
Potential for Ground dissolution Stability Hazard	3	C	High	High	C
Potential for Landslide Ground stability Hazard	3	C	Low	Low	C
Potential for Running Sand Ground stability Hazard	3	C	low	low	C
Potential for Shrinking or Swelling Clay Ground Stability Hazard	3	C	Very low	very low	C

Ground Stability Hazard	**Line**	**Slice**	**on site**	**near site**	**Options**
Potential for collapsible Ground Stability Hazard	4	A	Ver low	NA	D
Potential for compressible Ground Stability Hazard	4	A	No Hazard	NA	D
Potential for Ground dissolution Stability Hazard	4	A	Low	No Hazard	D
Potential for Landslide Ground stability Hazard	4	A	Low	Low	D
Potential for Running Sand Ground stability Hazard	4	A	Very low	No Hazard	D
Potential for Shrinking or Swelling Clay Ground Stability Hazard	4	A	Low	Low	D
Potential for collapsible Ground Stability Hazard	4	B	Very Low	NA	D
Potential for compressible Ground Stability Hazard	4	B	Moderate	NA	D
Potential for Ground dissolution Stability Hazard	4	B	Low		D
Potential for Landslide Ground stability Hazard	4	B	Low	Moderate	D
Potential for Running Sand Ground stability Hazard	4	B	Low	No HAzard	D

Potential for Shrinking or Swelling Clay Ground Stability Hazard	4	B	Very Low	No Hazard	D
Potential for collapsible Ground Stability Hazard	4	D	Very Low	NA	D
Potential for compressible Ground Stability Hazard	4	D	Moderate	NA	D
Potential for Ground dissolution Stability Hazard	4	D	High	Moderate	D
Potential for Landslide Ground stability Hazard	4	D	Very Low	NA	D
Potential for Running Sand Ground stability Hazard	4	D	Low	NA	D
Potential for Shrinking or Swelling Clay Ground Stability Hazard	4	D	Very Low	NA	D
Potential for collapsible Ground Stability Hazard	4	E	Very Low	NA	D
Potential for compressible Ground Stability Hazard	4	E	Moderate	NA	D
Potential for Ground dissolution Stability Hazard	4	E	High	NA	D
Potential for Landslide Ground stability Hazard	4	E	Very Low	NA	D
Potential for Running Sand Ground stability Hazard	4	E	Low	NA	D
Potential for Shrinking or Swelling Clay Ground Stability Hazard	4	E	Very low	NA	D

Ground Stability Hazard	**Line**	**Slice**	**on site**	**near site**	**Options**
Potential for collapsible Ground Stability Hazard	5	A	very low	Very low	A,B,C,D
Potential for compressible Ground Stability Hazard	5	A	No Hazard	Moderate	A,B,C,D
Potential for Ground dissolution Stability Hazard	5	A	High	Moderate	A,B,C,D
Potential for Landslide Ground stability Hazard	5	A	Very Low	Low	A,B,C,D
Potential for Running Sand Ground stability Hazard	5	A	Very low	Low	A,B,C,D
Potential for Shrinking or Swelling Clay Ground Stability Hazard	5	A	No Hazard	very low	A,B,C,D

Ground Stability Hazard	**Poly**	**Slice**	**on site**	**near site**	**Options**
Potential for collapsible Ground Stability Hazard	6	A	Very Low	NA	B
Potential for compressible Ground Stability Hazard	6	A	Moderate	NA	B
Potential for Ground dissolution Stability Hazard	6	A	High	Moderate	B
Potential for Landslide Ground stability Hazard	6	A	Very Low	Moderate	B
Potential for Running Sand Ground stability Hazard	6	A	Very Low	No Hazard	B
Potential for Shrinking or Swelling Clay Ground Stability Hazard	6	A	Very low	very low	B
Potential for collapsible Ground Stability Hazard	6	B	Very Low	NA	B
Potential for compressible Ground Stability Hazard	6	B	Moderate	NA	B
Potential for Ground dissolution Stability Hazard	6	B	HIgh	NA	B
Potential for Landslide Ground stability Hazard	6	B	Very low	No hazard	B
Potential for Running Sand Ground stability Hazard	6	B	low	No hazard	B

Potential for Shrinking or Swelling Clay Ground Stability Hazard	6	B	Very low	NA	B

Ground Stability Hazard	Poly	Slice	on site	near site	Options
Potential for collapsible Ground Stability Hazard	7	A	very low	NA	D
Potential for compressible Ground Stability Hazard	7	A	moderate	NA	D
Potential for Ground dissolution Stability Hazard	7	A	low	low	D
Potential for Landslide Ground stability Hazard	7	A	very low	low	D
Potential for Running Sand Ground stability Hazard	7	A	low	NA	D
Potential for Shrinking or Swelling Clay Ground Stability Hazard	7	A	low	no hazard	D

Annex E

UNEXPLODED ORDNANCE (UXO)

ANNEX E – UNEXPLODED ORDNANCE

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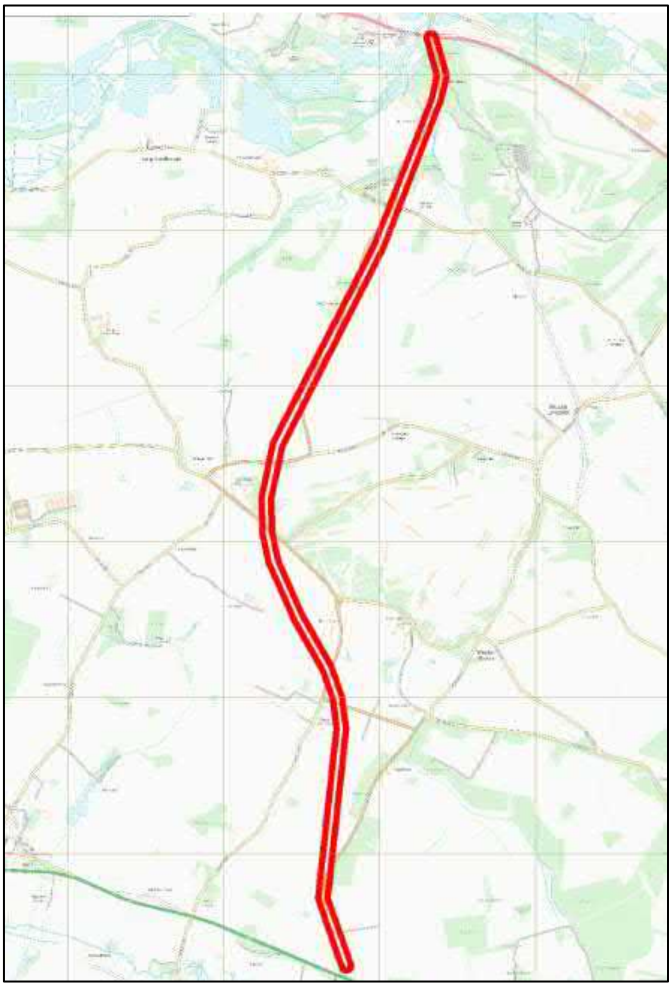
Landmark INFORMATION GROUP

6 alpha ASSOCIATES special risks consultancy

PRELIMINARY UNEXPLODED ORDNANCE (UXO) THREAT ASSESSMENT

Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework



6 ALPHA PROJECT NUMBER	P7198	**ORIGINATOR**	B. Wilkins
LANDMARK ORDER NUMBER	194238740_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Line 1	**RELEASED BY**	R. Griffiths (18th February2019)
SITE	Site at 609837, 315255		
RECOMMENDATION	This Site requires a Detailed UXO Threat and Risk Assessment		

STUDY SITE

The Study Site is described as “Site at 609837, 315255”, and it is centred on National Grid Reference 609740, 315280.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being LIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* recommends that the next stage in the risk management framework is:

DETAILED UXO THREAT & RISK ASSESSMENT

We would be pleased to provide this service, please contact *Envirocheck* for further details:

Envirocheck®
LANDMARK INFORMATION GROUP®

REPORT SUMMARY

During WWII, the Study Site was situated within *St Faiths & Aylsham Rural District* and *Mitford & Launditch Rural District*, which both recorded one High Explosive (HE) bomb strike per 100 hectares; a very low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site identified an airfield (on-site, 135m east and 200m east) as a primary bombing target.

Further research identified this airfield as *Royal Air Force* (RAF) *Attlebridge* (on-site) and was active between 1941-1956. It’s primary purpose was originally a satellite station, which then extended to accommodate *RAF* and *American Air Force* heavy bomber groups and their training.

Air Raid Precaution (ARP) records did not identify any HE bomb strikes within the Site. However, two unknown bombs were identified 415m east and 980m east.

Official bomb damage mapping was not available. Additionally, further research did not identify any evidence of bomb damage within 1,000m of the Site.

Given that *RAF Attlebridge* was located on-site; it would suggest that further action is warranted to address the potential for UXO encounter.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

For further information, please contact *Envirocheck*:
Website: http://www.envirocheck.co.uk
Telephone: +44 (0)844 844 9952
Email: customerservice@envirocheck.co.uk

DATA FINDINGS

Threat Source (within 1,000m)	Detail: Identified	Detail: Comments
Airfields/Military Facilities	✓	*RAF Attlebridge* (on-site).
Ordnance Manufacture/Storage	✗	None recorded within 1,000m.
WWII Decoy Bombing Sites	✗	None recorded within 1,000m.
WWII Defensive Features	✓	Spigot Mortar Emplacement (155m north-west).
WWII *Luftwaffe* Designated Bombing Targets	✓	*Luftwaffe* aerial photography identified an airfield (on-site, 135m east and 200m east) as a primary bombing target.
WWII Bomb Strikes Within Site Boundary	✗	ARP records did not identify any HE bomb strikes on-site.
WWII Bomb Strikes Near Site Boundary	✓	ARP records identified two unknown bombs; 415m east and 980m east.
WWII Bomb Damage	✗	Official bomb damage mapping was not available.
Abandoned Bomb Register	✗	The official abandoned bomb list did not identify any abandoned bombs located within 1,000m.
Potential Threat Sources	✓	The most probable UXO threat is posed by LSA/SAA/AXO associated with former *RAF* sites.
WWII Bombing Density Per 100 Hectares	✓	*St Faiths & Aylsham Rural District* and *Mitford & Launditch Rural District,* which both recorded one HE bomb strike per 100 hectares.

IMPORTANT NOTES

1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

BRITISH NATIONAL GRID

SITE AT 609837,315255

WWII High Explosive Bomb Density

BOMB SEARCH
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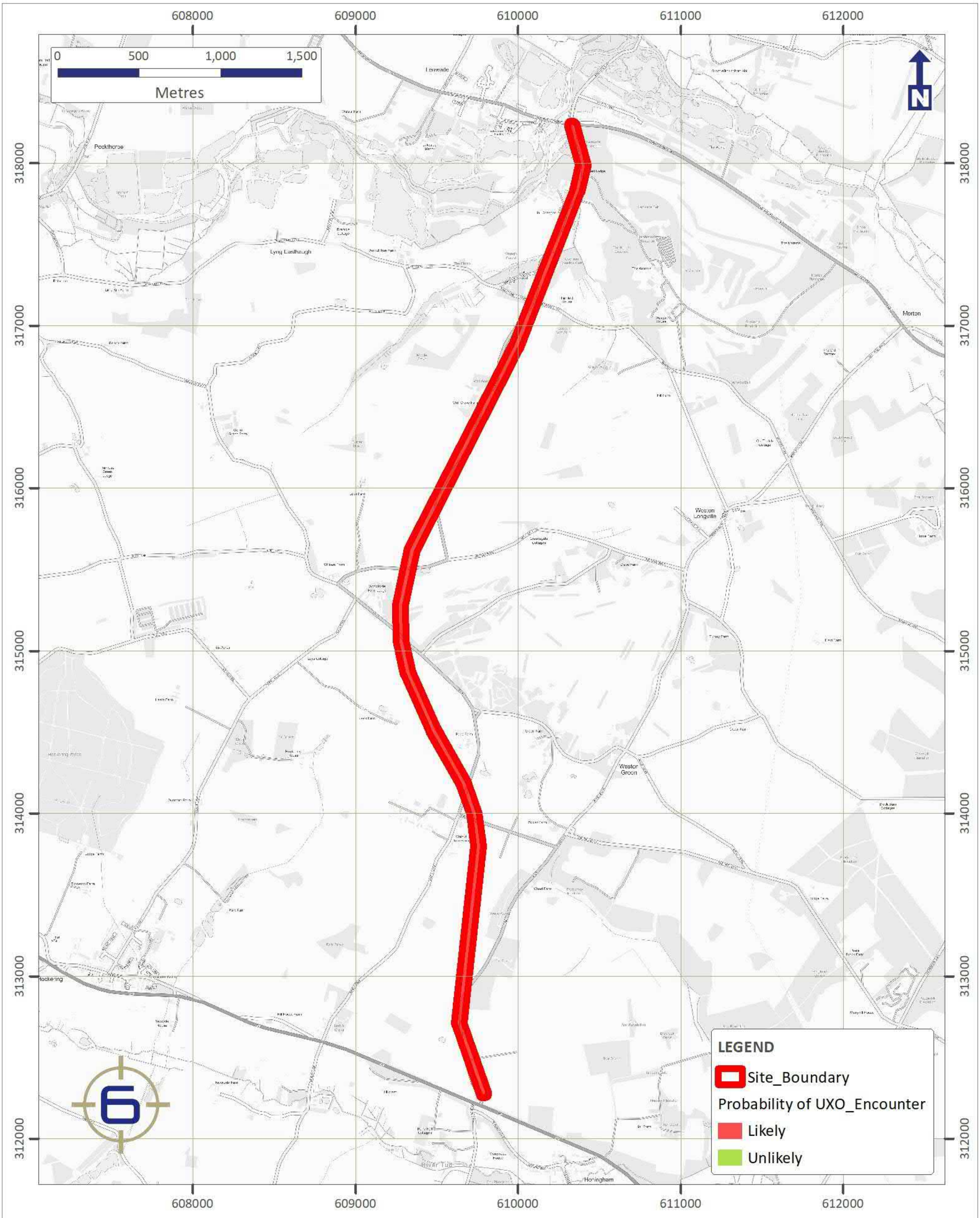
PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE		
P7198	1	BL	CC	15 February 2019	Contains Ordnance Survey data © Crown copyright and database right 2017	Produced by and Copyright to 6 Alpha Associates Ltd. Users noting any errors please notify 6 Alpha.

alpha ASSOCIATES

SITE AT 609837,315255

Probability of UXO Encounter



PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE
P7198	2	BL	CC	15 February 2019

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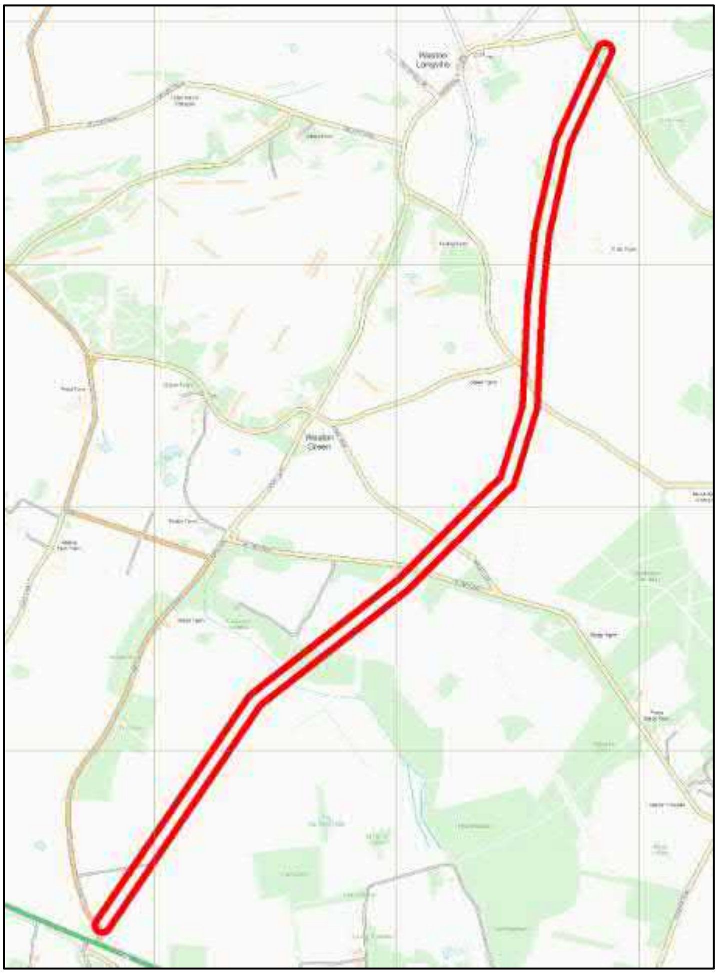
Landmark INFORMATION GROUP

6 alpha ASSOCIATES special risks consultancy

PRELIMINARY UNEXPLODED ORDNANCE (UXO) THREAT ASSESSMENT

Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework



6 ALPHA PROJECT NUMBER	P7197	**ORIGINATOR**	B. Wilkins
LANDMARK ORDER NUMBER	194238091_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Line 2	**RELEASED BY**	R. Griffiths (18th February 2019)
SITE	Site at 610823, 314082		
RECOMMENDATION	This Site requires a Detailed UXO Threat and Risk Assessment		

STUDY SITE

The Study Site is described as "Site at 610823, 314082", and it is centred on National Grid Reference 611010, 313990.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being LIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* recommends that the next stage in the risk management framework is:

DETAILED UXO THREAT & RISK ASSESSMENT

We would be pleased to provide this service, please contact *Envirocheck* for further details:

Envirocheck®
LANDMARK INFORMATION GROUP®

REPORT SUMMARY

During WWII, the Study Site was situated within *St Faiths & Aylsham Rural District* and *Mitford & Launditch Rural District* which both recorded one High Explosive (HE) bomb strike per 100 hectares; a very low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site identified an airfield (located on-site, 45m west, 290m west and 290m west) as a primary bombing target.

Further research identified that the airfield was *Royal Air Force* (RAF) *Attlebridge* (on-site, 20m north-west and 175m west) which was active between 1941-1956. It's primary purpose was originally a satellite station, which then extended to accommodate *RAF* and *American Air Force* heavy bomber groups and training. An analysis of official site plans identified bomb stores 285m west.

Air Raid Precaution (ARP) records did not identify any HE bomb strikes on-site. However, three HE bombs were identified within 875m of the Site boundary; the closest being 450m west. Additionally, two unknown bombs were identified 565m west and 675m west, as well as an incendiary bomb located 900m west.

Given that *RAF Attlebridge* was identified on-site; it would suggest that further action is warranted to address the potential for UXO encounter.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

For further information, please contact *Envirocheck*:
Website: http://www.envirocheck.co.uk
Telephone: +44 (0)844 844 9952
Email: customerservice@envirocheck.co.uk

DATA FINDINGS

Threat Source (within 1,000m)	Detail: Identified	Detail: Comments
Airfields/Military Facilities	✔	*RAF Attlebridge* (on-site, 20m north-west and 175m west).
Ordnance Manufacture/Storage	✔	Official site plans identified bomb stores (285m west).
WWII Decoy Bombing Sites	✘	None recorded within 1,000m.
WWII Defensive Features	✘	None recorded within 1,000m.
WWII *Luftwaffe* Designated Bombing Targets	✔	*Luftwaffe* aerial photography identified an airfield (on-site, 45m west, 290m west and 290m west) as primary bombing targets.
WWII Bomb Strikes Within Site Boundary	✘	ARP records did not identify any HE bombs on-site.
WWII Bomb Strikes Near Site Boundary	✔	ARP records identified three HE bomb strikes; 450m west, 605m west and 875m west.
WWII Bomb Damage	✘	Official bomb damage mapping was not available.
Abandoned Bomb Register	✘	The official abandoned bomb list did not identify any abandoned bombs located within 1,000m.
Potential Threat Sources	✔	The most probable UXO threat is posed by LSA/SAA/AXO associated with former *RAF* sites.
WWII Bombing Density Per 100 Hectares	✔	*St Faiths & Aylsham Rural District* and *Mitford & Launditch Rural District,* both recording one HE bomb strike per 100 hectares.

IMPORTANT NOTES

1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

BRITISH NATIONAL GRID

SITE AT 610823,314082

WWII High Explosive Bomb Density

BOMB SEARCH
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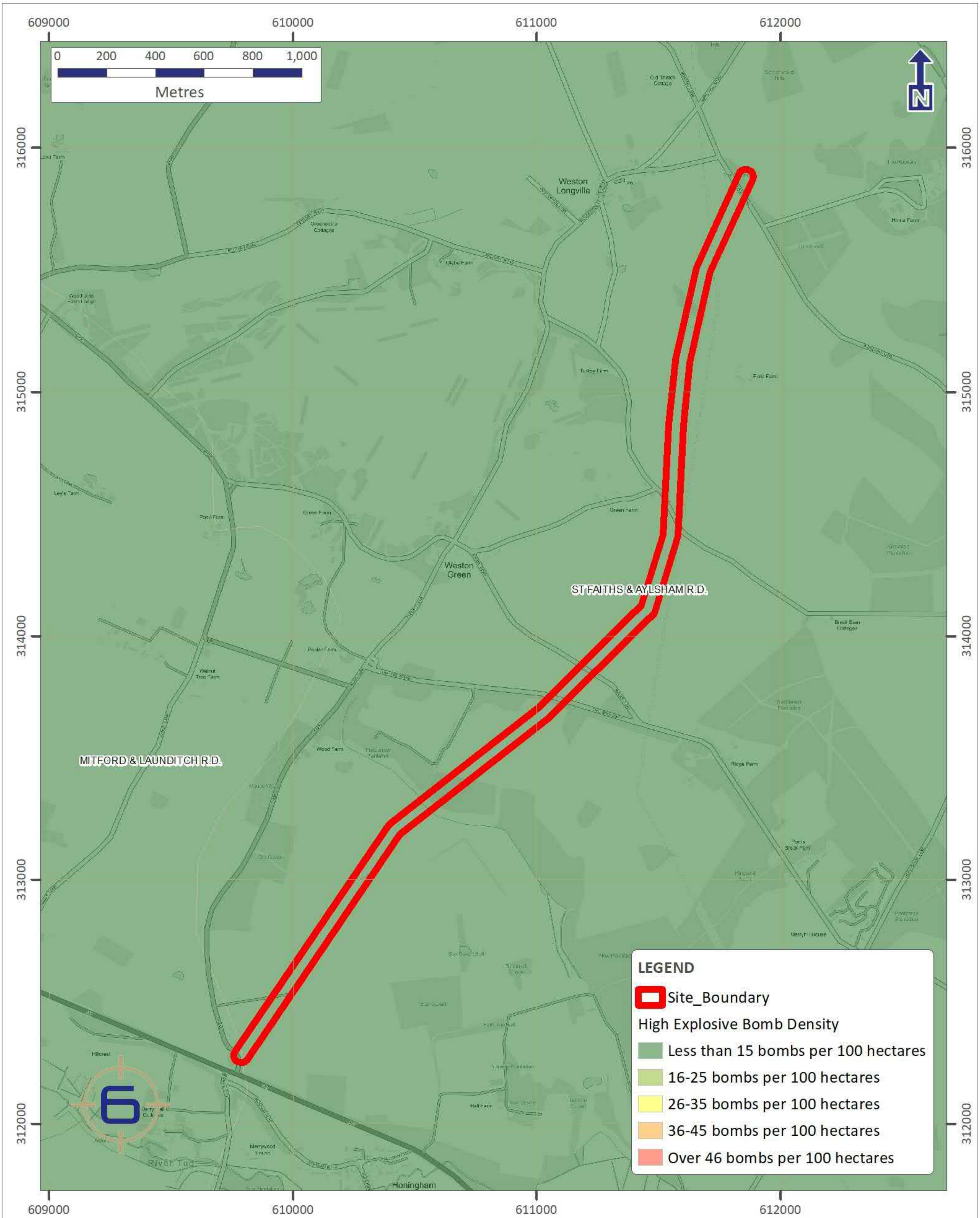

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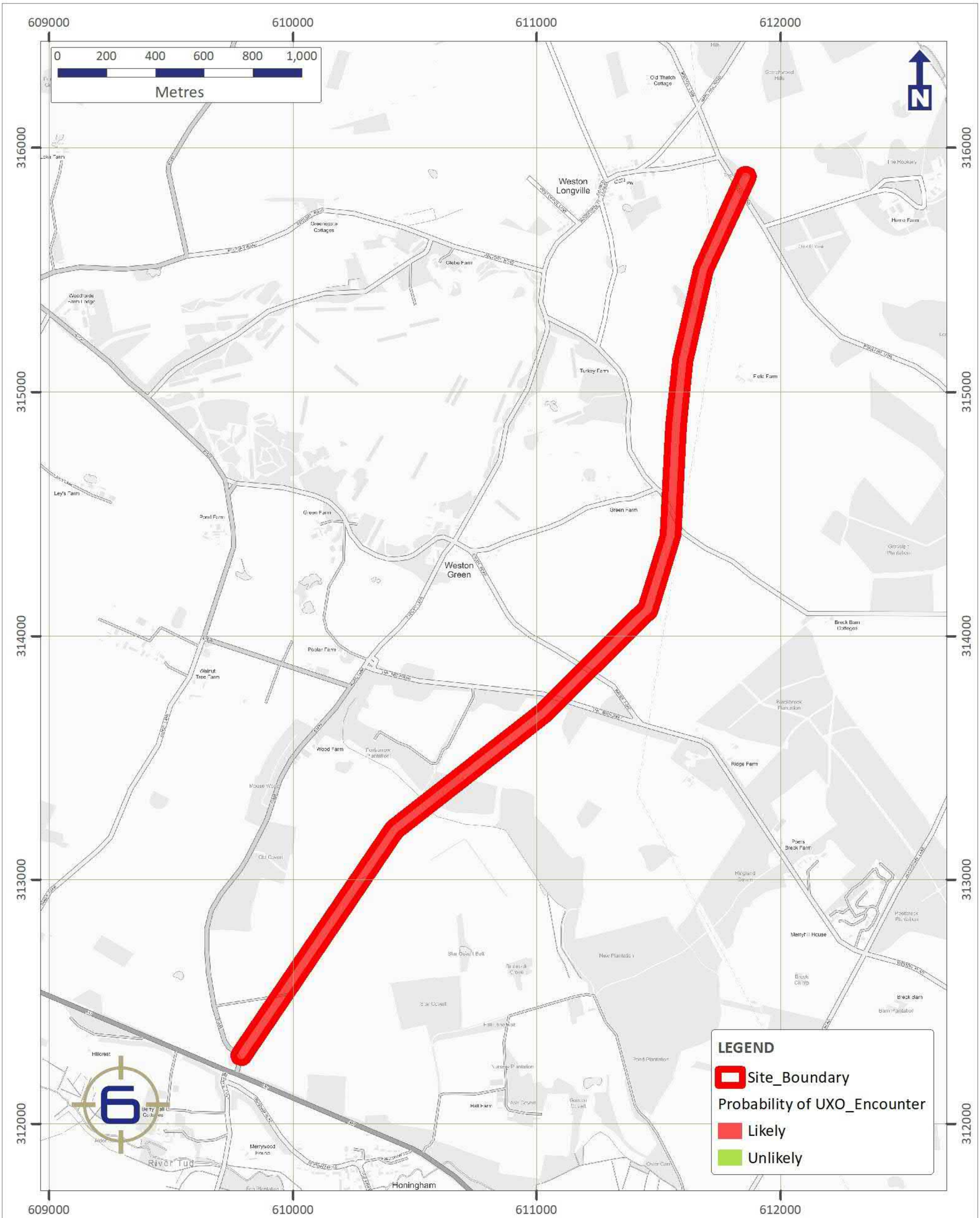
BRITISH NATIONAL GRID

SITE AT 610823,314082

Probability of UXO Encounter



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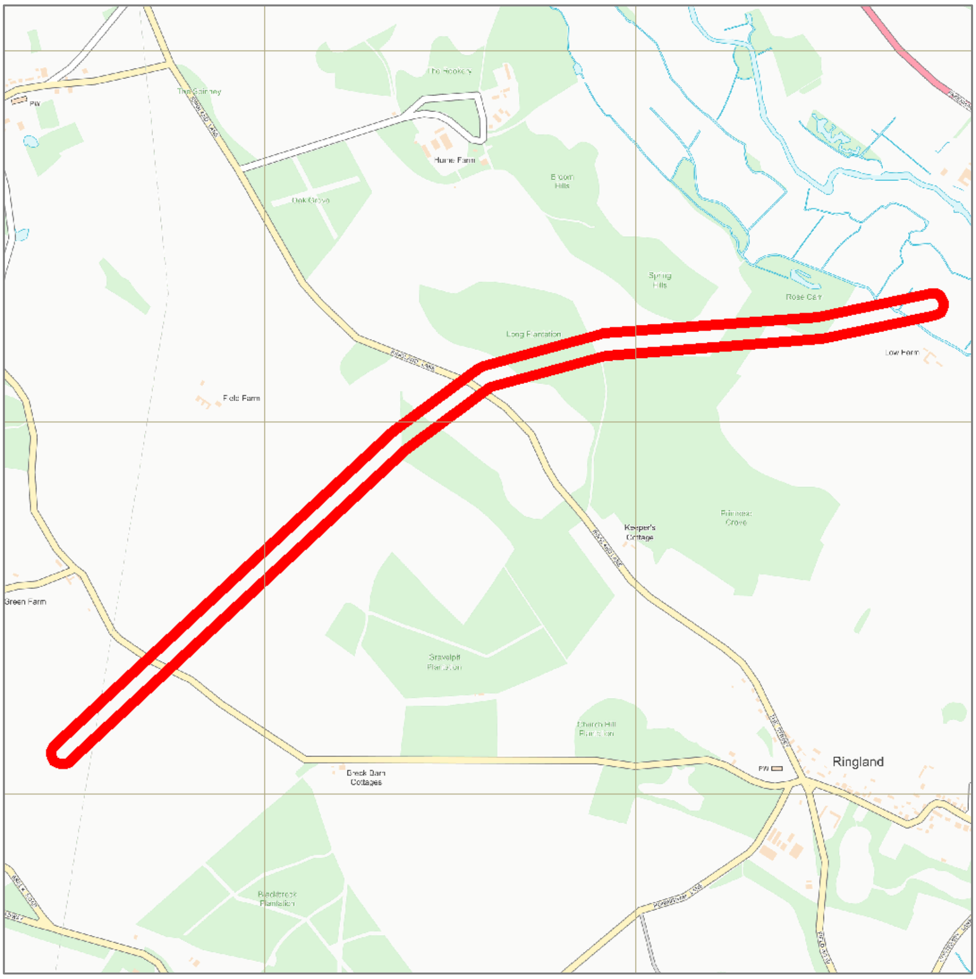
PRELIMINARY UNEXPLODED ORDNANCE (UXO) THREAT ASSESSMENT

Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework



6 ALPHA PROJECT NUMBER	P7200	**ORIGINATOR**	L. Hayes
LANDMARK ORDER NUMBER	194264816_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Line 3	**RELEASED BY**	R. Griffiths (18th February 2019)
SITE	Site at 612627, 314714		
RECOMMENDATION	No further action is required to address the UXO risk at this Site		

STUDY SITE

The Study Site is described as "Site at 612627, 314714", and it is centred on National Grid Reference 612540, 314890.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being UNLIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* concludes that **NO FURTHER ACTION** is required to address the UXO risk at this Study Site. Should you have any queries, please contact *Envirocheck*.

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REPORT SUMMARY

During WWII, the Study Site was situated within *St Faiths & Aylsham Rural District*, which recorded one High Explosive (HE) bomb strike per 100 hectares; a very low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site an airfield (located 390m north-west, 415m south-west, 870m south-west and 950m south-west) as a primary bombing target.

Further research identified this airfield as *Royal Air Force* (RAF) *Attlebridge* (located 340m south, 510m north-west, 585m south-west, 880m south-west and 985m south-west) which was active between 1941-1956. Its primary purpose was originally as a satellite station, before then being extended to accommodate *RAF* and *American Air Force* heavy bomber groups and their training. An analysis of official site plans identified bomb stores 650m north-west.

Air Raid Precaution (ARP) records did not identify any HE bomb strikes within the Site. However, one HE bomb strike was identified 640m west and one unknown bomb was identified 775m north-west.

Despite an airfield being located within the area during WWII; there is no evidence to suggest that further investigation into UXO is warranted.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

For further information, please contact *Envirocheck*: Telephone: +44 (0)844 844 9952

Website: http://www.envirocheck.co.uk Email: customerservice@envirocheck.co.uk

DATA FINDINGS

Threat Source (within 1,000m)	Identified	Comments
Airfields/Military Facilities	✓	*RAF Attlebridge* (340m south, 510m north-west, 585m south west, 880m south-west and 985m south-west).
Ordnance Manufacture/Storage	✓	Official site plans identified bomb stores (650m north-west).
WWII Decoy Bombing Sites	✗	None recorded within 1,000m.
WWII Defensive Features	✗	None recorded within 1,000m.
WWII *Luftwaffe* Designated Bombing Targets	✓	An airfield (390m north-west, 415m south-west, 870m south-west, and 950m south-west).
WWII Bomb Strikes Within Site Boundary	✗	ARP records did not identify any HE bomb strikes on-site.
WWII Bomb Strikes Near Site Boundary	✓	ARP records identified one HE bomb strike 640m west and one unknown bomb strike 775m north-west.
WWII Bomb Damage	✗	Official bomb damage mapping was not available.
Abandoned Bomb Register	✗	The official abandoned bomb list did not identify any abandoned bombs within 1,000m.
Potential Threat Sources	✗	Further research has not uncovered any potential UXO threats associated with the Study Site.
WWII Bombing Density Per 100 Hectares	✓	The Site was located within *St Faiths & Aylsham Rural District*, which recorded one HE bomb strike per 100 hectares.

IMPORTANT NOTES

1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

BRITISH NATIONAL GRID

SITE AT 612627,314714

WWII High Explosive Bomb Density

BOMB SEARCH
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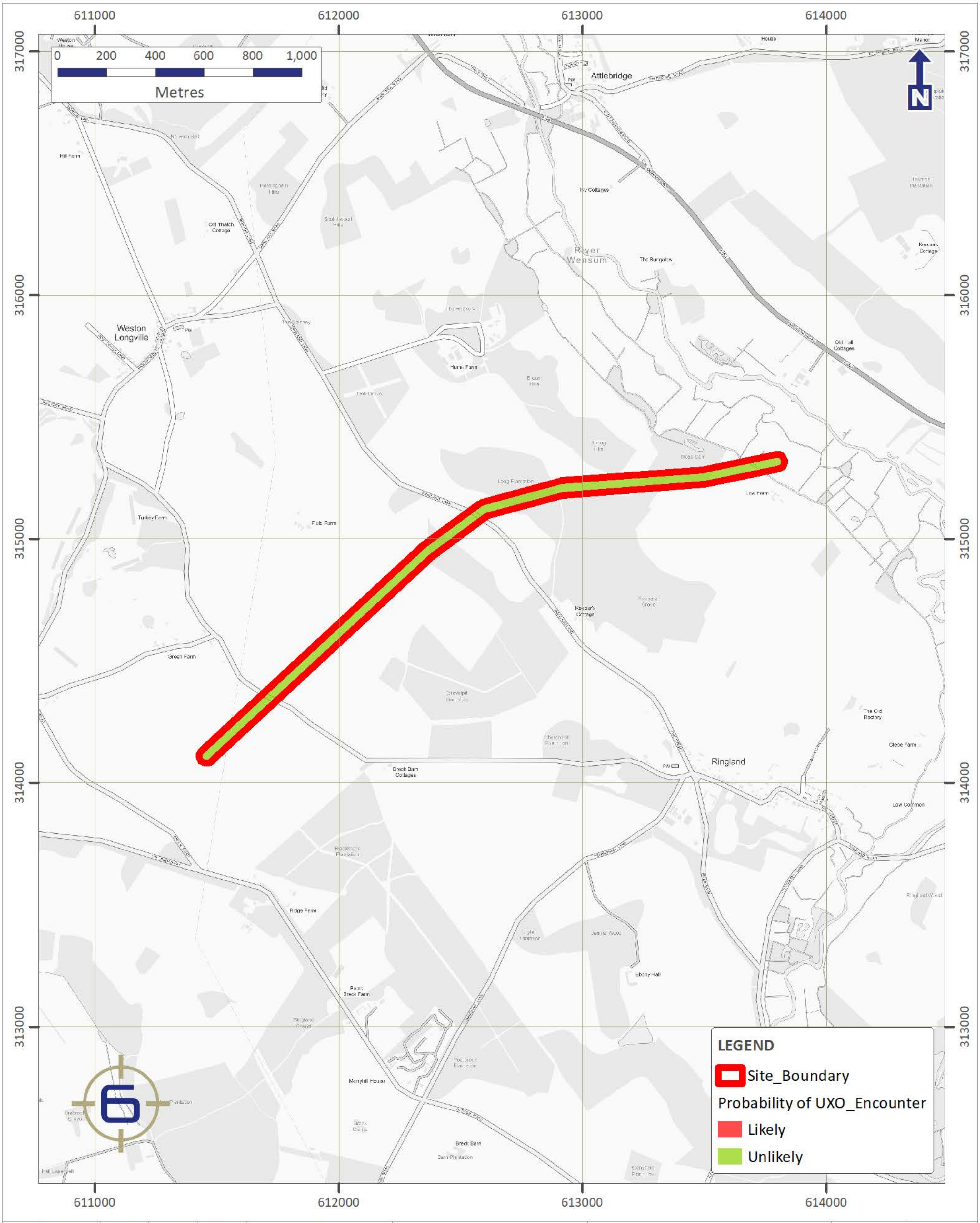
SITE AT 612627,314714

Probability of UXO Encounter



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PRELIMINARY UNEXPLODED ORDNANCE (UXO) THREAT ASSESSMENT

Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework

6 ALPHA PROJECT NUMBER	P7196	**ORIGINATOR**	L. Hayes
LANDMARK ORDER NUMBER	194236735_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Line 4	**RELEASED BY**	R. Griffiths (18th February 2019)
SITE	Site at 613309, 313834		
RECOMMENDATION	No further action is required to address the UXO risk at this Site		

UNEXPLODED ORDNANCE THREAT ASSESSMENT

STUDY SITE

The Study Site is described as "Site at 613309, 313834", and it is centred on National Grid Reference 613130, 313940.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being UNLIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* concludes that **NO FURTHER ACTION** is required to address the UXO risk at this Study Site. Should you have any queries, please contact *Envirocheck*.

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REPORT SUMMARY

During WWII, the Study Site was situated within *St. Faiths & Aylsham Rural District* and *Forehoe & Henstead Rural District*, recording one and two High Explosive (HE) bomb strikes per 100 hectares respectively; both very low levels of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site did not identify any primary bombing targets located on-site or within 1,000m of it.

Air Raid Precaution (ARP) records did not identify any HE bomb strikes within the Site. However, two HE bomb strikes were identified 825m east-southeast and 965m west.

Official bomb damage mapping was not available. Further research of historical records did not identify any evidence of bomb damage located within 1,000m.

As there was no bombing or bomb damage recorded in the Site's vicinity during WWII, there is no evidence to suggest that further investigation into UXO is warranted.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

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DATA FINDINGS

Threat Source (within 1,000m)	Detail: Identified	Detail: Comments
Airfields/Military Facilities	✗	None recorded within 1,000m.
Ordnance Manufacture/Storage	✗	None recorded within 1,000m.
WWII Decoy Bombing Sites	✗	None recorded within 1,000m.
WWII Defensive Features	✗	None recorded within 1,000m.
WWII *Luftwaffe* Designated Bombing Targets	✗	*Luftwaffe* aerial photography did not identify any primary bombing targets within 1,000m.
WWII Bomb Strikes Within Site Boundary	✗	ARP records did not identify any HE bomb strikes on-site.
WWII Bomb Strikes Near Site Boundary	✓	ARP records identified two HE bombs (825m east-southeast and 965m west).
WWII Bomb Damage	✗	Official bomb damage mapping was not available.
Abandoned Bomb Register	✗	The official abandoned bomb list did not identify any abandoned bombs within 1,000m.
Potential Threat Sources	✓	Further research has not uncovered any potential UXO threats associated with the Study Site.
WWII Bombing Density Per 100 Hectares	✓	*St. Faiths & Aylsham* and *Forehoe & Henstead Rural Districts*, recording one & two HE bomb strikes per 100 hectares respectively.

IMPORTANT NOTES

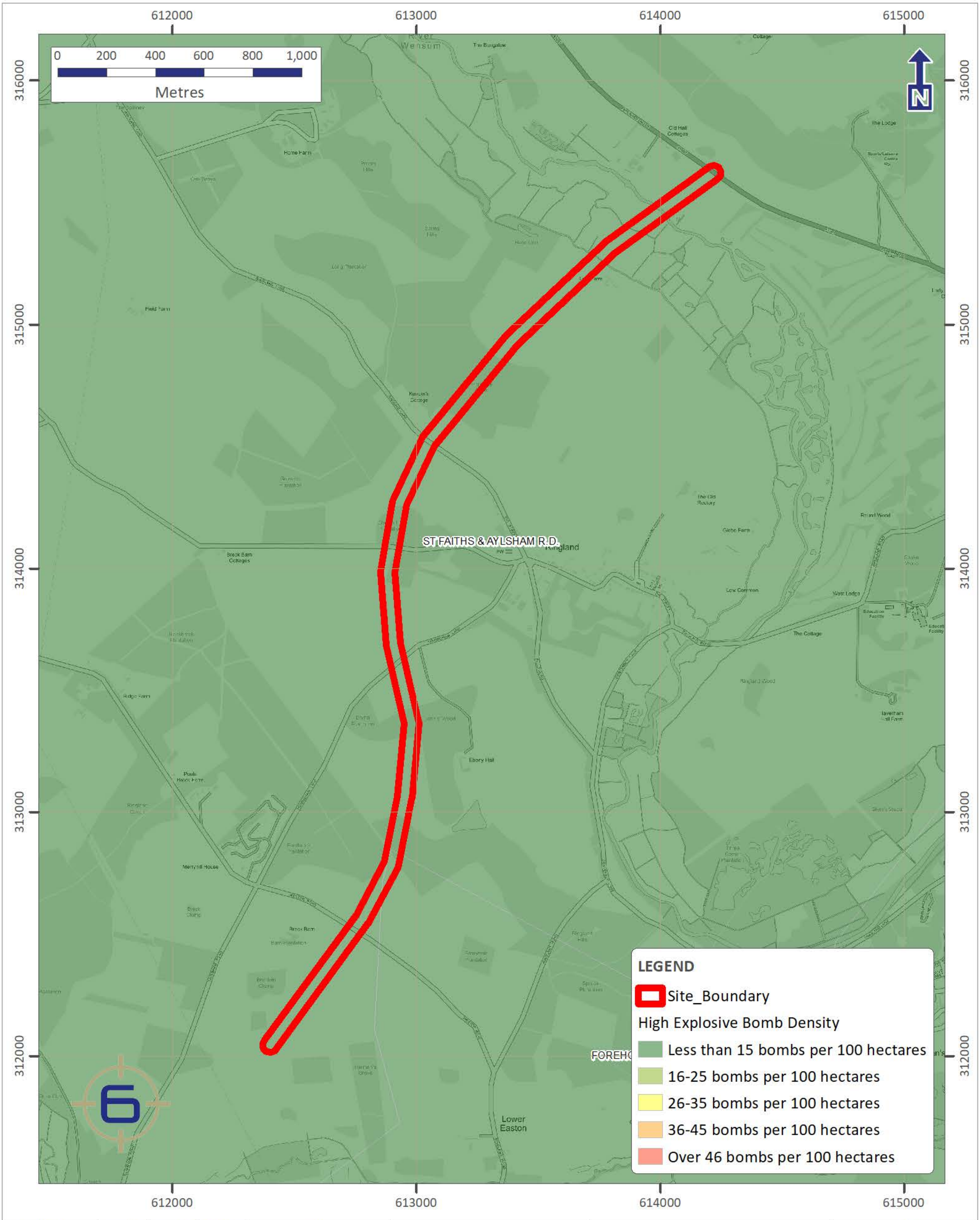
1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

BRITISH NATIONAL GRID

BOMB SEARCH
WWW.6ALPHA.COM

SITE AT 613309,313834

WWII High Explosive Bomb Density



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SITE AT 613309,313834

Probability of UXO Encounter

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Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework

6 ALPHA PROJECT NUMBER	P7199	**ORIGINATOR**	B. Wilkins
LANDMARK ORDER NUMBER	194263576_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Line 5	**RELEASED BY**	R. Griffiths (18th February 2019)
SITE	Site at 613969, 315908		
RECOMMENDATION	No further action is required to address the UXO risk at this Site		

STUDY SITE

The Study Site is described as "Site at 613969, 315908", and it is centred on National Grid Reference 613940, 315860.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being UNLIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* concludes that **NO FURTHER ACTION** is required to address the UXO risk at this Study Site. Should you have any queries, please contact *Envirocheck*.

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REPORT SUMMARY

During WWII, the Study Site was situated within *St Faiths & Aylsham Rural District,* which recorded one HE bomb strike per 100 hectares; a very low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site did not identify any primary bombing targets located on-site or within 1,000m.

Neither *Air Raid Precaution* (ARP) records nor official bomb damage mapping associated with the Site were available. In addition, an analysis of post-war mapping and further research of historical records did not identify any evidence of bombing nor bomb damage within 1,000m of the Site.

As there was no bombing or bomb damage recorded within the Site's vicinity during WWII, there is no evidence to suggest that further investigation into UXO is warranted.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

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Website: http://www.envirocheck.co.uk Email: customerservice@envirocheck.co.uk

DATA FINDINGS

Threat Source (within 1,000m)	Detail: Identified	Detail: Comments
Airfields/Military Facilities	✗	None recorded within 1,000m.
Ordnance Manufacture/Storage	✗	None recorded within 1,000m.
WWII Decoy Bombing Sites	✗	None recorded within 1,000m.
WWII Defensive Features	✗	None recorded within 1,000m.
WWII *Luftwaffe* Designated Bombing Targets	✗	*Luftwaffe* aerial photography did not identify any primary bombing targets located on-site or within 1,000m.
WWII Bomb Strikes Within Site Boundary	✗	ARP records were not available.
WWII Bomb Strikes Near Site Boundary	✗	ARP records were not available.
WWII Bomb Damage	✗	Official bomb damage mapping was not available.
Abandoned Bomb Register	✗	The official abandoned bomb list did not identify any abandoned bombs located on-site or within 1,000m.
Potential Threat Sources	✗	Further research has not uncovered any potential UXO threats associated with the Study Site.
WWII Bombing Density Per 100 Hectares	✓	The Site was located within *St Faiths & Aylsham Rural District*, which recorded one HE bomb strike per 100 hectares.

IMPORTANT NOTES

1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

BRITISH NATIONAL GRID

SITE AT 613969,315908

WWII High Explosive Bomb Density

BOMB SEARCH
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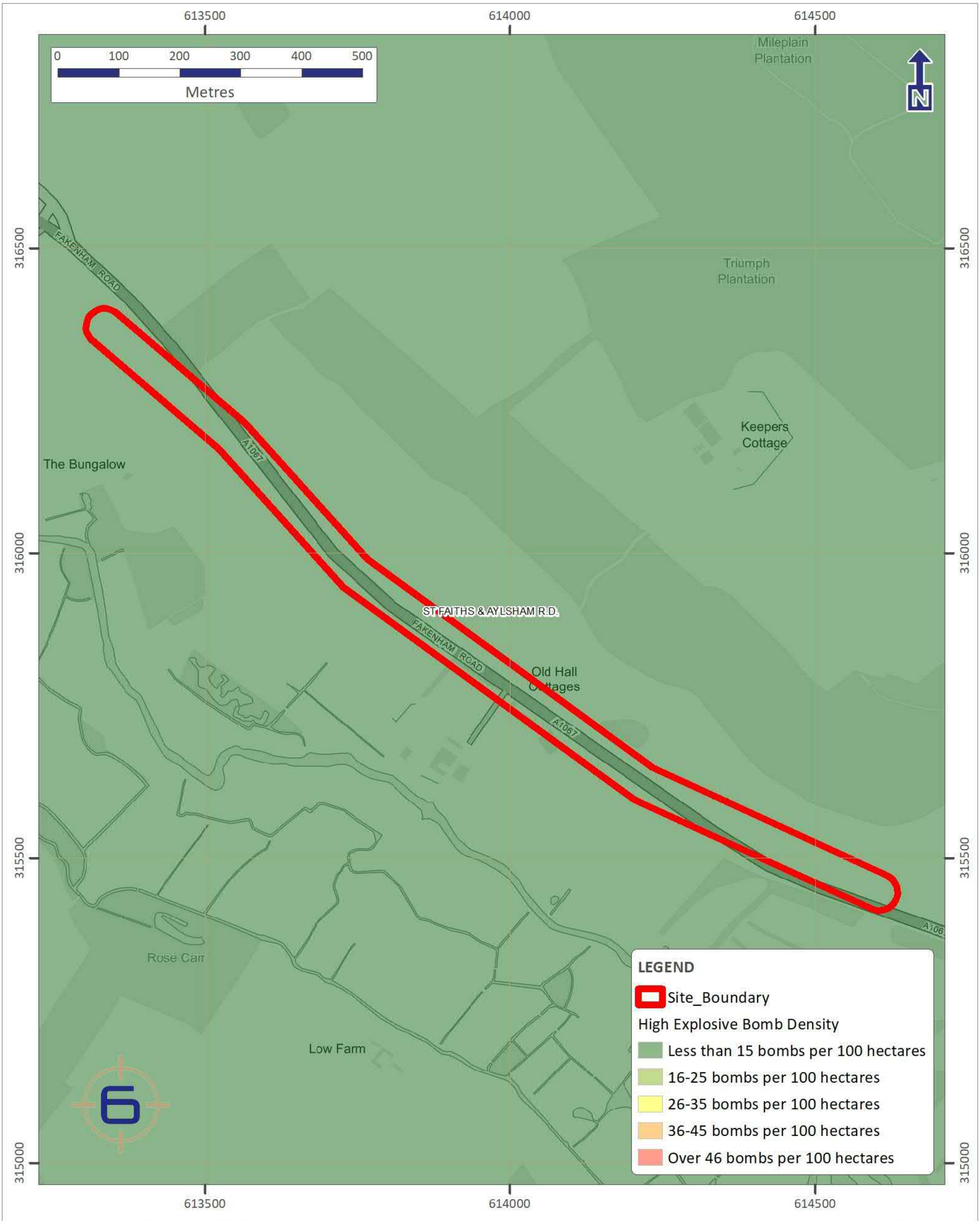

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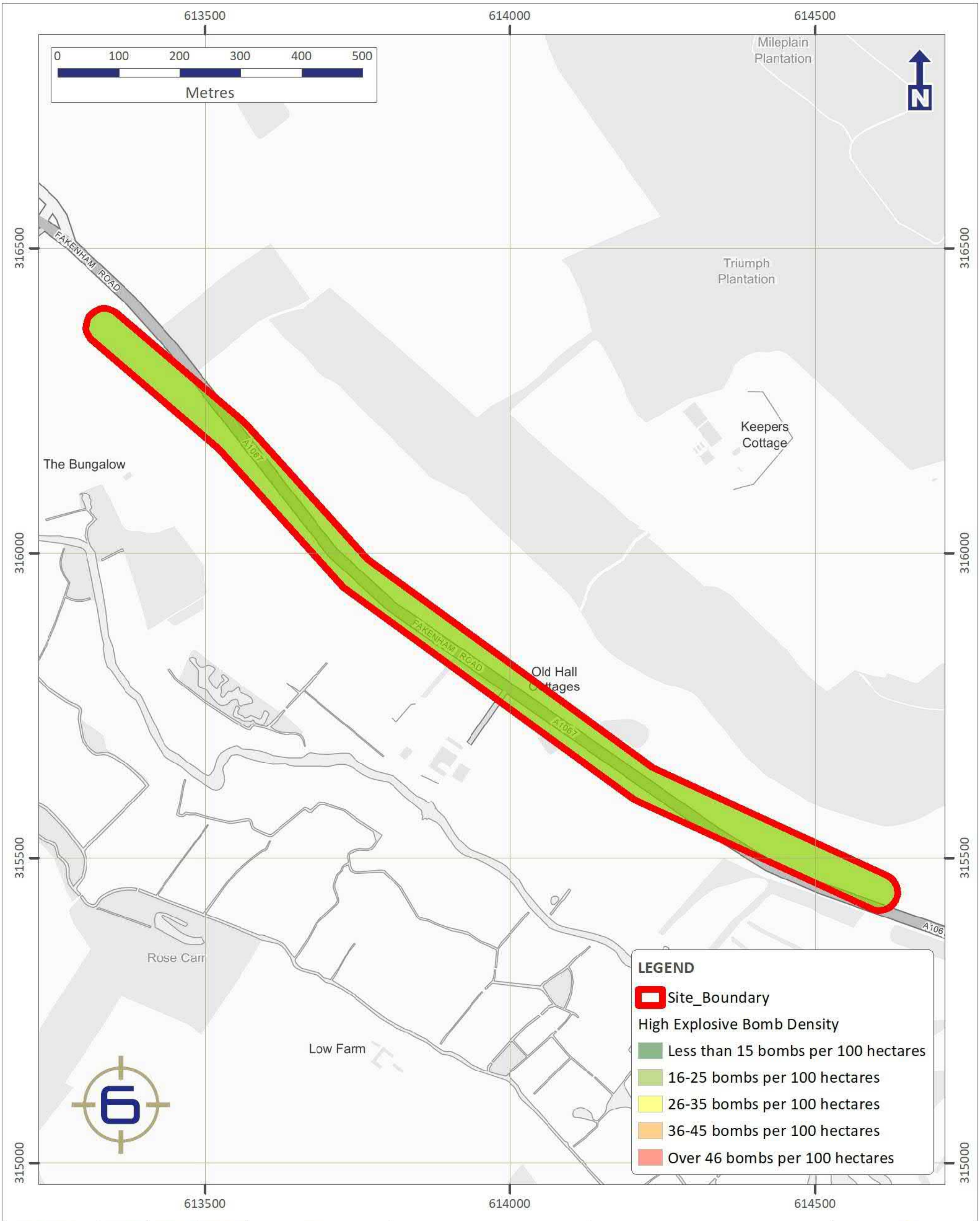
SITE AT 613969,315908

WWII High Explosive Bomb Density



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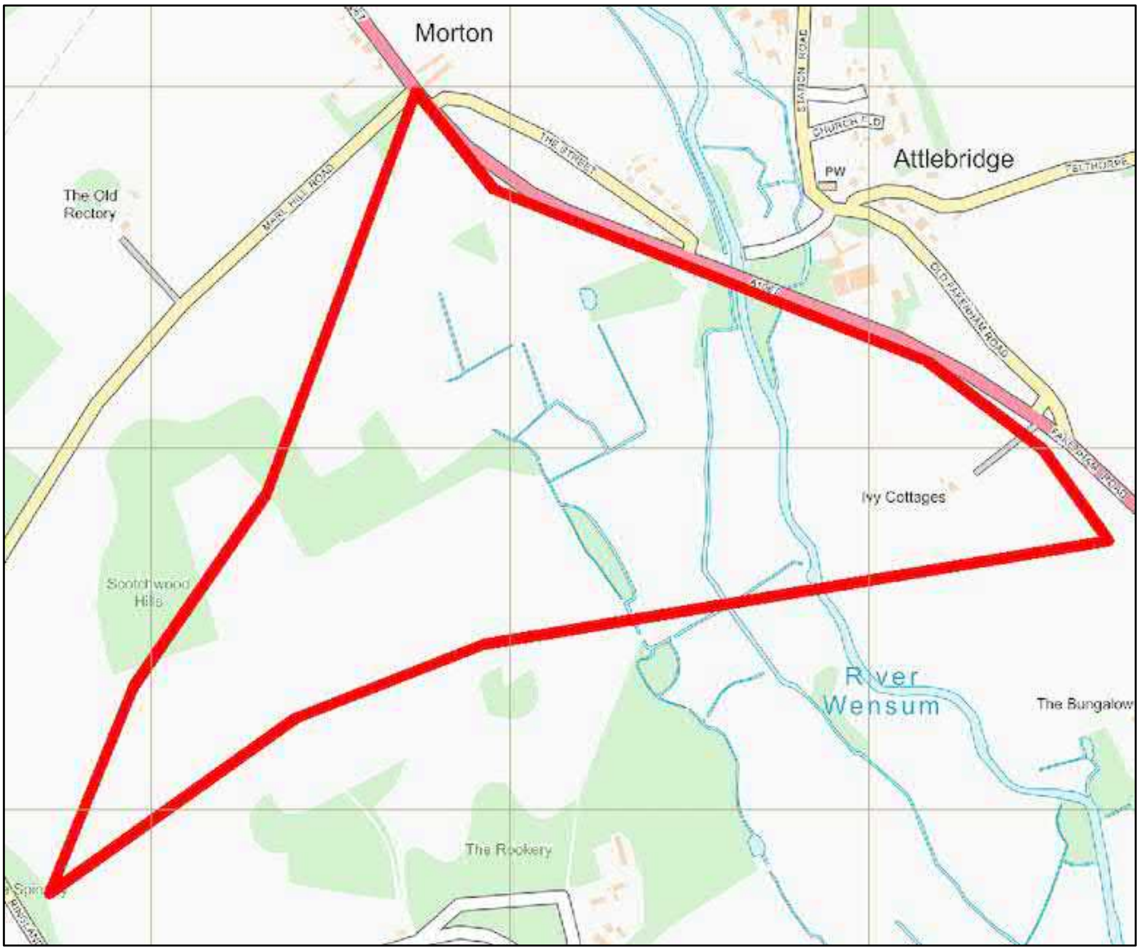
Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework



6 ALPHA PROJECT NUMBER	P7195	**ORIGINATOR**	J. Webber
LANDMARK ORDER NUMBER	194233932_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Poly 6	**RELEASED BY**	R. Griffiths (18th February 2019)
SITE	Site at 612596, 316439		
RECOMMENDATION	No further action is required to address the UXO risk at this Site		

UNEXPLODED ORDNANCE THREAT ASSESSMENT

STUDY SITE

The Study Site is described as “Site at 612596, 316439”, and it is centred on National Grid Reference 612560, 316460.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being UNLIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* concludes that **NO FURTHER ACTION** is required to address the UXO risk at this Study Site. Should you have any queries, please contact *Envirocheck*.

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REPORT SUMMARY

During WWII, the Study Site was situated within *St Faiths & Aylsham Rural District*, which recorded one High Explosive (HE) bomb strike per 100 hectares; a very low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site identified an airfield (875m south-west) as a primary bombing target.

Further research identified this airfield as *Royal Air Force* (RAF) *Attlebridge* (located 920m south-west) which was active between 1941-1956. Its primary purpose was originally as a satellite station, before then being extended to accommodate *RAF* and *American Air Force* heavy bomber groups and their training.

Air Raid Precaution (ARP) records did not identify any HE bomb strikes within the Site, however one was located 605m south-west of the Site boundary.

Official bomb damage was not available. In addition, an analysis of post-war mapping and further research did not identify any evidence of potential bomb damage on-site or within the vicinity.

Despite an airfield being located within the area during WWII, there is no evidence to suggest that further investigation into UXO is warranted.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

For further information, please contact *Envirocheck*: Telephone: +44 (0)844 844 9952

Website: http://www.envirocheck.co.uk Email: customerservice@envirocheck.co.uk

DATA FINDINGS

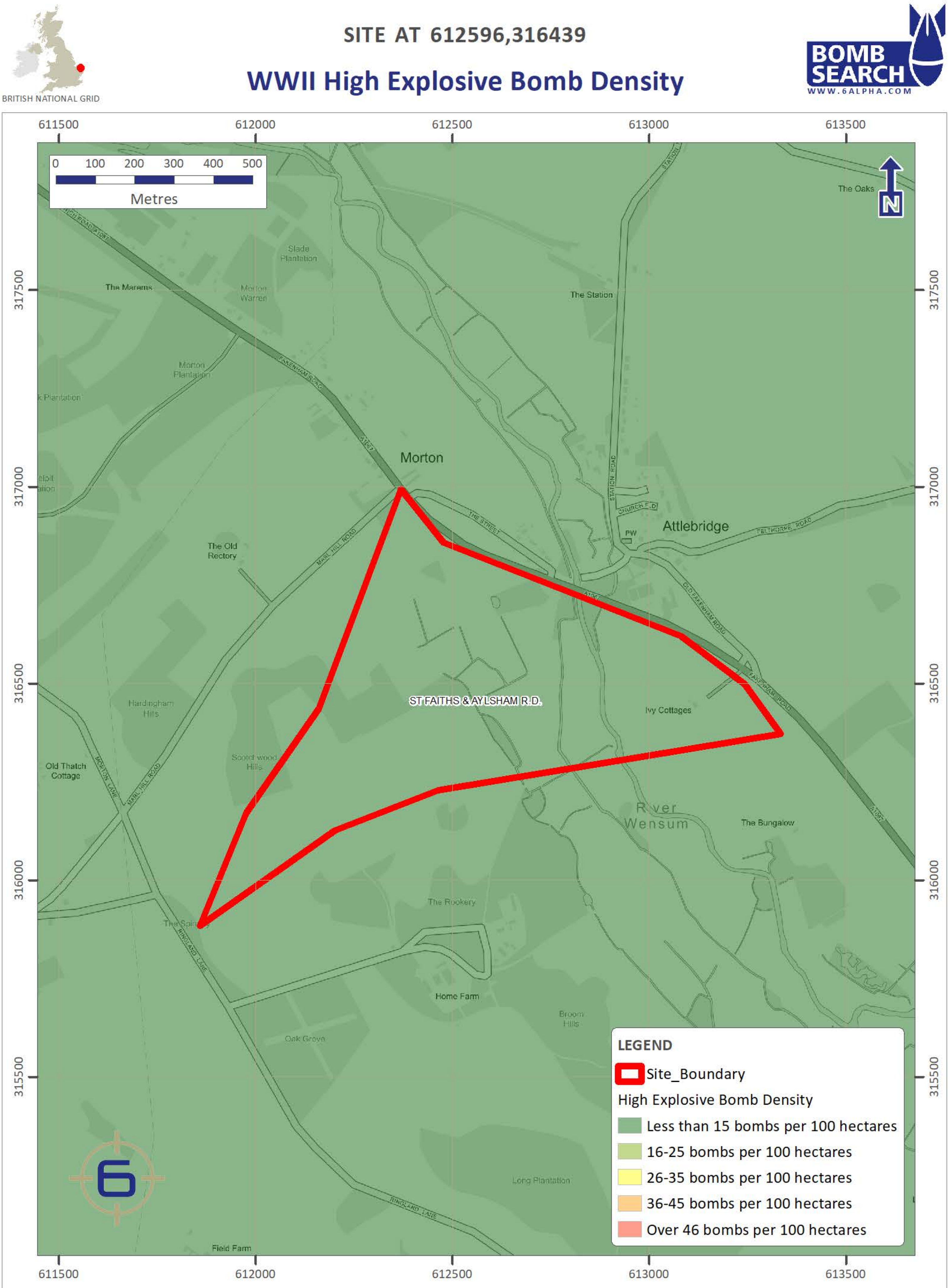
Threat Source (within 1,000m)	Detail	
	Identified	Comments
Airfields/Military Facilities	✔	*RAF Attlebridge* (920m south-west).
Ordnance Manufacture/Storage	✘	None recorded within 1,000m.
WWII Decoy Bombing Sites	✘	None recorded within 1,000m.
WWII Defensive Features	✔	AA searchlight (710m north-east)
WWII *Luftwaffe* Designated Bombing Targets	✔	*Luftwaffe* aerial photography identified an airfield (located 875m south-west) as a primary bombing target.
WWII Bomb Strikes Within Site Boundary	✘	ARP records did not identify any HE bomb strikes on-site.
WWII Bomb Strikes Near Site Boundary	✔	ARP records identified one HE bomb strike 605m south-west.
WWII Bomb Damage	✘	Official bomb damage mapping was not available.
Abandoned Bomb Register	✘	The official abandoned bomb list did not identify any abandoned bombs located within 1,000m.
Potential Threat Sources	✘	Further research has not uncovered any potential UXO threats associated with the Study Site.
WWII Bombing Density Per 100 Hectares	✔	The Site was located within *St Faiths & Aylsham Rural District*, which recorded one HE bomb strike per 100 hectares.

IMPORTANT NOTES

1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

SITE AT 612596,316439

WWII High Explosive Bomb Density



PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE		
P7195	1	CC	BL	15 February 2019	Contains Ordnance Survey data © Crown copyright and database right 2017	Produced by and Copyright to 6 Alpha Associates Ltd. Users noting any errors please notify 6 Alpha.

BRITISH NATIONAL GRID

SITE AT 612596,316439

Probability of UXO Encounter

BOMB SEARCH
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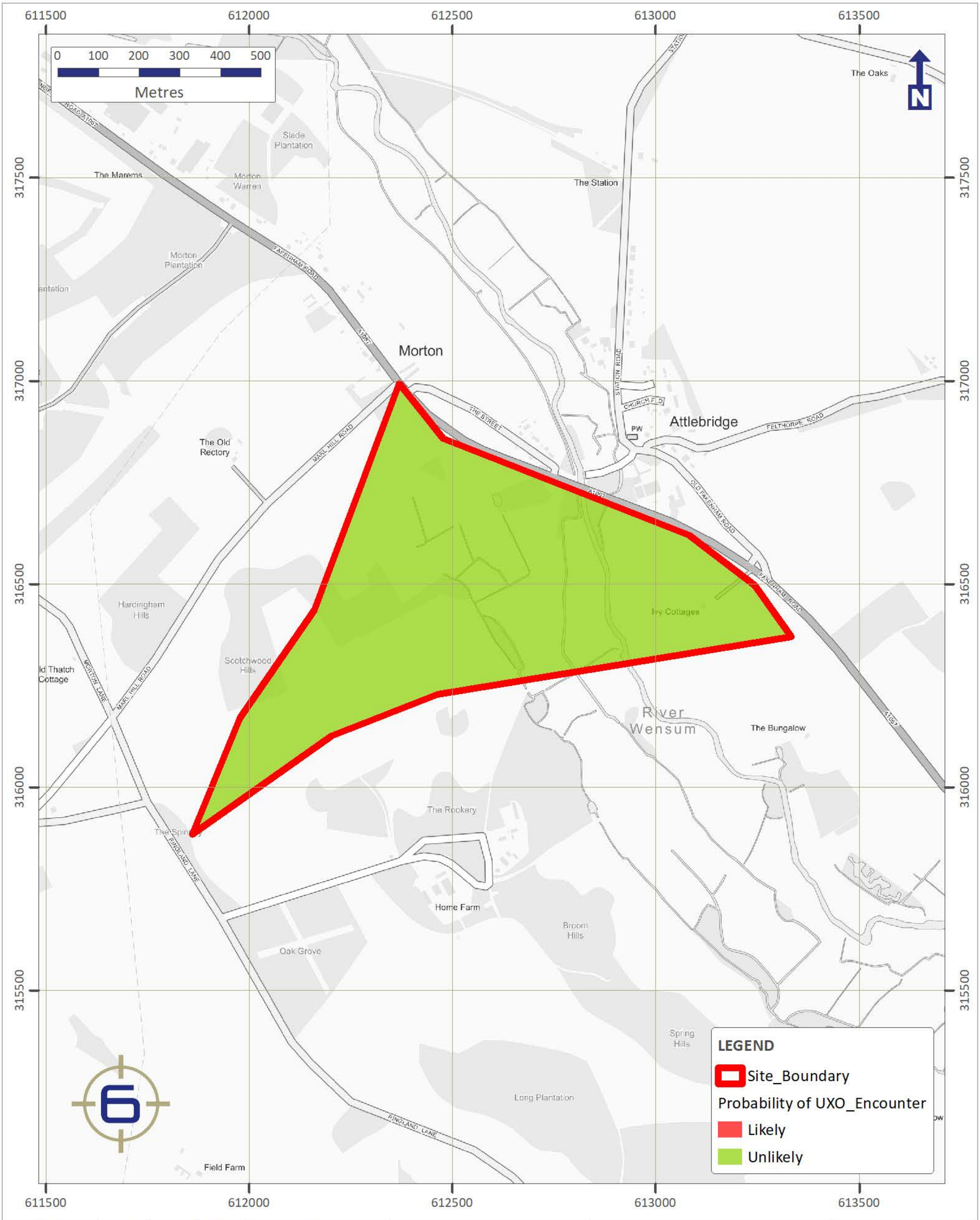

PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE
P7195	2	CC	BL	15 February 2019

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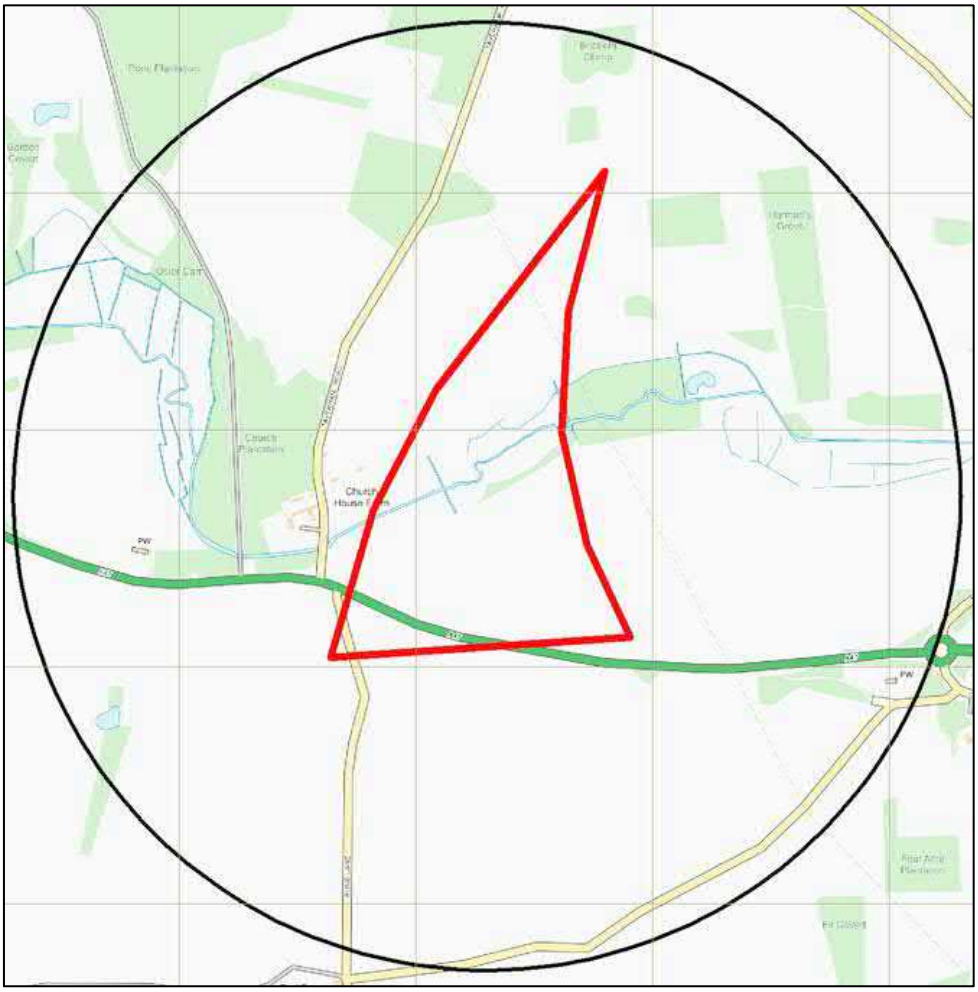
special risks consultancy

PRELIMINARY UNEXPLODED ORDNANCE (UXO) THREAT ASSESSMENT

Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) – A guide for the Construction Industry' Risk Management Framework



6 ALPHA PROJECT NUMBER	P7194	**ORIGINATOR**	J. Webber
LANDMARK ORDER NUMBER	194231977_1	**REVIEWED BY**	C. Cole (18th February 2019)
CLIENT REFERENCE	NWL Poly 7	**RELEASED BY**	R. Griffiths (18th February 2019)
SITE	Site at 612136, 311533		
RECOMMENDATION	No further action is required to address the UXO risk at this Site		

UNEXPLODED ORDNANCE THREAT ASSESSMENT

STUDY SITE

The Study Site is described as "Site at 612136, 311533", and it is centred on National Grid Reference 612150, 311360.

THREAT POTENTIAL AND RECOMMENDATIONS

The potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at this site is assessed as being UNLIKELY (*Figure 2*).

In accordance with *CIRIA* C681 Chapter 5 on managing UXO risks, *6 Alpha* concludes that **NO FURTHER ACTION** is required to address the UXO risk at this Study Site. Should you have any queries, please contact *Envirocheck*.

Telephone: +44 (0)844 844 9952 Email: customerservice@envirocheck.co.uk

Envirocheck®
LANDMARK INFORMATION GROUP®

REPORT SUMMARY

During WWII, the Study Site was situated within *St Faiths & Aylsham Rural District* and *Forehoe & Henstead Rural District* which recorded one and two High Explosive (HE) bomb strikes per 100 hectares respectively; both a very low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Site did not identify any primary bombing targets within 1,000m of Site boundary.

Air Raid Precaution (ARP) records did not identify any HE bomb strikes within the Site. However, two HE bomb strikes were identified 380m west and 870m east of the Site boundary.

Official bomb damage mapping was not available. In addition, an analysis of post-war mapping and further research did not identify any evidence of bomb damage within 1,000m of Site.

Despite there being bomb strikes recorded within the wider area during WWII; there is no evidence to suggest that further investigation into UXO is warranted.

USING THIS REPORT

This Preliminary Assessment is designed to inform environmental and construction professionals of the potential threat of military related explosives and/or ordnance on, or in, the vicinity of the Study Site.

This assessment is designed to be employed as a site-screening tool to meet with the requirement of Phase One of the *CIRIA UXO Risk Management Framework*; there are two broad prospective outcomes; either the threat level requires a detailed threat & risk assessment; or no further action is required. In the former instance we can provide a report within 10 working days (or more quickly upon application).

Two figures accompany the report, the *Second World War* (WWII) High Explosive (HE) Bomb Density and the final Probability of UXO Encounter. The purpose of this approach is to demonstrate that whilst bomb density statistics give an indication for WWII bombing, they should not be relied upon exclusively to generate a holistic assessment.

For further information, please contact *Envirocheck*:
Website: http://www.envirocheck.co.uk

Telephone: +44 (0)844 844 9952
Email: customerservice@envirocheck.co.uk

DATA FINDINGS

Threat Source (within 1,000m)	Detail	
	Identified	Comments
Airfields/Military Facilities	✗	None recorded within 1,000m.
Ordnance Manufacture/Storage	✗	None recorded within 1,000m.
WWII Decoy Bombing Sites	✗	None recorded within 1,000m.
WWII Defensive Features	✓	AA searchlight (275m north-west).
WWII *Luftwaffe* Designated Bombing Targets	✗	*Luftwaffe* aerial photography did not identify any primary bombing targets within 1,000m.
WWII Bomb Strikes Within Site Boundary	✗	ARP records did not identify any HE bomb strikes on-site.
WWII Bomb Strikes Near Site Boundary	✓	ARP records identified two HE bomb strikes located 380m west and 870m east.
WWII Bomb Damage	✗	Official bomb damage mapping was not available.
Abandoned Bomb Register	✗	The official abandoned bomb list did not identify any abandoned bombs located within 1,000m.
Potential Threat Sources	✗	Further research has not uncovered any potential UXO threats associated with the Study Site.
WWII Bombing Density Per 100 Hectares	✓	Within *St Faiths & Aylsham* and *Forehoe & Henstead Rural District*, which recorded one and two HE bomb strikes per 100 hectares.

IMPORTANT NOTES

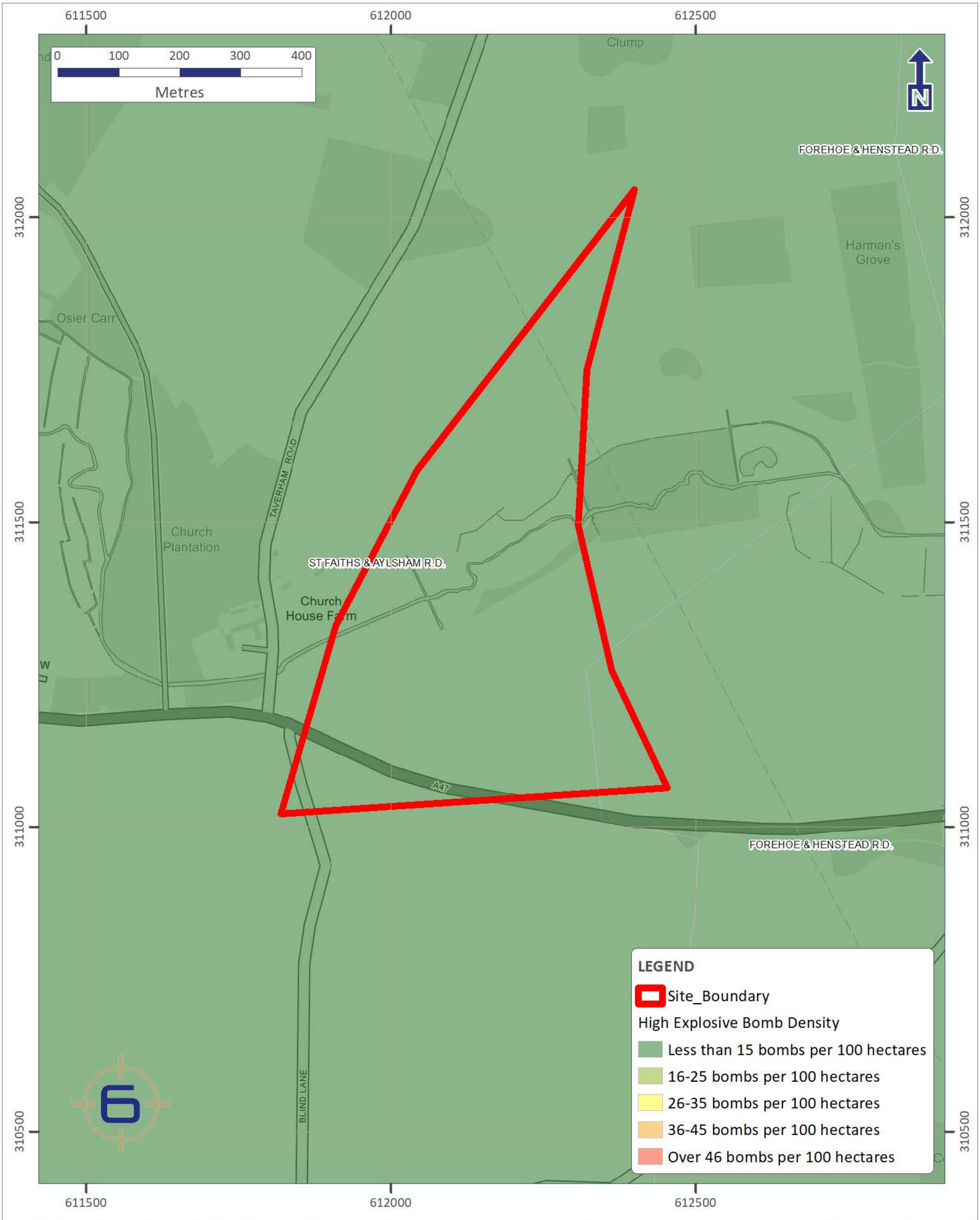
1. The term 'Preliminary UXO Threat Assessment' has been used to describe this report, to fall in line with the *CIRIA* C681 guidelines. Whilst the term 'Risk' can be justifiably used at this stage, the reader should note that the 'Consequence' function of 'Risk' is not considered. Should it be required, this would be addressed in the 'Detailed UXO Threat & Risk Assessment' (Stages 2 and 3).
2. This report is accurate and up to date at the time of writing.
3. The assessment levels have been generated from historical data and third party sources. Where possible *6 Alpha* have sought to verify the accuracy of such data, but cannot be held accountable for inherent errors that may be in third party data sets (e.g. *National Archives* or library sources).
4. *6 Alpha* have exercised all reasonable care, skill and due diligence in producing this service.
5. Whilst every effort has been used to identify all potential UXO/explosive threats, there were a number of private facilities, which may not have released privately recorded information concerning UXO/explosive threats into the public domain. It is therefore possible that some of the aforementioned sites may not be included within the database.

BRITISH NATIONAL GRID

SITE AT 612136,311533

WWII High Exposive Bomb Density

BOMB SEARCH
WWW.6ALPHA.COM



PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE			
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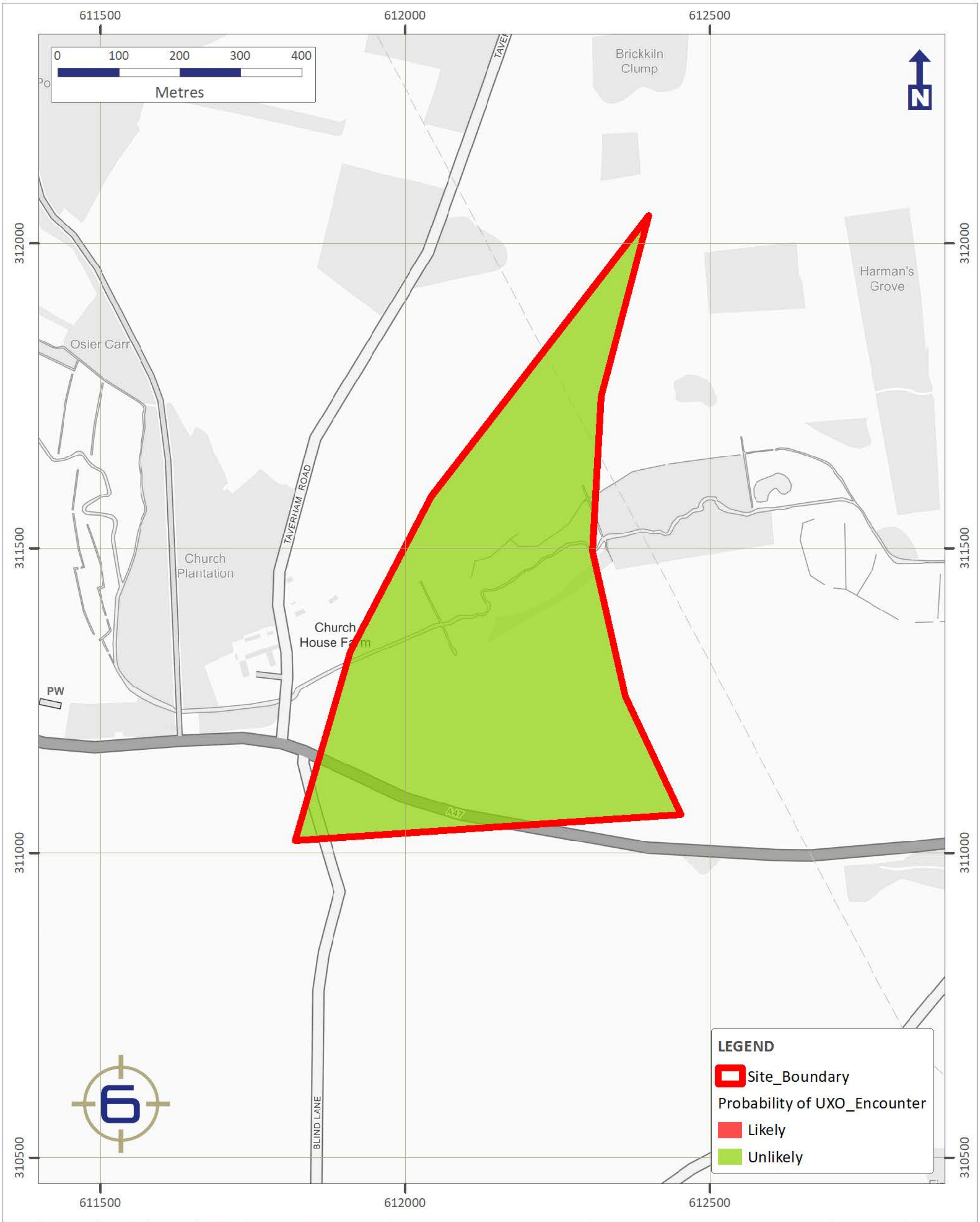
BRITISH NATIONAL GRID

SITE AT 612136,311533

Probability of UXO Encounter

BOMB SEARCH
WWW.6ALPHA.COM



PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE		
P7194	2	CC	BL	15 February 2019	Contains Ordnance Survey data © Crown copyright and database right 2017	Produced by and Copyright to 6 Alpha Associates Ltd. Users noting any errors please notify 6 Alpha.

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Annex F

EXISTING GI INFORMATION

ANNEX F – EXISTING GI INFORMATION

Type	Reference	Name	Depth [m]	ID	Easting	Northing
Borehole	TG01NE20	GT WITCHINGHAM NFK BH1	4	512791	609530	318410
Borehole	TG01NE21	GT WITCHINGHAM NFK BH2	4	512792	609950	318170
Water well	TG01NE29	WHITE HOUSE	31	512800	609910	318030
Water well	TG01NE30	COUNCIL HOUSES LENWADE	48.8	512801	609680	318460
Water well	TG01NE51	WALNUT TREE FARM	30.1	512822	609290	317430
Water well	TG01SE7	30 YDS N OF FRANSGREEN FARM E TUDDENHAM	106.68	512900	609240	314070
Water well	TG01SE71	HIGH CROFT EAST TUDDENHAM	42.7	512964	608820	312690
Borehole	TG11NW10	WESTON LONGVILLE	15.24	514384	611300	315480
Borehole	TG11NW100	NORTHERN DISTRIBUTOR ROAD BHPW3	17.5	19436655	614522	315459
Borehole	TG11NW101	NORTHERN DISTRIBUTOR ROAD BHP0	12.5	19436656	614693	315419
Borehole	TG11NW13	MORTON WARREN MORTON	24.38	514387	612050	317520
Borehole	TG11NW14	MORTON BRIDGE	10.36	514388	612780	316740
Borehole	TG11NW15	MORTON HALL	20.72	514389	612440	315500
Borehole	TG11NW19	ATTLEBRIDGE HILLS	24.38	514393	613690	316430
Borehole	TG11NW2	RAILWAY STATION LENWADE	12.19	514376	610380	318500
Borehole	TG11NW20	ATTLEBRIDGE HALL	10.05	514394	613950	315650
Borehole	TG11NW25	ATTLEBRIDGE HILLS	14.93	514399	614540	315450
Water well	TG11NW29	WOODSTOCK FAKENHAM ROAD ATTLEBRIDGE	33.53	514403	614020	315710
Borehole	TG11NW3	THE ROUGH GROUNDS LENWADE	20.72	514377	610540	317510
Borehole	TG11NW35	GREAT WITCHINGHAM SEWERAGE 3	6	514409	610220	318280
Borehole	TG11NW36	GREAT WITCHINGHAM SEWERAGE 4	6	514410	610440	318240
Borehole	TG11NW37	GREAT WITCHINGHAM SEWERAGE 5	6	514411	610370	318410
Borehole	TG11NW38	GREAT WITCHINGHAM SEWERAGE 6	4	514412	610770	318150
Borehole	TG11NW39	GREAT WITCHINGHAM SEWERAGE 7	4	514413	611790	317500
Borehole	TG11NW4	WESTON LONGVILLE	15.24	514378	610510	316420
Borehole	TG11NW40	GREAT WITCHINGHAM SEWERAGE 8	4	514414	612200	317220
Borehole	TG11NW41	MORTON ESTATE NORFOLK 10	6.7	514415	612350	317530
Borehole	TG11NW42	MORTON ESTATE NORFOLK 11	9.75	514416	612360	317320
Borehole	TG11NW43	MORTON ESTATE NORFOLK 12	3.65	514417	612130	317520
Borehole	TG11NW5	THE RECTORY WESTON LONGVILLE	18.28	514379	610610	315630
Water well	TG11NW50	CHURCH FARM WESTON LONGVILLE	49.8	514424	611280	315820
Water well	TG11NW53	MALTHOUSE FARM ATTLEBRIDGE	33.8	514427	613000	316750
Water well	TG11NW60	OLD HALL WESTON LONGVILLE	5.5	514434	610260	317840

Type	Reference	Name	Depth [m]	ID	Easting	Northing
Water well	TG11NW63	ATLAS WORKS LENWADE	48.2	514437	610690	318220
Borehole	TG11NW7	PLOUGHED MEADOW PLANTATION ALDERFORD	18.59	514381	611630	318090
Water well	TG11NW71	THE DUCKERIES RECTORY ROAD WESTON LONGVILLE	43.9	514445	610180	315700
Water well	TG11NW77	CHURCH HILL ATTLEBRIDGE	48.8	514451	613050	316810
Borehole	TG11NW8	OAK PLANTATION MORTON	8.83	514382	611340	317420
Water well	TG11NW82	OLD HALL WESTON LONGVILLE	32	514456	610260	317830
Water well	TG11NW83	OLD HALL WESTON LONGVILLE	44.2	514457	610200	317780
Borehole	TG11NW9	NORWICH BELT WESTON LONGVILLE	24.38	514383	611430	316500
Water well	TG11NW97	10 COUNCIL HOUSES HODURING ROAD WESTON LONGVILLE	61	514471	611200	315760
Borehole	TG11NW99	NORTHERN DISTRIBUTOR ROAD BHPW1A	20.45	19436654	614337	315519
Water well	TG11SE83	HEATH FARM HOCKERING	86.9	512976	608330	314560
Water well	TG11SW100	RW2-RINGLAND	65	514774	612800	313300
Borehole	TG11SW102	HONINGHAM SEWERAGE 1	10.5	514776	610490	311860
Borehole	TG11SW104	HONINGHAM SEWERAGE 3	5.5	514778	610500	311790
Borehole	TG11SW105	HONINGHAM SEWERAGE BH4	4	514779	610460	311720
Borehole	TG11SW106	HONINGHAM SEWERAGE BH5	4	514780	610220	311670
Borehole	TG11SW107	HONINGHAM SEWERAGE BH6	4	514781	610140	311710
Borehole	TG11SW108	PUMP STATION HONINGHAM BH1	8.2	514782	610300	311710
Borehole	TG11SW11	GRAVEL PIT PLANTATION RINGLAND	18.89	514682	612530	314450
Borehole	TG11SW112	MORTON ESTATE NORFOLK 7	5.18	514786	612200	314270
Borehole	TG11SW113	MORTON ESTATE NORFOLK 9	3.35	514787	612480	314440
Borehole	TG11SW114	MORTON ESTATE NORFOLK 5	8.22	514788	612710	313300
Borehole	TG11SW115	MORTON ESTATE NORFOLK 6	4.87	514789	612820	313270
Borehole	TG11SW117	MORTON ESTATE NORFOLK 4	8.53	514791	612780	313110
Borehole	TG11SW118	HONINGHAM PROPOSED ANTENNA MAST 1	10	214792	610070	312150
Borehole	TG11SW12	BLACKBECK PLANTATION RINGLAND	18.59	514683	612430	313480
Water well	TG11SW120	BRECK FARM HONINGHAM	21.3	514794	611280	313310
Water well	TG11SW121	PUMP FARM WESTON LONGVILLE	41.5	514795	611470	314560
Water well	TG11SW122	GREEN FARM WESTON LONGVILLE	54.9	514796	611290	314570
Water well	TG11SW127	BERNARD MATTHEWS LTD WESTON GREEN WESTON LONVILLE	70.1	514801	610590	314510
Water well	TG11SW129	BRECK FARM HONINGHAM	65.5	514803	611250	313350

Type	Reference	Name	Depth [m]	ID	Easting	Northing
Borehole	TG11SW13	RINGLAND CLUMP RINGLAND	23.16	514684	612340	312710
Water well	TG11SW130	MANOR FARM RINGLAND	80	514804	613320	314350
Borehole	TG11SW14	DEREHAM ROAD EASTON	18.28	514685	612670	311120
Borehole	TG11SW144	A47 HONINGHAM EXPRESS LANE WS5	3.99	18963686	611228	311249
Borehole	TG11SW145	A47 HONINGHAM EXPRESS LANE WS6	4.4	18963687	611254	311239
Borehole	TG11SW156	A47 HONINGHAM EXPRESS LANE TP6	1.2	18963699	611252	311234
Borehole	TG11SW16	ROYAL HILL RINGLAND	20.42	514687	613500	314670
Borehole	TG11SW17	JENNIS'S WOOD RINGLAND	7.62	514688	613170	313740
Borehole	TG11SW28	HONINGHAM DIVERSION 1	4.57	514699	610060	312050
Borehole	TG11SW3	STAR COVERT HONINGHAM	17.37	514674	610570	312340
Borehole	TG11SW31	HONINGHAM DIVERSION 4	15.24	514702	610600	311820
Borehole	TG11SW32	HONINGHAM DIVERSION 5	12.49	514703	610630	311800
Borehole	TG11SW35	HONINGHAM DIVERSION 8	4.57	514706	611190	311230
Borehole	TG11SW36	HONINGHAM DIVERSION 9	16.76	514707	611830	311120
Water well	TG11SW37/A	THE HALL HONINGHAM	20.72	514708	611240	312460
Water well	TG11SW37/B	THE HALL HONINGHAM	53.84	514709	611240	312460
Water well	TG11SW38	HONINGHAM HALL GARDEN COTTAGES HONINGHAM	26.82	514710	611020	312030
Water well	TG11SW39	BRECK BARN FARM HONINGHAM	48.76	514711	612470	312490
Water well	TG11SW41	FORMER SEARCHLIGHT STATION HONINGHAM	35.58	514713	611720	311590
Water well	TG11SW42	THE MILL HOUSE HONINGHAM	3.65	514714	610350	311650
Water well	TG11SW45	POLICE HOUSE HONINGHAM	36.57	514718	610530	311540
Water well	TG11SW48	GREEN FARM WESTON LONGVILLE	51.81	514721	610080	314440
Water well	TG11SW53	HILL COTTAGE HONINGHAM	24.38	514726	610430	311640
Water well	TG11SW54	IVY HOUSE FARM WESTON LONGVILLE	53.64	514727	610830	314330
Water well	TG11SW58	THE CHURCH LODGE HONINGHAM	30.78	514731	611610	311200
Water well	TG11SW59/A	HONINGHAM BRECK FARM HONINGHAM	89.91	514732	610810	313720
Water well	TG11SW59/B	HONINGHAM BRECK FARM HONINGHAM	121.92	514733	610810	313720
Borehole	TG11SW6	EAST OF WESTON GREEN	19.81	514677	611360	314570
Borehole	TG11SW68	A47 NORWICH SOUTHERN BY PASS 1	6.3	514742	611830	311220
Borehole	TG11SW69	A47 NORWICH SOUTHERN BY PASS 2 (T)	3.5	514743	611890	311130
Borehole	TG11SW7	TELEGRAPH HILL HONINGHAM	18.28	514678	611640	313650

Type	Reference	Name	Depth [m]	ID	Easting	Northing
Borehole	TG11SW70	A47 NORWICH SOUTHERN BY PASS 3 (T)	3.5	514744	612050	311100
Borehole	TG11SW71	A47 NORWICH SOUTHERN BY PASS 4	7	514745	612195	311030
Borehole	TG11SW72	A47 NORWICH SOUTHERN BY PASS 5 (T)	3.5	514746	612420	311040
Borehole	TG11SW73	A47 NORWICH SOUTHERN BY PASS 6	7	514747	612570	311010
Borehole	TG11SW74	A47 NORWICH SOUTHERN BY PASS 7	7	514748	612750	310995
Borehole	TG11SW8	HALL HILLS HONINGHAM	24.38	514679	611750	312510
Borehole	TG11SW9	CHURCH PLANTATION HONINGHAM	21.94	514680	611800	311740
Water well	TG11SW94	MERRY HILL FARM RINGLAND	54.86	514768	612320	312780
Water well	TG11SW99	RW1-RINGLAND	65	514773	612800	313300

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SITE INVESTIGATION REPORT NO. 42823

TG01NE 1

TG01NE/20-21

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841
	2	0995	1817
TG 11 NW	3	1022	1828
	4	1044	1824
	5	1037	1841
	6	1077	1815
	7	1179	1750
	8	1220	1722

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

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SITE INVESTIGATION REPORT NO. 42823

TG01NE 1

TG01NE/20-21

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

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	2	0995	1817
TG 11 NW	3	1022	1828
	4	1044	1824
	5	1037	1841
	6	1077	1815
	7	1179	1750
	8	1220	1722

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

Version 2.0.6

BGS ID: 512800 : BGS Reference: TG01NE29
British National Grid (27700) : 609910,318030

147/170 White House, Swanton Morley TG01/38

Surface +71. Shaft 20; rest bore. Lining tubes: 80 x 4 in from 1 down. R.W.L. +63. P.W.L. +63. *Page, Sept. 1946.* Shaft filled in. I/c engine. *Aug. 1947.* Hardness: total 400. Anal. [redacted] Yield c. 350 g.p.d. Electric pump. *July 1960.*

Pleist. Drift)			
? UCk)	...	20	20
UCk	...	80	100

PLEIST DRIFT + U.CHALK? 20'	EXISTING WELL	20	20
	CHALK	30	50
U.CHALK 80'	CHALK + FLINTS	22	72
	CHALK.	28	100


British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 512822 : BGS Reference: TG01NE51
British National Grid (27700) : 609290,317430
Report an issue with this borehole

(2)

(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	If measurements start below ground surface, state how far .. METRES T	D	THICKNESS Feet	THICKNESS Inches	DEPTH Feet	DEPTH Inches
	EARTH.	0·30	0·30	1	0	1	0
GLACIAL SAND & GRAVEL	SAND, CLAY & STONES.	1·82	2·13	6	0	7	0
	SAND.	2·43	4·57	8	0	15	0
	GRAVEL.	4·87	9·44	16	0	31	0
U. CHALK.	CHALK (OCCASIONAL FLINTS)	25·60	35·05	84	0	115	0

Data Bank

P.P. R.G.
9/11/71

Version 2.0.6

BGS ID: 512900 : BGS Reference: TG01SE7
British National Grid (27700) : 609240,314070

Report an issue with this borehole

9 161/244 c.300 yd N. of Fransgreen Farm, East Tuddenham (formerly ~~Air~~ of Defence Ministry). (Sealed) TG 01 SE/7 0924 . 1407.

1X

Surface +177¼. Lining tubes: 34½ x 21 in from 2 down; 179 x 15 in from 3 down. Water struck at +137¼, +17¼ and -52¾. R.W.L. +128¼. P.W.L. +43¼. Recovered to +128¼ in a few min. Yield 4,290 g.p.h. (6 d. test). Air lift. Hardness: P. 25, T. 265. Anal. LeGrand, Dec. 1942.

Boulder Clay	20	20
Sand and Gravel	43	63
Boulder Clay	37	100
UCk	250	350

Boulder clay 20'	Top Soil	1	1
	Brown Sandy Clay + Stones	19	20
Sand + gravel 43'	Sandy gravel	20	40
	Blowing sand	23	63
Boulder clay 37'	Boulder clay	37	100
upper chalk 250'	Chalk + Flints	250	350

pp. P.N. Hildreth
29.5.69

6" Sheet
50 SW

161/474 High Croft, Dereham Road Crossways, East Tuddenham TG01/7

Surface +132. Lining tubes: 120 x 4 in from surface. R.W.L. +84.

Bull, May 1950. TG 0882 1269

Electric pump. Aug. 1960.

Sand and Gravel	... ...	42	42
Boulder Clay	... ...	6	48
Sand and Gravel	... ...	8	56
UCk	... ...	84	140

Sand + Gravel 42'	Coarse yellow sand	11	11
	Brown Sand	31	42
chalky Boulder Clay 6'	Blue clay + chalk stones	6	48
Sand + Gravel 8'	Flint + Crag sand	8	56
Upper Chalk 84'	Chalk	84	140

pp. P.N. Hildreth
6.2.69.

6" Quarter Sheet
62 NW/W

BGS ID: 512976 : BGS Reference: TG01SE83
British National Grid (27700) : 608330,314560

147/142 Heath Farm, Hockering (formerly Air Ministry) TG01/105

Surface +180. Lining tubes: 100 × 10½ in from surface. Water struck at +112. R.W.L. +126. P.W.L. +62. Recovered to +126 in 15 min. Yield 5,500 g.p.h. (3 d. test). I/c engine and electric pump. Hardness: P. 57, T. 263. Ferruginous. Anal. *Gosling, Nov. 1942.*

R.W.L. +135. P.W.L. +50. Yield 2,500 g.p.h. *Oct. 1953.* R.W.L. +138. P.W.L. +94. Yield 2,500 g.p.h. *Oct. 1955.* R.W.L. +c.125. P.W.L. +c.105. Suction +c.70. *Nov. 1958.* Yield 1,000 g.p.h., 10 h.p.d. Electric pump. *July 1960.* TG 0833 1456

Boulder Clay	54	54
Sand and Gravel... ...	36	90
Boulder Clay	8	98
UCk	187	285

BOULDER CLAY 54'	YELLOW CLAY	32	32
	BLUE CLAY	22	54
~~BROWN~~ SAND + GRAVEL 36'	BROWN SAND	36	90
BOULDER CLAY 8'	BLUE CLAY	8	98
U CHALK. 187.	SHOTTY CHALK	47	145
	(UNDETERMINED · BORED THROUGH)	45	190
	GOOD CHALK.	95	285

Version 2.0.6

BGS ID: 514384 : BGS Reference: TG11NW10

British National Grid (27700) : 611300,315480

Report an issue with this borehole

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TG 11 NW 10 1130 1548 Weston Longville

Surface level (+40.3 m) +132 ft
Groundwater conditions not recorded
Wirth B1, 8 inch diam.
October 1969

Overburden (1.2 m) 4 ft
Mineral (13.1 m) 43 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
Boulder Clay	Soil and clay	(1.2)	4	(1.2)	4
Glacial Sand (a) and Gravel	Sandy gravel. Traces of hard chalk fragments. Gravel: fine and coarse, subangular to angular flint. Sand: medium with fine subangular; brown.	(3.7)	12	(4.9)	16
(b)	Sand. Gravel in the lower 4 ft (1.2 m) of the deposit. Gravel: fine subangular flint. Sand: fine with medium, subangular; brown to orange.	(9.4)	31	(14.3)	47
Upper Chalk	Chalk.	(0.9+)	3+	(15.2)	50

	%	mm	%
(a) Gravel	40	+64	0
		-64+16	24
		-16+4	16
Sand	58	-4+1	5
		$-1+\frac{1}{4}$	34
		$-\frac{1}{4}+1/16$	19
Fines	2	-1/16	2
(b) Gravel	2	+64	0
		-64+16	0
		-16+4	2
Sand	94	-4+1	1
		$-1+\frac{1}{4}$	25
		$-\frac{1}{4}+1/16$	68
Fines	4	-1/16	4

Depth below surface (ft)	Percentage Fines	Sand	Gravel
4 - 7	3	47	50
7 - 10	2	38	60
10 - 13	2	84	14
13 - 16	0	65	35
16 - 19	1	99	0
19 - 22	2	98	0
22 - 25	5	95	0
25 - 28	2	98	0
28 - 31	7	93	0
31 - 34	6	93	1
34 - 37	5	95	0
37 - 40	3	97	0
40 - 43	1	99	0
43 - 47	7	78	15

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 1 of 2

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHPW3
Carried out for Norfolk County Council	Date Started 24/10/2006	Date Finished	24/10/2006
Remarks:	Type of Rig		
	Depth 17.50	Height 20.940 mAOD	Logged by MM; Drawn by ptp; Checked by
	Co-ords 614522E - 315459N		

Backfill	Water	Description	Legend	Depth (m)	Sample Type	Sample No.	Field Tests	MC%	ρ_a	SO_3	Cl-	pH	Org.	CBR	Other
		Dark brown sandy TOPSOIL (TOPSOIL)				B01 D01									
		Dark brown silty fine and medium SAND with some fine and medium flint gravel. (CRAG_SAND)		1.00		B02 D02 B03 D03									
		Brown silty fine and medium SAND with some fine and medium flint gravel with lenses of beige sandy clayey silt. (CRAG_SAND)		2.00		B04 D04									
		Off white silt size comminuted CHALK. Grade VI, Dm. (UPPER CHALK)		3.00		B05 D05									
				4.00											
				5.00											
				6.00											
				7.00											
				8.00											
				9.00											

Continued next sheet

FIG a

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 2 of 2

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHPW3
Carried out for Norfolk County Council	Date Started 24/10/2006	Date Finished	24/10/2006
Remarks:	Type of Rig		
	Depth 17.50	Height 20.940 mAOD	Logged by MM; Drawn by ptp; Checked by
	Co-ords 614522E - 315459N		

Backfill	Water	Description	Legend	Depth (m)	Sample Type	Sample No.	Field Tests	MC%	ρ_s	SO_3	Cl-	pH	Org.	CBR	Other
		Off white silt size comminuted CHALK. Grade VI, Dm. (UPPER CHALK)		11.00											
				12.00											
				13.00											
					W	W01									
				14.00											
				15.00											
				16.00											
				17.00											
		End of Borehole at 17.50 m		18.00											
				19.00											

FIG b

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 1 of 2

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHP0
Carried out for Norfolk County Council	Date Started 23/10/2006	Date Finished	23/10/2006
Remarks:	Type of Rig		
	Depth 12.50	Height 16.290 mAOD	Logged by NB / Drawn by ptp / Checked by
	Co-ords 614693E - 315419N		

Backfill	Water	Description	Legend	Depth (m)	Sample Type	Sample No.	Field Tests	MC%	ρ_a	SO_3	Cl-	pH	Org.	CBR	Other
		Dark brown sandy TOPSOIL (TOPSOIL)			●	D01									
		Brown silty fine and medium SAND with some fine and medium flint gravel. (COVER SILT)			●	B01									
					●	D02									
		Stiff brown sandy, silty CLAY with SOME fine, medium and coarse flint gravel. (CRAG_CLAY)		1.00	●	B02									
		Off white silt size comminuted CHALK with some fine and medium intact chalk fragments, very weak. Grade VI. Dm. (UPPER CHALK)		2.00											
					●	D03									
				3.00	●	B03									
				4.00											
				5.00											
				6.00											
				7.00											
				8.00											
				9.00											

Continued next sheet

FIG a

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 2 of 2

AGS

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHP0
Carried out for Norfolk County Council	Date Started 23/10/2006	Date Finished	23/10/2006
Remarks:	Type of Rig		
	Depth 12.50	Height 16.290 mAOD	Logged by NB
			Drawn by ptp
	Co-ords 614693E - 315419N		Checked by

Backfill	Water	Description	Legend	Depth (m)	Sample Type	Sample No.	Field Tests	MC%	ρ_s	SO_3	Cl-	pH	Org.	CBR	Other
		Off white silt size comminuted CHALK with some fine and medium intact chalk fragments, very weak. Grade VI. Dm. (UPPER CHALK)		11.00 12.00											
		End of Borehole at 12.50 m		13.00 14.00 15.00 16.00 17.00 18.00 19.00											

FIG b

TG 11 NW 13 1205 1752 **Morton Warren, Morton**

Surface level (+12. 9 m) +42 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0. 6 m) 2 ft
Mineral (3. 7 m) 12 ft
Waste (19. 2 m) 63 ft
Bedrock (0. 9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil	(0. 6)	2	(0. 6)	2
Terrace Gravel	Gravel. 'Clayey' from 8 to 11 ft (2. 4 to 3. 5 m). Gravel: fine to coarse, angular to subangular flint with traces of fine subrounded quartz. Sand: medium and fine with some coarse, subangular to subrounded quartz and flint; brown.	(3. 7)	12	(4. 3)	14
Interglacial Deposits	Grey silty clay with traces of fine sand and hard chalk, with occasional pebbles.	(19. 2)	63	(23. 5)	77
Upper Chalk	Chalk	(0. 9+)	3+	(24. 4)	80

%	mm		%
	+64	:	0
Gravel 56	-64+16	:	23
	-16+4	:	33
	-4+1	:	7
Sand 35	$-1+\frac{1}{4}$	:	16
	$-\frac{1}{4}+1/16$	:	12
Fines 9	-1/16	:	9

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 5	6	27	67
5 - 8	7	37	56
8 - 11	18	36	46
11 - 14	4	42	54

TG 11 NW 14 1278 1674 Morton Bridge

Surface level (+11.0 m) +36 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0.6 m) 2 ft
Mineral (8.8 m) 29 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil	(0.6)	2	(0.6)	2
Suballuvium Gravel	Gravel. 'Clayey' from 23 to 26 ft (7.0 to 7.9 m). Gravel: fine to coarse, subangular to subrounded, brown and black flint, some subangular white flint and fine subrounded quartz; traces of quartz and quartzite cobbles in lower half of deposit. Sand: medium with coarse, subrounded quartz, with subangular to subrounded flint; brown to grey.	(8.8)	29	(9.5)	31
Upper Chalk	Chalk	(0.9+)	3+	(10.4)	34

	%	mm		%
		+64	:	0
Gravel	56	-64+16	:	26
		-16+4	:	30
		-4+1	:	13
Sand	41	$-1+\frac{1}{4}$	:	23
		$-\frac{1}{4}+1/16$	:	5
Fines	3	-1/16	:	3

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 5	6	56	38
5 - 8	1	35	64
8 - 11	1	37	62
11 - 14	1	35	64
14 - 17	1	54	45
17 - 20	1	35	64
20 - 23	0	53	47
23 - 26	12	46	42
26 - 29	8	25	67
29 - 31	3	26	71

TG 11 NW 15 1244 1550 **Morton Hall**

Surface level (+37.9 m) +125 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0.3 m) 1 ft
Mineral (11.0 m) 36 ft
Waste (3.4 m) 11 ft
Mineral (7.0 m) 23 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil	(0.3)	1	(0.3)	1
Glacial Sand (a) and Gravel	Pebbly sand. Gravel mainly in lower 15 ft (4.6 m). Traces of hard chalk in upper half of deposit. 'Clayey' from 25 to 31 ft (7.6 to 9.4 m). Gravel: fine and coarse, subangular, flint with quartz. Sand: medium with fine, subangular; brown.	(11.0)	36	(11.3)	37
Boulder Clay	Brown chalky clay with bands of fine sand.	(3.3)	11	(14.6)	48
Glacial Sand (b) and Gravel	'Clayey' pebbly sand. Gravel mainly in lower 5 ft (1.5 m) of deposit. 'Clayey' from 57 to 60 ft (17.4 to 18.3 m). Gravel: fine and coarse, subangular to subrounded flint, traces of quartz and quartzite. Sand: medium with fine, subangular. Traces of hard chalk near the top; light brown.	(5.2)	17	(19.8)	65
Upper Chalk	Chalk	(0.9+)	3+	(20.7)	68

	%	mm		%
		+64	:	0
(a) Gravel	22	-64+16	:	11
		-16+4	:	11
		-4+1	:	5
Sand	73	$-1+\frac{1}{4}$	:	38
		$-\frac{1}{4}+1/16$	:	30
Fines	5	-1/16	:	5
		+64	:	0
(b) Gravel	19	-64+16	:	11
		-16+4	:	8
		-4+1	:	6
Sand	70	$-1+\frac{1}{4}$	:	43
		$-\frac{1}{4}+1/16$	:	21
Fines	11	-1/16	:	11

Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	7	87	6
4 - 7	2	52	46
7 - 10	3	96	1
10 - 13	1	98	1
13 - 16	2	98	0
16 - 19	1	99	0
19 - 22	0	97	3
22 - 25	1	84	15
25 - 28	16	46	38
28 - 31	13	43	44
31 - 34	9	38	53
34 - 37	5	39	56
48 - 51	12	58	30
51 - 54	2	98	0
54 - 57	2	92	6
57 - 60	30	66	4
60 - 63	14	58	28
63 - 65	2	46	52

TG 11 NW 19 1369 1643 **Attlebridge Hills**

Surface level (+34. 9 m) +115 ft	Overburden (0. 3 m) 1 ft
Water not struck	Mineral (13. 7 m) 45 ft
Wirth B1, 8 inch diam.	Waste (1. 2 m) 4 ft
October 1969	Mineral (9. 1 m+) 30 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil	(0. 3)	1	(0. 3)	1
Glacial Sand and Gravel (a)	Sand. Gravel only in top 6 ft (1. 8 m). Gravel: fine, subangular with subrounded flint and occasional hard chalk. Sand: fine with medium, subangular to subrounded, mainly quartz with flint; orange to brown.	(13.7)	45	(14. 0)	46
Boulder Clay	Brown chalky clay.	(1. 2)	4	(15. 2)	50
Glacial Sand and Gravel (b)	Sand. Gravel absent. 'Clayey' in upper 9 ft (2. 7 m). Sand: fine with medium, subangular to subrounded, mainly flint with quartz and chalk; yellow.	(9. 1+)	30+	(24. 3)	80

	%	mm	%
(a) Gravel	1	+64	0
		-64+16	0
		-16+4	1
Sand	94	-4+1	2
		$-1+\frac{1}{4}$	40
		$-\frac{1}{4}+1/16$	52
Fines	5	-1/16	5

Depth below surface (ft)	Fines	Sand	Gravel
1 - 4	2	94	4
4 - 7	0	91	9
7 - 10	2	98	0
10 - 13	3	97	0
13 - 16	11	89	0
16 - 19	8	92	0
19 - 22	3	97	0
22 - 25	9	91	0
25 - 28	2	98	0
28 - 31	2	98	0
31 - 34	1	99	0
34 - 37	1	99	0
37 - 40	2	98	0
40 - 43	0	100	0
43 - 46	30	70	0

	%	mm	%
(b) Gravel	0	+64	0
		-64+16	0
		-16+4	0
Sand	95	-4+1	4
		$-1+\frac{1}{4}$	31
		$-\frac{1}{4}+1/16$	60
Fines	5	-1/16	5

Depth below surface (ft)	Fines	Sand	Gravel
50 - 53	15	85	0
53 - 56	2	98	0
56 - 59	13	87	0
59 - 62	2	98	0
62 - 65	3	97	0
65 - 68	4	94	2
68 - 71	1	99	0
71 - 74	5	95	0
74 - 77	2	98	0
77 - 80	2	98	0

TG 11 NW 2 1038 1850 Railway Station, Lenwade

Surface level (+12. 9 m) +42 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0. 3 m) 1 ft
Mineral (11. 0 m) 36 ft
Bedrock (0. 9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil	(0. 3)	1	(0. 3)	1
Suballuvium Gravel	Gravel. Fines almost absent Gravel: fine to coarse, sub-angular, brown flint, with traces of fine subrounded quartz and quartzite Sand: medium with coarse, sub-angular, mainly flint with chalk; brown	(11. 0)	36	(11. 3)	37
Upper Chalk	Chalk	(0. 9+)	3+	(12. 2)	40

	%	mm	%
		+64	0
Gravel	58	-64+16	26
		-16+4	32
		-4+1	15
Sand	41	$-1+\frac{1}{4}$	23
		$-\frac{1}{4}+1/16$	3
Fines	1	-1/16	1

Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	1	40	59
4 - 7	0	36	64
7 - 10	0	36	64
10 - 13	0	39	61
13 - 16	3	36	61
16 - 19	1	82	17
19 - 22	0	43	57
22 - 25	0	41	59
25 - 28	0	28	72
28 - 31	0	35	65
31 - 34	0	37	63
34 - 37	2	43	55

TG 11 NW 20 1395 1565 Attlebridge Hall

Surface level (+10.9 m) +36 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0.6 m) 2 ft
Mineral (8.5 m) 28 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil.	(0.6)	2	(0.6)	2
Terrace Gravel	Gravel. 'Clayey' in the top 3 ft (0.9 m) Gravel: fine to coarse, subangular with some subrounded brown flint; traces of subrounded quartz, and traces of flint cobbles. Sand: medium with fine and coarse, mainly flint; brown.	(8.5)	28	(9.1)	30
Upper Chalk	Chalk.	(0.9+)	3+	(10.0)	33

	%	mm		%
		+64	:	0
Gravel	68	-64+16	:	35
		-16+4	:	33
		-4+1	:	8
Sand	30	$-1+\frac{1}{4}$	:	15
		$-\frac{1}{4}+1/16$	:	7
Fines	2	-1/16	:	2

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 5	12	44	44
5 - 8	1	42	57
8 - 11	0	82	18
11 - 14	1	44	55
14 - 17	3	15	82
17 - 20	1	15	84
20 - 23	1	9	90
23 - 26	0	7	93
26 - 30	0	17	83

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Version 2.0.6

BGS ID: 514399 : BGS Reference: TG11NW25
British National Grid (27700) : 614540,315450
Report an issue with this borehole

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TG 11 NW 25 1454 1545 Attlebridge Hills

Surface level (+20.8 m) +68 ft
Water not struck
Wirth B1, 8 inch diam.
November 1969

Overburden (0.6 m) 2 ft
Mineral (13.4 m) 44 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil	(0.6)	2	(0.6)	2
Glacial Sand and Gravel	Sandy gravel. Gravel: fine to coarse, subangular with subrounded, mainly flint with quartz and quartzite. Sand: medium with coarse and traces of fine, subangular, mainly flint; brown to orange.	(13.4)	44	(14.0)	46
Upper Chalk	Chalk.	(0.9+)	3+	(14.9)	49

	%	mm	%
		+64 :	0
Gravel	32	-64+16 :	16
		-16+4 :	16
		-4+1 :	10
Sand	65	-1+¼ :	49
		-¼+1/16 :	6
Fines	3	-1/16 :	3

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 5	0	81	19
5 - 8	0	47	53
8 - 11	0	71	29
11 - 14	2	76	22
14 - 17	0	70	30
17 - 20	5	59	36
20 - 23	4	52	44
23 - 26	0	50	50
26 - 29	5	67	28
29 - 31	2	69	29
31 - 34	0	72	28
34 - 37	4	56	40
37 - 40	2	70	28
40 - 43	10	75	15
43 - 46	6	61	33

TG11 NW/29.

Institute use only

LOGICAL SSIFICATION	NATURE OF STRATA *If measurements start below ground surface, state how far.*	Thickness Feet	Thickness Inches	Thickness Metres	Depth Feet	Depth Inches	Depth Metres
GLACIAL SAND & GRAVEL	FINE SAND & OCCASIONAL GRAVEL			0.79			0.79
	DENSE MED. SAND + GRAVEL			2.26			3.05
	SOFT BROWN SILTY SAND			2.74			5.79
	SOFT GREY SILT			1.52			7.31
	BROWN SAND & GRAVEL			0.61			7.92
	FLINT BOULDERS			0.61			8.53
UPPER CHALK	SOFT "PUTTY" CHALK			2.44			10.97
	FIRM CHALK & FLINTS			16.46			27.43
	SOFT CHALK & FLINTS			6.10			33.53

TG 11 NW 3 1054 1751 The Rough Grounds, Lenwade

Surface level (+27.7 m) +91 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0.6) 2 ft
Mineral (0.9 m) 3 ft
Waste (2.7 m) 9 ft
Mineral (6.4 m) 21 ft
Waste (0.9 m) 3 ft
Mineral (8.2 m) 27 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil	(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a) 'Clayey' pebbly sand Gravel: coarse sub-angular flint Sand: fine with medium, subangular; brown	(0.9)	3	(1.5)	5
Boulder Clay	Slightly sandy brown clay with traces of gravel	(2.7)	9	(4.2)	14
Glacial Sand and Gravel	(b) Pebbly sand. Gravel mainly in lower 6 ft (1.8 m). 'Clayey' at the top. Traces of hard chalk fragments Gravel: fine with coarse, subangular flint Sand: fine and medium, subangular; brown	(6.4)	21	(10.6)	35
Boulder Clay	Brown chalky clay	(0.9)	3	(11.5)	38
Glacial Sand and Gravel	(c) Pebbly sand. Gravel mainly in upper 12 ft (3.7 m). 'Clayey' in upper 3 ft (0.9 m). Traces of hard chalk fragments Gravel: fine and coarse subangular flint Sand: medium with fine, subangular; brown	(8.2)	27	(19.7)	65
Upper Chalk	Chalk	(0.9+)	3+	(20.6)	68

		%	mm	%
(a)			+64	0
	Gravel	17	-64+16	15
			-16+4	2
			-4+1	5
	Sand	65	$-1+\frac{1}{4}$	30
			$-\frac{1}{4}+1/16$	30
	Fines	18	-1/16	18
(b)			+64	0
	Gravel	7	-64+16	2
			-16+4	5
			-4+1	6
	Sand	87	$-1+\frac{1}{4}$	33
			$-\frac{1}{4}+1/16$	48
	Fines	6	-1/16	6
(c)			+64	0
	Gravel	9	-64+16	5
			-16+4	4
			-4+1	5
	Sand	88	$-1+\frac{1}{4}$	50
			$-\frac{1}{4}+1/16$	33
	Fines	3	-1/16	3

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 5	18	65	17
14 - 17	16	82	2
17 - 20	8	92	0
20 - 23	3	97	0
23 - 26	5	95	0
26 - 29	4	94	2
29 - 32	4	81	15
32 - 35	5	66	29
38 - 41	11	87	2
41 - 44	6	73	21
44 - 47	2	77	21
47 - 50	2	75	23
50 - 53	2	98	0
53 - 56	1	98	1
56 - 59	0	100	0
59 - 62	1	99	0
62 - 65	4	80	16

Office Copy

TG11 NW/35-40

TG11 NW 1

SITE INVESTIGATION REPORT NO. 42823

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841	
	2	0995	1817	
TG 11 NW	3	1012	1828	1-35
	4	1044	1824	1-36
	5	1037	1841	1-37
	6	1077	1815	1-38
	7	1179	1780	1-39
	8	1220	1722	1-40

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 0DU.

JULY 1983

Office Copy

TG11 NW/35–40

TG11 NW 1

SITE INVESTIGATION REPORT NO. 42823

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841	
	2	0995	1817	
TG 11 NW	3	1022	1828	1–35
	4	1044	1824	1–36
	5	1037	1841	1–37
	6	1077	1815	1–38
	7	1179	1780	1–39
	8	1220	1722	1–40

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

BGS ID: 514410 : BGS Reference: TG11NW36
British National Grid (27700) : 610440,318240

MAY GURNEY (TECHNICAL SERVICES) Ltd., NORWICH TG11NW/36

LOCATION : GREAT WITCHINGHAM SEWERAGE SCHEME. NORFOLK.

JOB No. 42823 **BOREHOLE No.** 4

COMMENCED : 27.5.83 **COMPLETED :** 1.6.83 **DIAMETER :** 150mm

GROUND WATER struck at 3.00 **m. below ground level. Standing at** Sealed off **m. below ground level**

DESCRIPTION	LEGEND	DEPTH METRES	O.D. LEVEL	SAMPLE/ TEST	DEPTH METRES	REMARKS
GROUND LEVEL		0.00				Starter pit hand-dug to 1.50m to check for services
MADE GROUND - dark brown peaty sand with some gravel				J1/B1	0.00-1.50	
MEDIUM DENSE brown variably silty SAND with some gravel, becoming more gravelly with depth		1.30		SPT J2/B2	1.50 1.50-2.20	N = 15
				SPT J3/B3	2.20 2.20-3.00	N = 15
				SPT J4/B4	3.00 3.00-3.80	N = 16
'FIRM' light grey chalky sandy clayey SILT with fine chalk gravel		3.80		J5	3.80	
				U1	4.50	
'FIRM' light grey very sandy chalky SILT with some chalk fragments		5.00		€SJ(1) J6/B5	5.00 5.00-5.90	
				SPT	6.00	N = 24
END OF BOREHOLE		6.00		W1		

Depth scale: 0 1 2 3 4 5 6 7 8 9 10

KEY :
H.V. - Hand Vane Test
S.P.T. - Standard Penetration Test
C - Undrained shear strength
N - Number of blows per 300 mm penetration in S.P.T.
J - Jar sample
B - Bulk sample
W - Water sample
U - 100 mm undisturbed sample

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TG11 NW/35-40

TG11 NW 1

SITE INVESTIGATION REPORT NO. 42823

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841	
	2	0995	1817	
TG 11 NW	3	1022	1828	1-35
	4	1044	1824	1-36
	5	1037	1841	1-37
	6	1077	1815	1-38
	7	1179	1780	1-39
	8	1220	1722	1-40

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

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TG11 NW/35-40

TG11 NW 1

SITE INVESTIGATION REPORT NO. 42823

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841	
	2	0995	1817	
TG 11 NW	3	1032	1828	1-35
	4	1044	1824	1-36
	5	1037	1841	1-37
	6	1077	1815	1-38
	7	1179	1780	1-39
	8	1220	1722	1-40

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

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TG11 NW/35–40

TG11 NW 1

SITE INVESTIGATION REPORT NO. 42823

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841	
	2	0995	1817	
TG 11 NW	3	1022	1828	1–35
	4	1044	1824	1–36
	5	1037	1841	1–37
	6	1072	1815	1–38
	7	1179	1780	1–39
	8	1220	1722	1–40

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

TG 11 NW 4 1051 1642 Weston Longville

Surface level (+43. 6 m) + 142 ft
Groundwater conditions not recorded
Wirth B1, 8 inch diam.
October 1969

Overburden (4. 5 m) 15 ft
Mineral (10. 7 m+) 35 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil	(0.9)	3	(0. 9)	3
Boulder Clay	Grey chalky clay	(0. 9)	3	(1.8)	6
	Brown chalky clay	(2.7)	9	(4.5)	15
Glacial Sand and Gravel	Sand. Gravel mainly in upper 21 ft (6.4 m) Some hard chalk fragments in upper 12 ft (3.7 m) Gravel: fine subangular to subrounded flint. Sand: medium with fine subrounded quartz; yellow to orange.	(10. 7+)	35+	(15. 2)	50

	%	mm		%
		+64	:	0
Gravel	3	-64+16	:	1
		-16+4	:	2
		-4+1	:	3
Sand	95	$-1+\frac{1}{4}$	:	51
		$-\frac{1}{4}+1/16$	:	41
Fines	2	-1/16	:	2

Depth below surface (ft)	Percentage Fines	Sand	Gravel
15 - 18	1	92	7
18 - 21	1	96	3
21 - 24	5	89	6
24 - 27	2	88	10
27 - 30	2	98	0
30 - 33	5	92	3
33 - 36	0	94	6
36 - 39	0	99	1
39 - 42	1	99	0
42 - 45	1	95	4
45 - 48	1	99	0
48 - 50	2	98	0

Office Copy

TG11 NW/35–40

TG11 NW 1

SITE INVESTIGATION REPORT NO. 42823

LOCATION

GREAT WITCHINGHAM SEWERAGE SCHEME
LENWADE - MORTON
NORFOLK.

TG 1018 to TG 1217

TG 01 NE	1	0953	1841	
	2	0995	1817	
TG 11 NW	3	1022	1828	1–35
	4	1044	1824	1–36
	5	1037	1841	1–37
	6	1077	1815	1–38
	7	1179	1780	1–39
	8	1220	1722	1–40

FOR

BROADLAND DISTRICT COUNCIL
TECHNICAL SERVICES DEPARTMENT
THORPE LODGE
YARMOUTH ROAD
NORWICH
NR7 ODU.

JULY 1983

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 10 **at** Morston Estate. TG11NW/41

For Mr. J.V. Berney.

1235/1753

O/No. 2374 **Boring Completed on** 24.10.62. **O.D. Level**

Boring lined to a Depth of 18'0" **Diameter** 7¼"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Top soil,	1	6	1	6				
Peat.	3	6	5	0				
Sand & gravel.	12	6	17	6	23.10.62.		6'0"	4'9"
Chalk.	5	0	22	6				
		TOTAL DEPTH	22	6				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

Disturbed Jar Samples Taken at - 3', 8', 13', 22'6".

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From	To	Blows
From	To	Blows
From	To	Blows

Boring Foreman's Remarks

Signed L. J. Bradl

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 11 **at** Morton Estate.

For Mr. J.V. Berney.

TG11NW/42

O/No. 2374 Boring Completed on 26.10.62. O.D. Level 1236-1732

Boring lined to a Depth of 28'0" Diameter 7½"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Top soil.	1	6	1	6	25.10.62.		6'0"	
					"	Even.		6'6"
Sand & gravel.	23	0	24	6	26.10.	Morn.		10'0"
Large gravel.	2	6	27	0				
Chalk & flints.	5	0	32	0				
TOTAL DEPTH			32	0				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

2 Bulk samples taken.

Disturbed Jar Samples Taken at – 3', 8', 13', 18', 23', 32'.

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From To Blows

From To Blows

From To Blows

Boring Foreman's Remarks

Signed J. T[illegible]

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 12 at Morston Estate. TG11NW/43

For Mr. J.V. Berney. 1213-1752

O/No. 2374 Boring Completed on O.D. Level

Boring lined to a Depth of Diameter 7½"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Top soil.	1	0	1	0	29.10.62.		9'0"	
Sand & gravel.	16	6	17	6	30.10.	Morn.		8'3"
					"	Even.		10'6"
Sand, flints, chalk & bands of clay.	10	0	27	6	31.10.	Morn.		8'9"
TOTAL DEPTH			27	6				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

Disturbed Jar Samples Taken at - 3', 8', 13', 17'6", 20'6", 27'6".

Two bulk samples taken.

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From	To	Blows
From	To	Blows
From	To	Blows

Boring Foreman's Remarks

Signed A Terrell

TG 11 NW 5 1061 1563 The Rectory, Weston Longville

Surface level (+47.9 m) +157 ft Waste (18.3 m+) 60 ft+
Water not struck
Wirth B1, 8 inch diam.
October 1969

		Thickness (m)	ft	Depth (m)	ft
Boulder Clay	Soil and brown stony clay	(6.1)	20	(6.1)	20
	Brown clay	(9.1)	30	(15.2)	50
	Grey clay	(3.1+)	10+	(18.3)	60

1

147/51 Church Farm, Weston Longville TG11/50

TG 1128 1582

Surface +160. Shaft 51½; rest bore. Depth 163½. Lining tubes: 101½ × ? 4 in from 47½ down. *Buckingham, date unknown.*

Deepened by bore. *Buckingham, 1944.* Yield 800 g.p.d. I/c engine. *July 1960.*

Boulder Clay	51½	51½
Sand and Gravel	23	74½
Boulder Clay	10	84½
UCk	113½	200

PLEIST DRIFT & ? CRAG 84½'	WELL	51½	51½
	SAND	23	74½
	CLAY	10	84½
U. CHALK 113½	CHALK	79	163½
classified by R. Allender. 1965	NO DETAILS BELOW 163½' DOWN TO 200'		
	Log. Reclassified 23/3/71		

147/408 **Malthouse Farm, Attlebridge** TG 1300 1675 TG11/35

Surface +45. Lining tubes: 93 × 4 in from surface. Ck -12. R.W.L. +31½. P.W.L. +19. Recovered to +31½ in 15 min. Yield 500 g.p.h. (8 h. test). Electric pump. Page, *June 1957*.

Pleisc. Drift (Buried channel)	...	57	57
~~Ck~~	...	54	111

DRIFT "CRAG" 57	TOP SOIL	2	2
	GRAVEL	13	15
	BRICK EARTH	4	19
	GRAVEL	3	22
	BROWN SAND	21	43
	GREY CLAY	14	57
U. CHALK. 54	CHALK.	54	111

classified by R. Allender 1965

log Re classified 23·3·71

TG11/18

147/306 Old Hall, Weston Longville

(a) (Sealed). Surface +52. Shaft 18. *Date unknown.* Hardness: P. 54, T. 222. Anal. *Nov. 1952.*

(b) (Sealed). Surface +52. Bore 105. Lining tubes: 75 × 4 in from surface. R.W.L. +41. P.W.L. +35. Yield 1,000 g.p.h. (8 h. test). *Buckingham, Sept. 1950.* Anal. *Jan. 1951.* Unfit for drinking. *Before 1953.*

(c) Surface +58. Lining tubes: 100 × 6 in from surface. R.W.L. +38. Yield 700 g.p.h. (8 h. test). Ferruginous. Anal. *Buckingham, Mar. 1953.* P.W.L. +34. Recovered to +38 in 8 min. Electric pump. *July 1960.*

(c) Drift	... ...	10	10
UCk	... ...	135	145

Drift 10	Gravel	10	0	10	0
U.Ck. 145	Marl	40	0	50	0
	Chalk	95	0	145	0

Further details see additional information sheet


British Geological Survey
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British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey

2

(For Institute use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA — If measurements start below ground surface, state how far.	THICKNESS Feet	THICKNESS Inches	THICKNESS Metres	DEPTH Feet	DEPTH Inches	DEPTH Metre
Glacial Deposits 112'	Dug well	20	0	6·10	20		6·10
	Sand and stones	7	0	2·13	27		8·23
	Blue Clay	8		2·44	35		10·67
	Brown sand and stones	55		16·76	90		27·43
	Blue clay and stones	22		6·71	112		34·14
Upper Chalk 46'	Chalk	46		14·02	158		48·16

pp PNH
17.8.70

DATA Bank

TG 11 NW 7 1163 1809 **Ploughed Meadow Plantation, Alderford**

Surface level (+10.9 m) +36 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (1.8 m) 6 ft
Mineral (2.7 m) 9 ft
Waste (13.1 m) 43 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
Alluvium	Soil and peaty brown silt and clay.	(1.8)	6	(1.8)	6
Suballuvium Gravel	Gravel Gravel: fine to coarse, subangular flint, traces of subrounded quartz and flint. Sand: medium and coarse, subangular; grey to brown.	(2.7)	9	(4.5)	15
Interglacial Deposits	Grey silt with chalk sand and traces of gravel.	(13.1)	43	(17.6)	58
Upper Chalk	Chalk	(0.9+)	3+	(18.5)	61

	%	mm	%
		+64	: 0
Gravel	66	-64+16	: 33
		-16+4	: 33
		-4+1	: 13
Sand	33	$-1+\frac{1}{4}$	: 17
		$-\frac{1}{4}+1/16$	3
Fines	1	-1/16	: 1

Depth below surface (ft)	Percentage Fines	Sand	Gravel
6 - 9	1	40	59
9 - 12	0	36	64
12 - 15	1	24	75

Version 2.0.6

BGS ID: 514445 : BGS Reference: TG11NW71
British National Grid (27700) : 610180,315700
Report an issue with this borehole

147/326 **The Duckeries, Rectory Road, Weston** Longville TG11/152

Surface +167. Lining tubes: × 4 in from surface. Ck +58. Suction +147½. I/c engine. *Page, Apr. 1951.* TG 1018 1570
Yield 100 g.p.d. *July 1960.*

Boulder Clay	39	39
Sand and Gravel... ...	49	88
Boulder Clay	12	100
Sand and Gravel	9	109
UCk	35	144

BOULDER CLAY 39	LOAM	2	2
	SANDSTONE AND CLAY	37	39
SAND AND GRAVEL 49	SHINGLE	4	43
	SAND	45	88
BOULDER CLAY 12	STONE AND CLAY	12	100
CRAG 9	SAND	8	108
	STONE	1	109
U.CHALK. 35	CHALK.	35	144

classified by R.A. 1965

log Reclassified 23/3/71

1. 147/513 Church Hill, Attlebridge TG 1305 1681 TG11/180

Surface +53. Lining tubes: 153 × 4 in from surface. R.W.L. +30. P.W.L. +29. Recovered to +30 in 2 min. Yield 400 g.p.h. (8 h. test). Electric pump. Page, May 1959.

Pleist. Drift (Buried channel)	...	143	143
UCk	... ...	17	160

PLEIST DRIFT) ? CRAG) (BURRIED CHANNEL) 143	TOPSOIL.	3	3
	GRAVEL.	7	10
	RED SAND	45	55
	CHALK.	2	57
	GREY SAND	85	142
	BLUE CLAY	1	145
U. CHALK. 17	CHALK.	17	160

Classified by [redacted] R. Allender. 1965

☐ + Log Reclassified 23.3.71

TG 11 NW 8 1134 1742 **Oak Plantation, Morton**

Surface level (+27.0 m) +89 ft
Groundwater conditions not recorded
Shell and auger, 8 inch diam.
November 1969

Overburden (0.6 m) 2 ft
Mineral (1.8 m) 6 ft
Waste (3.7 m) 12 ft
Mineral (1.8 m) 6 ft
Bedrock (0.9 m+) 3 ft+

			Thickness (m)	ft	Depth (m)	ft
		Soil	(0.6)	2	(0.6)	2
Glacial Sand and Gravel	(a)	'Clayey' sandy gravel. Sandy and chalky at base. Gravel: coarse with fine subangular with traces of subrounded, flint. Sand: fine and medium, subangular; brown.	(1.8)	6	(2.4)	8
Boulder Clay		Soft brown chalky clay, with traces of sand and gravel.	(3.7)	12	(6.1)	20
Glacial Sand and Gravel	(b)	'Clayey' pebbly sand. Gravel in upper 3 ft (0.9 m). Gravel: coarse, subangular flint, with subangular to subrounded chalk. Sand: fine, with traces of medium, subangular; brown.	(1.8)	6	(7.9)	26
Upper Chalk		Chalk	(0.9+)	3+	(8.8)	29

	%	mm		%
		+64	:	0
(a) Gravel	21	-64+16	:	8
		-16+4	:	3
		-4+1	:	3
Sand	62	$-1+\frac{1}{4}$	:	30
		$-\frac{1}{4}+1/16$	:	39
Fines	17	-1/16	:	17
		+64	:	0
(b) Gravel	12	-64+16	:	11
		-16+4	:	1
		-4+1	:	1
Sand	71	$-1+\frac{1}{4}$	:	13
		$-\frac{1}{4}+1/16$	:	57
Fines	17	-1/16	:	17

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 5	10	75	15
5 - 8	25	69	6
20 - 23	13	63	24
23 - 26	21	79	0

Version 2.0.6

BGS ID: 514456 : BGS Reference: TG11NW82
British National Grid (27700) : 610260,317830
Report an issue with this borehole

TG11/18

147/306 Old Hall, Weston Longville

15 Elm

(a) (Sealed). Surface +52. Shaft 18. *Date unknown.* Hardness: P. 54, T. 222. Anal. *Nov. 1952.*

(b) (Sealed). Surface +52. Bore 105. Lining tubes: 75 × 4 in from surface. R.W.L. +41. P.W.L. +35. Yield 1,000 g.p.h. (8 h. test). *Buckingham, Sept. 1950.* Anal. *Jan. 1951.* Unfit for drinking. *Before 1953.*

(c) Surface +58. Lining tubes: 100 × 6 in from surface. R.W.L. +38. Yield 700 g.p.h. (8 h. test). Ferruginous. Anal. *Buckingham, Mar. 1953.* P.W.L. +34. Recovered to +38 in 8 min. Electric pump. *July 1960.*

(c) Drift	... ...	10	10
UCk	... ...	135	145

Drift 10	Gravel	10	0	10	0
U.Ck. 145	Marl	40	0	50	0
	Chalk	95	0	145	0

Further details see additional information sheet


British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey

TG11/18

147/306 Old Hall, Weston Longville

15 Elm

(a) (Sealed). Surface +52. Shaft 18. *Date unknown.* Hardness: P. 54, T. 222. Anal. *Nov. 1952.*

(b) (Sealed). Surface +52. Bore 105. Lining tubes: 75 × 4 in from surface. R.W.L. +41. P.W.L. +35. Yield 1,000 g.p.h. (8 h. test). *Buckingham, Sept. 1950.* Anal. *Jan. 1951.* Unfit for drinking. *Before 1953.*

(c) Surface +58. Lining tubes: 100 × 6 in from surface. R.W.L. +38. Yield 700 g.p.h. (8 h. test). Ferruginous. Anal. *Buckingham, Mar. 1953.* P.W.L. +34. Recovered to +38 in 8 min. Electric pump. *July 1960.*

(c) Drift	... ...	10	10
UCk	... ...	135	145

Drift 10	Gravel	10	0	10	0
U.Ck. 145	Marl	40	0	50	0
	Chalk	95	0	145	0

Further details see additional information sheet


British Geological Survey
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British Geological Survey
British Geological Survey
British Geological Survey

TG 11 NW 9 1143 1650 Norwich Belt, Weston Longville

Surface level (+40.4 m) +132 ft
Water not struck
Wirth B1, 8 inch diam.
December 1969

Overburden (0.3 m) 1 ft
Mineral (15.5 m) 51 ft
Waste (7.6 m+) 25 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	'Clayey' pebbly sand. Gravel mainly in upper half of deposit. 'Clayey' mainly in upper 18 ft (5.5 m) and lower 12 ft (3.7 m). Traces of hard chalk pebbles. Gravel: coarse, subangular to angular flint. Sand: fine with medium, subangular; brown.	(15.5)	51	(15.8)	52
Boulder Clay	Silty fine sand with traces of clay.	(0.9)	3	(16.8)	55
	Brown chalky clay	(7.6+)	25+	(24.4)	80

	%	mm		%
		+64	:	0
Gravel	6	-64+16	:	4
		-16+4	:	2
		-4+1	:	3
Sand	80	-1+¼	:	23
		-¼+1/16	:	54
Fines	14	-1/16	:	14

Depth below surface (ft)	Fines	Sand	Gravel
1 - 4	14	36	50
4 - 7	19	72	9
7 - 10	20	65	15
10 - 13	24	72	4
13 - 16	23	62	15
16 - 19	11	89	0
19 - 22	10	90	0
22 - 25	1	92	7
25 - 28	4	96	0
28 - 31	2	98	0
31 - 34	8	92	0
34 - 37	8	92	0
37 - 40	8	92	0
40 - 43	29	71	0
43 - 46	20	80	0
46 - 49	15	85	0
49 - 52	10	90	0

Version 2.0.6

BGS ID: 514471 : BGS Reference: TG11NW97
British National Grid (27700) : 611200,315760

Report an issue with this borehole

<< < Prev Page 2 of 6 Next > >>

147/546 St. Faith's and Aylsham R.D.C., 10, Council Houses, Hoduring Road, Weston Longville. TG 1120 1576

Surface +160. Bore. Ck +45. R.W.L. +107½. P.W.L. +103. Yield 2,000 g.p.h. (test).
Bullen, July 1956.
Suction +79. Yield 500 g.p.h. *Oct. 1964.*

TG11/68

Boulder Clay	45	45
Sand and Gravel... ...	45	90
Boulder Clay	10	100
Sand and Gravel... ...	15	115
UCk	85	200

BOULDER CLAY 45	BROWN CLAY	45	45
	YELLOW SAND AND CLAY (MIXED)	10	55
SAND AND GRAVEL 45	CLOSE YELLOW SAND	35	90
BOULDER CLAY 10	BLUE CLAY	10	100
CRAG 15	GREY SAND	10	110
	SHARP GREY SAND	5	115
U. CHALK 85	SOFT STICKY CHALK	50	165
	GOOD CHALK	35	200

classified by R. Allender 1965.

log
Re-classified by F. Cox
23.3.71

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 1 of 3

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHPW1A
Carried out for Norfolk County Council	Date Started 29/03/2007	Date Finished	30/03/2007
Remarks:	Type of Rig		
	Depth 20.45	Height 22.067 mAOD	Logged by BA; Drawn by ptp; Checked by
	Co-ords 614337E - 315519N		

Description	Depth (m)	Sample Type	Sample No.	Field Tests
MADE GROUND : Orange silty fine sand with some fine and medium flint gravel (MADE GROUND)			001	
	1.00		001 002	N=17
Very soft brown very clayey very sandy SILT with some fine and medium flint gravel (COVER SILT)				
Orangey brown silty fine SAND with laminae of grey sandy silt (CRAG_SAND)	2.00		002 003	N=21
	3.00		003 004	N=21
Laminated grey very clayey sandy SILT (CRAG_SILT)	4.00		004 005	N=21
Thin bed of brown fine and medium sand	5.00		005	N=25
Very soft brown very sandy very clayey SILT (CRAG_SILT)			006	
Brown clayey silty fine SAND with much fine and medium flint gravel (CRAG_SAND)	6.00		006	50/250mm
			007	
	7.00			
			007	N=9
Off white silt sized comminuted CHALK with a little fine intact chalk. Very weak. GradeVI.Dm. (UPPER CHALK)	8.00		008	
	9.00		008	N=17
Continued next sheet				

Laboratory Tests: MC% | ρ_a | SO_3 | Cl- | pH | Org. | CBR | Other

FIG a

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 2 of 3

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHPW1A
Carried out for Norfolk County Council	Date Started 29/03/2007	Date Finished	30/03/2007
Remarks:	Type of Rig		
	Depth 20.45	Height 22.067 mAOD	Logged by BA; Drawn by ptp; Checked by
	Co-ords 614337E - 315519N		

Backfill	Water	Description	Legend	Depth (m)	Sample Type	Sample No.	Field Tests	MC%	ρ_a	SO_3	Cl-	pH	Org.	CBR	Other
		Off white silt sized comminuted CHALK with a little fine intact chalk. Very weak. GradeVI.Dm. (UPPER CHALK)			●	009	N=8								
		Off white silt sized comminuted CHALK with a little fine intact chalk. Very weak with some flint gravel. GradeVI.Dm. (UPPER CHALK)		11.00											
		Off white silt sized comminuted CHALK with a little fine intact chalk. Very weak. GradeVI.Dm. (UPPER CHALK)		12.00	●	010	N=6								
				13.00											
					●	011	N=7								
				14.00											
	150 15.00			15.00	●	012	N=10								
				16.00											
		Off white silt sized comminuted CHALK with some fine and medium intact chalk gravel. Very weak. GradeVI.Dm. (UPPER CHALK)			●	013	N=17								
				17.00											
				18.00	●	014	N=18								
				19.00											
		Continued next sheet													

FIG b

NORFOLK PARTNERSHIP LABORATORY

BOREHOLE LOG

Sheet 3 of 3

Scheme Norwich Northern Distributor Road	Job No. PTPK1000ii	Borehole No.	BHPW1A
Carried out for Norfolk County Council	Date Started 29/03/2007	Date Finished	30/03/2007
Remarks:	Type of Rig		
	Depth 20.45	Height 22.067 mAOD	Logged by BA; Drawn by ptp; Checked by
	Co-ords 614337E - 315519N		

Backfill	Water	Description	Legend	Depth (m)	Sample Type	Sample No.	Field Tests	MC%	ρ_s	SO_3	Cl-	pH	Org.	CBR	Other
		Off white silt sized comminuted CHALK with some fine and medium intact chalk gravel. Very weak. GradeVI.Dm. (UPPER CHALK)			●	015	N=16								
		End of Borehole at 20.45 m													
				21.00											
				22.00											
				23.00											
				24.00											
				25.00											
				26.00											
				27.00											
				28.00											
				29.00											

FIG c

Eastern L.S. Anglian Water. Region, NRA

900066

TG11SW 100 128 - 133

TG 11/2128

* * GEORGE STOW & CO LTD * *

Code: AW017

Reading Road - Henley-on-Thames - RG9 1DX

TG11SW

BOREHOLE RECORD

Borehole No: RW 2

Date completed: 4-09-90

161

All depths to be measured below Ground Level

Client: N.R.A. Anglian Region

Exact Site: RW 2 - Ringland (NGR: TG 128 133)

Ground Level (O.D.): c30m ....m

Depth of Bore: 65 m Diameter: At Top 450 mm. Bottom 300 mm

Details of Permanent Lining Tubes

Diameter	Length Inserted							
450 mm	20.5 m	Plain	..... m	Slotted	Top At	0.5 m	A.G.L.
300 mm	8 m	"	..... m	"	"	17 m	B.G.L.
300 mm	..... m	"	36 m	"	"	25 m	B.G.L.
300 mm	4 m	"	..... m	"	"	61 m	B.G.L.

Rest Level of Water below Ground Level: 18.86 m

Yield on test 8 hours Pumping: 55 litres/sec Date: 4-09-90

Pumping Water Level: 22.11 m below G.L.

Time of Recovery: ....

Remarks: Prior to acidising gave 8.6 l/sec with 5m drawdown.
Following acidising gave 55 l/sec with 3.25m drawdown.

STRATA RECORD

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS METRES	DEPTH METRES
"Glacial Loam and Marl" – possibly Norwich Brickearth	brown sandy soil	2	2
	brown clay	4	6
	grey-brown sandy CLAY	4	10
Upper Chalk	puggy CHALK, flints at base	10	20
	CHALK with flints	45	65

Amm
17/4/91

TG11 SW /102

May Gurney — May Gurney (Technical Services) Limited — JOB No. 44335

LOCATION: HONINGHAM SEWERAGE SCHEME, NORFOLK (TG 105118)

COMMENCED: 7.9.87 COMPLETED: 7.9.87 DIAMETER: 150mm BOREHOLE No. 1

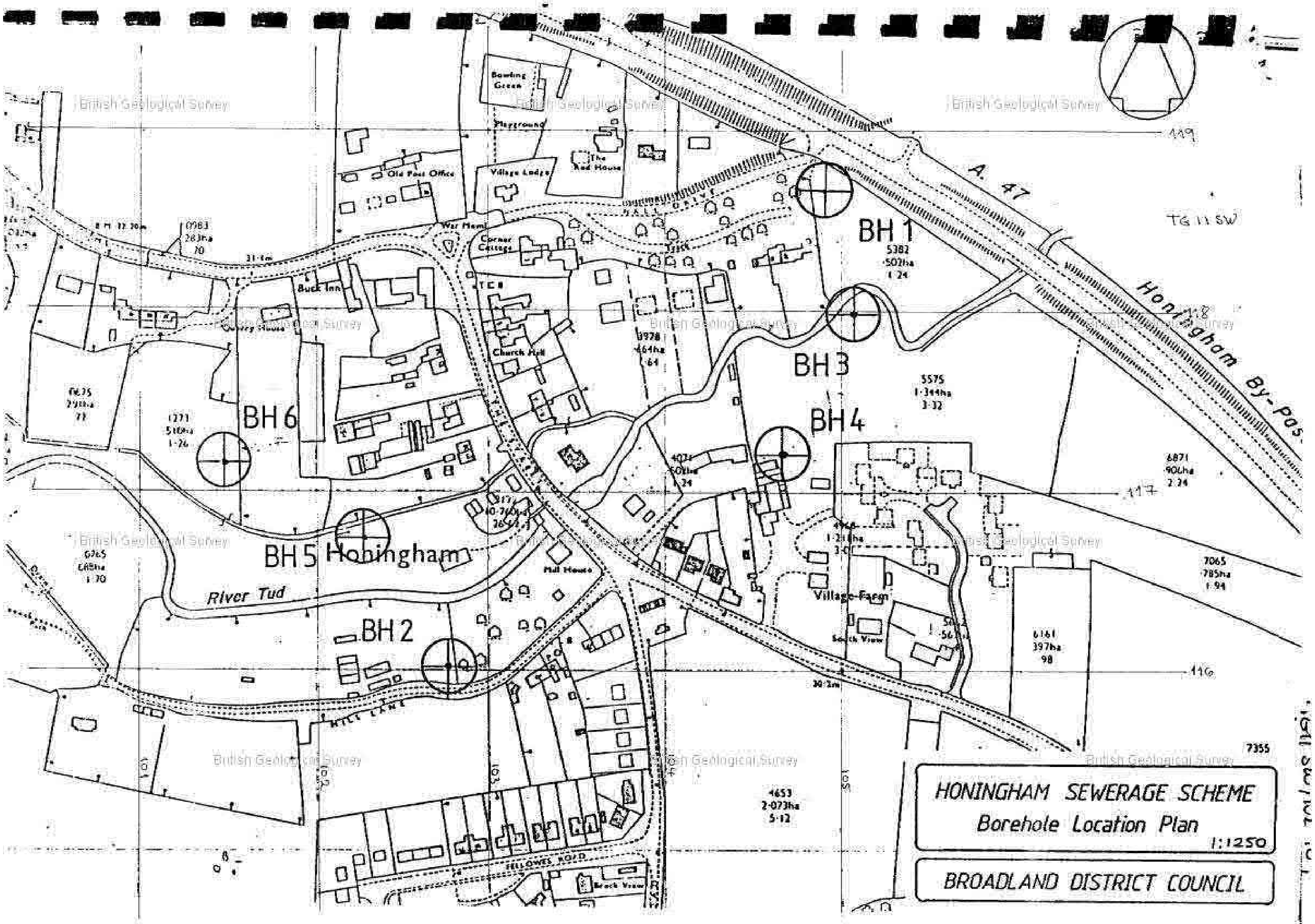
GROUNDWATER: (see notes below) Struck i 4.40 ii ...... Standing iii 1.20 iv 1.20 (m. depth)

DESCRIPTION	DEPTH (m)	REDUCED LEVEL	SAMPLE/TEST	DEPTH (m)	REMARKS
GROUND LEVEL		mA.O.D			
MADE GROUND - brown very sandy clayey silt, chalk traces	0.00	25.31	J1 B1	0.00 0.00-0.60	
LOOSE grey-brown very clayey silty fine-coarse SAND with a little gravel	0.60	24.71	CPT J2 B2 CPT	0.70 0.60 0.60-2.20 1.50	N = 8 N = 11
...becoming MEDIUM DENSE grey-brown gravelly clayey silty SAND			CPT J3 B3 CPT	2.20 2.20 2.20-3.60 3.00	N = 14 N = 15
FIRM dark grey silty CLAY with chalk gravel	3.60	21.71	J4 B4	3.60 3.60-4.40	
MEDIUM DENSE grey chalky sandy fine- coarse subangular GRAVEL	4.40	20.91	CPT J5 B5 CPT W1	4.50 4.40 4.40-6.00 6.00 6.00	N = 13 N = 30
SOFT white part-weathered CHALK (Grade V) comprising unweathered chalk fragments in a remoulded matrix with occasional flint	6.30	19.01	J6 B6 CPT J7 B7	6.30 6.30-7.50 7.50 7.50 7.50-9.00	 N = 9
...becoming less weathered with depth			CPT J8 B8 CPT	9.00 9.00 9.00-10.00 10.00	N = 10 N = 11
END OF BOREHOLE	10.50	14.81			

J = Jar disturbed sample
B = Bulk disturbed sample
U = 100mm dia. undisturbed sample
P = 100mm dia. piston sample
W = Water sample
SPT = Standard Penetration Test
CPT = Cone Penetration Test
N = No. blows per 300mm penetration
FHT = Falling Head Test (results elsewhere)
V = Vane test

GROUNDWATER NOTES

Ref	Date/time	Casing depth
i	7.9/1650	4.40m
ii		
iii	7.9/1700	4.40m
iv	7.9/1730	6.50m


HONINGHAM SEWERAGE SCHEME
Borehole Location Plan
1:1250
BROADLAND DISTRICT COUNCIL
BH 1
BH 2
BH 3
BH 4
BH 5
BH 6
Honingham
River Tud
A 47
Honingham By-Pass
TG 11 SW
Bowling Green
Playground
Old Post Office
Village Lodge
The Red House
War Memorial
Corner Cottage
Buck Inn
Church Hall
Mill House
Village Farm
South View
Fellowes Road
Mill Lane
British Geological Survey

TG11 SW /104

May Gurney May Gurney (Technical Services) Limited | JOB No. 44335

LOCATION: HONINGHAM SEWERAGE SCHEME (TG 105117)

COMMENCED: 10.9.87 COMPLETED: 10.9.87 DIAMETER: 150mm BOREHOLE No. 3

GROUNDWATER: (see notes below) Struck i 1.60 ii - Standing iii 1.40 iv - (m. depth)

DESCRIPTION	LEGEND	DEPTH (m)	REDUCED LEVEL	SAMPLE/TEST	DEPTH (m)	REMARKS
GROUND LEVEL			mA.O.D			
LOOSE grey-brown peaty silty SAND with some rootlets		0.00	23.36	J1 B1 CPT	0.00 0.00-1.50 0.70	N = 6
MEDIUM DENSE to DENSE grey-brown sandy fine-coarse GRAVEL with occasional cobbles		1.60	21.76	CPT J2 B2 CPT J3 B3 CPT J4 B4 CPT J5 CPT W1	1.50 1.60 1.60-2.20 2.20 2.20 2.20-3.00 3.00 3.00 3.00-4.60 4.50 4.60 5.00 5.00	N = 25 N = 33 N = 37 N = 11 N = 10
END OF BOREHOLE		5.50	17.86			

J = Jar disturbed sample		SPT = Standard Penetration Test	
B = Bulk disturbed sample		CPT = Cone Penetration Test	
U = 100mm dia. undisturbed sample		N = No. blows per 300mm penetration	
P = 100mm dia. piston sample		FHT = Falling Head Test (results elsewhere)	
W = Water sample		V = Vane test	

GROUNDWATER NOTES

Ref	Date/time	Casing depth
i	10.9/1142	1.60m
ii		
iii	10.9/1152	1.60m
iv		

TG11 SW /105

May Gurney — May Gurney (Technical Services) Limited — JOB No. 44335

LOCATION: HONINGHAM SEWERAGE SCHEME (TG 105117)

COMMENCED: 8.9.87 COMPLETED: 8.9.87 DIAMETER: 150mm BOREHOLE No. 4

GROUNDWATER: (see notes below) Struck i 3.00* ii .... Standing iii .... iv .... (m. depth)

DESCRIPTION	LEGEND	DEPTH (m)	REDUCED LEVEL	SAMPLE/ TEST	DEPTH (m)	REMARKS
			mA.O.D			
GROUND LEVEL		0.00	25.54	J1	0.00	
MADE GROUND - brick rubble & silty sand				B1	0.00-0.50	
MEDIUM DENSE brown silty fine-coarse SAND and fine-coarse GRAVEL		0.50	25.04	CPT	0.70	N = 17
				J2	0.50	
				B2	0.50-1.50	
				CPT	1.50	N = 15
				J3	1.50	
				B3	1.50-2.20	
...becoming very silty SAND with a little gravel				CPT	2.20	N = 12
				J4	2.20	
				B4	2.20-3.00	
...becoming more gravelly with depth				CPT	3.00	N = 12
				J5	3.00	
				B5	3.00-4.00	
				CPT	4.00	N = 15
END OF BOREHOLE		4.50	21.04			
						* seepage only

J = Jar disturbed sample		SPT = Standard Penetration Test	
B = Bulk disturbed sample		CPT = Cone Penetration Test	
U = 100mm dia. undisturbed sample		N = No. blows per 300mm penetration	
P = 100mm dia. piston sample		FHT = Falling Head Test (results elsewhere)	
W = Water sample		V = Vane test	

GROUNDWATER NOTES

Ref	Date/time	Casing depth
i		
ii		
iii		
iv		

TG11 SW /106

May Gurney May Gurney (Technical Services) Limited — JOB No. 44335

LOCATION: HONINGHAM SEWERAGE SCHEME (TG 102117)

COMMENCED: 9.9.87 COMPLETED: 9.9.87 DIAMETER: 150mm BOREHOLE No. 5

GROUNDWATER: (see notes below) Struck i 0.60 ii .... Standing iii 0.60 iv .... (m. depth)

DESCRIPTION	LEGEND	DEPTH (m)	REDUCED LEVEL	SAMPLE/ TEST	DEPTH (m)	REMARKS
GROUND LEVEL			mA.O.D			
SOFT dark brown fibrous-amorphous PEAT		0.00	24.09	J1 B1	0.00 0.00-0.60	
MEDIUM DENSE to DENSE grey-brown sandy fine-coarse GRAVEL with occasional cobbles		0.60	23.49	CPT J2 B2 CPT J3 B3 CPT J4 B4 CPT J5	0.70 0.60 0.60-1.50 1.50 1.50 1.50-2.20 2.20 2.20 2.20-3.00 3.00 3.00-3.90	N = 29 N = 35 N = 39 N = 35
FIRM light grey chalky sandy SILT		3.90	20.19	J6 W1 CPT	3.90 4.00 4.00	 N = 14
END OF BOREHOLE		4.50	19.59			

J = Jar disturbed sample
B = Bulk disturbed sample
U = 100mm dia. undisturbed sample
P = 100mm dia. piston sample
W = Water sample

SPT = Standard Penetration Test
CPT = Cone Penetration Test
N = No. blows per 300mm penetration
FHT = Falling Head Test (results elsewhere)
V = Vane test

GROUNDWATER NOTES

Ref	Date/time	Casing depth
i	9.9/0900	0.60m
ii		
iii	9.9/0910	0.60m
iv		

TG11 SW /107

May Gurney May Gurney (Technical Services) Limited

JOB No. 44335

LOCATION: HONINGHAM SEWERAGE SCHEME (TG 101117)

COMMENCED: 9.9.87 COMPLETED: 9.9.87 DIAMETER: 150mm BOREHOLE No. 6

GROUNDWATER: (see notes below) Struck i 0.60 ii .... Standing iii 0.60 iv .... (m. depth)

DESCRIPTION	LEGEND	DEPTH (m)	REDUCED LEVEL	SAMPLE/TEST	DEPTH (m)	REMARKS
			mA.O.D			
GROUND LEVEL		0.00	24.30	J1	0.00	
SOFT dark brown fibrous-amorphous PEAT				B1	0.00-0.80	
				CPT	0.70	N = 22
MEDIUM DENSE to DENSE grey-brown slightly silty fine-coarse SAND and fine-coarse GRAVEL		0.80	23.50	J2	0.80	
				B2	0.80-1.50	
				CPT	1.50	N = 35
				J3	1.50	
				B3	1.50-2.20	
				CPT	2.20	N = 32
				J4	2.20	
				B4	2.20-3.00	
...becoming sandy fine-coarse GRAVEL				CPT	3.00	N = 37
				J5	3.00	
				B5	3.00-3.80	
FIRM light grey chalky sandy SILT		3.80	20.50	J6	3.80	
				CPT	4.00	N = 16
				W1	4.00	
END OF BOREHOLE		4.50	19.80			

J = Jar disturbed sample
B = Bulk disturbed sample
U = 100mm dia. undisturbed sample
P = 100mm dia. piston sample
W = Water sample

SPT = Standard Penetration Test
CPT = Cone Penetration Test
N = No. blows per 300mm penetration
FHT = Falling Head Test (results elsewhere)
V = Vane test

GROUNDWATER NOTES

Ref	Date/time	Casing depth
i	9.9/1520	0.60m
ii		
iii	9.9/1530	0.60m
iv		

ı GR5W/108

May Gurney May Gurney (Technical Services) Limited — JOB No. 44569

LOCATION: PROPOSED PUMPING STATION, OFF THE STREET, HONNINGHAM, NORFOLK

COMMENCED: 4.3.88 COMPLETED: 4.3.88 DIAMETER: 150mm BOREHOLE No. 1

GROUNDWATER: (see notes below) Struck i 3.75 ii .... Standing iii 2.70 iv .... (m, depth)

DESCRIPTION	LEGEND	DEPTH (m)	REDUCED LEVEL	SAMPLE/TEST	DEPTH (m)	REMARKS
GROUND LEVEL		0.00	* mAOD 25.25	J1	0.00	* Relative to an assumed datum shown on site plans
MADEGROUND - Dark brown peaty topsoil with abundant rootlets becoming brown silty clay with abundant coke and chalk fragments				B1	0.00-0.70	
				CPT	0.70	N = 7
				J2	0.70	
				B2	0.70-1.50	
SOFT orange to brown silty sandy CLAY		1.60	24.65	CPT	1.50	N = 5
				J3	1.50	
SOFT grey to dark brown clayey sandy SILT with shell fragments and pockets of black amorphous peat		2.00	23.25	B3	1.50-2.20	
				CPT	2.20	N = 2
				J4	2.20	
				B4	2.20-3.00	
LOOSE dark brown peaty silty medium SAND		3.00	22.25	CPT	3.00	N = 8
				J5	3.00	
Dark brown silty medium SAND with abundant medium gravel.				B5	3.00-4.50	
DENSE medium flint GRAVEL with grey coarse sand.		4.10	21.15			
				CPT	4.50	N = 40
				J6	4.50	
...becoming fine to coarse				B6	4.50-5.20	
				B7	5.20-7.70	
DENSE grey silty fine to medium SAND		5.70	19.55	U1	5.70	50 blows for 400 mm
STIFF grey very sandy CLAY with bands of fine to medium sand.		7.70	17.55	CPT	7.70	N = 43
END OF BOREHOLE		8.20	17.05			

J = Jar disturbed sample		SPT = Standard Penetration Test	
B = Bulk disturbed sample		CPT = Cone Penetration Test	
U = 100mm dia. undisturbed sample		N = No. blows per 300mm penetration	
P = 100mm dia. piston sample		FHT = Falling Head Test (results elsewhere)	
W = Water sample		V = Vane test	

GROUNDWATER NOTES

Date/time	Casing depth

TG 11 SW 11 1253 1445

Gravel Pit Plantation, Ringland

Surface level (+33.8 m) +111 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (0.3 m) 1 ft
Mineral (14.3 m) 47 ft
Waste (3.4 m) 11 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil.	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	Pebbly sand. Gravel concentrated in upper 18 ft (5.5 m), absent from 19 to 34 ft (5.8 to 10.4 m). Clayey in lower 8 ft (2.4 m). Gravel: fine to coarse, subangular, mainly flint. Sand: medium with fine and traces of coarse, subangular; light brown.	(14.3)	47	(14.6)	48
Boulder Clay	Grey chalky clay.	(3.4)	11	(18.0)	59
Upper Chalk	Chalk.	(0.9+)	3+	(18.9)	62

	%	mm	%
		+64	0
Gravel	14	-64+16	8
		-16+4	6
		-4+1	12
Sand	79	$-1+\frac{1}{4}$	42
		$-\frac{1}{4}+1/16$	25
Fines	7	-1/16	7

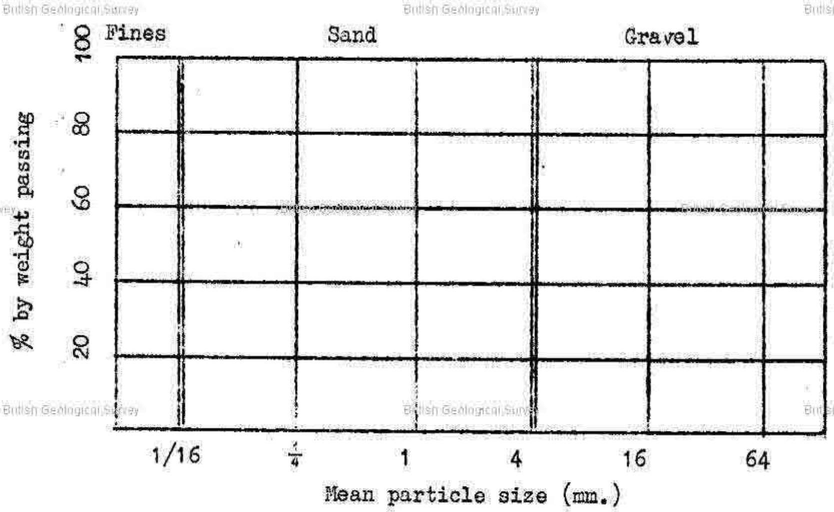
Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	0	88	12
4 - 7	0	98	2
7 - 10	4	60	36
10 - 13	3	26	71
13 - 16	5	43	52
16 - 19	8	79	13
19 - 22	2	98	0
22 - 25	0	100	0
25 - 28	0	100	0
28 - 31	1	99	0
31 - 34	0	100	0
34 - 37	1	96	3
37 - 40	5	83	12
40 - 43	32	63	5
43 - 46	26	64	10
46 - 48	22	72	6

Institute of Geological Sciences	Borehole Reg. No.: TG 11 SW/11
Mineral Assessment Unit	Temporary designation:
Sand and Gravel Survey	Nat. Grid Ref.: 1253 1445
BOREHOLE RECORD SHEET	Locality: Gravel Pit Plantn. Ringland
	Date: 30-10-69
	Recorded by: A.R. Clayton.

Drilled by: Fitzpatrick	Horizon	Thickn. m	Thickn. ft.	Nature
Drill Type: Wirth B1	Overburden		1	Soil.
Hole diameter: 8"	Mineral		47	Sand and Gravel.
Ground level (O.D.): c120.	Baserock		14	Clay and Chalk.
Water struck at (O.D.): Dry				

Remarks

Grading Curve (from Sampling Analysis Sheet)	Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil.	1	1	-
Clayey med.-co. sand & fine-med. gravel. Sand Med. & co. SA-A (flint) w. brown clay. Gravel Fine w. granule & med. SA-A flint w. co. SA-A flint tr. chalk & occ. SA-SR fine qtz. LPS 35.	16	15	N932-936
Med. sand w. co. & med. gravel. Sand Med. SA light brown occ. tr. clay. Gravel Co. w. med. & tr. fine SA flint w. tr. SA flint cobbles LPS 80.	19	3	N937
Med. sand w. co. & med. gravel. Sand) Gravel) AS N937 but no cobbles.	25	6	N938-939
Med. sand w. co. & med. gravel. Sand) Gravel) AS N937 LPS 150.	28	3	N940
			→

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.
Med. sand w./tr. med.-co. gravel. Sand Med. SA tr. co. SA brown. Gravel Fine & med. w. co. SA & A flints occ. SA flint cobbles LPS 70.	40	12	N941-944
Med. sand w. med. gravel. Sand med. w. tr. co. SA (occ. chalk) tr. brown chalky clay. Gravel Med. & fine w. co. SA flint tr. med. & fine chalk.	48	8	N945-947
Grey chalky boulder clay.	59	11	-
Chalk	62	3	-

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 7 at Morston Estate.
For Mr. J.V. Berney.
TG11SW/112
O/No. 2374 **Boring Completed on** 12.11.62. **O.D. Level** 1220 1427
Boring lined to a Depth of 17'6" **Diameter** 7¼"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Sand & stones.	5	0	5	0				
Sand & gravel.	7	6	12	6				
Mottled clay.	1	0	13	6			Nil.	
Sand.	4	0	17	6				
TOTAL DEPTH			17	6				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

2 Bulk samples taken.

Disturbed Jar Samples Taken at – 2', 7', 12', 17'6".

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From To Blows

From To Blows

From To Blows

Boring Foreman's Remarks

Signed J. Thndyll
For LE GRAND ADSCO LIMITED

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 9 **at** Morston Estate.

For Mr. J.V. Berney. TG11SW/113

O/No. 2374 Boring Completed on 13.11.62. O.D. Level ~~1248~~ 1444

Boring lined to a Depth of 11'0" Diameter 7¼"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Top soil.	-	9	-	9				
Sand & gravel.	3	9	4	6				
Clay & boulders.	2	0	6	6				
Loamy sand.	1	0	7	6			Nil.	
Sandy clay & stones.	3	6	11	0				
TOTAL DEPTH			11	0				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

Disturbed Jar Samples Taken at - 3', 5'6", 7', 11'.

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From To Blows

From To Blows

From To Blows

Boring Foreman's Remarks

Signed L. Thodge

For LE GRAND ADSCO LIMITED

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 5 **at** Morton Estate.

TG11SW/114

For Mr. J.V. Berney.

O/No. 2374 **Boring Completed on** 2.11.62. **O.D. Level** 1271 1330

Boring lined to a Depth of 23'0" **Diameter** 7¼"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Loamy sand.	5	0	5	0	1.11.62.		12'0"	
Brown clay.	2	3	7	3				
Sand & gravel.	10	0	17	3				
Loamy sand.	4	9	22	0				
Chalk.	5	0	27	0				
TOTAL DEPTH			27	0				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

Disturbed Jar Samples Taken at - 3', 6'6", 7'6", 12'6", 18', 27'.

Two bulk samples taken.

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From	To	Blows
From	To	Blows
From	To	Blows

Boring Foreman's Remarks

Signed [signature]
For LE GRAND ADSCO LIMITED

LE GRAND ADSCO LIMITED

RECORD OF TEST BORING No. 6 **at** Morston Estate.

For Mr. J.V. Berney.

TG11SW/115
1282 1327

O/No. 2374 **Boring Completed on** 7.11.62. **O.D. Level**

Boring lined to a Depth of 15'0" **Diameter** 7¼"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Sand & stones.	2	0	2	0				
Sand.	14	0	16	0				
TOTAL DEPTH			16	0				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

Disturbed Jar Samples Taken at – 1', 6', 11', 16'.

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From	To	Blows
From	To	Blows
From	To	Blows

Boring Foreman's Remarks

Signed J. Tandy
For LE GRAND ADSCO LIMITED

LE GRAND ADSCO LIMITED

TQ11SW/117
1278 1311

RECORD OF TEST BORING No. 4 at Morkton Estate.
For Mr. J.V. Berney.

O/No. 2374 Boring Completed on 5.11.62. O.D. Level
Boring lined to a Depth of 28'0" Diameter 7¼"

BORING FOREMAN'S STRATA RECORD	THICKNESS Ft	THICKNESS Ins	DEPTH Ft	DEPTH Ins	WATER OBSERVATIONS Date	Time	W.S.	SWL
Sand & stones.	2	0	2	0				
Sand.	26	0	28	0			Nil.	
TOTAL DEPTH			28	0				

SAMPLING DETAILS

Lab Location No.

Undisturbed Core Samples Taken at

Disturbed Jar Samples Taken at – 1', 6', 11', 16', 21', 26'.

Water Samples Taken ~~YES~~/NO

Standard Penetration Tests Carried Out

From To Blows
From To Blows
From To Blows

Boring Foreman's Remarks

Signed S. Tbudd
For LE GRAND ADSCO LIMITED

S.I.C. TG 11 SW (118)

150mm diameter light cable percussion BOREHOLE RECORD

S.I.C.(East Anglia) Limited

Location	O.S. reference	Job No.	Date	
HONINGHAM Proposed Antenna Mast	TG 1007 1215	7392	21.10.98	BH 1 Sheet 1 of 1

DESCRIPTIVE Soil Classification	Depth	Legend	Water	In situ tests & samples	Reduced level AOD	INTERPRETATIVE Soil Parameters
START						
TOPSOIL: Dark brown leaf mould	0.0				+40.1	TOPSOIL
Firm brown very sandy silty CLAY with much flint gravel	0.2			D1 (0.3) CPT (0.7) N = 34 D2 (0.7)	+39.9	GLACIAL SANDY CLAY c - φ soil
Stiff to very stiff brown and orange-brown very sandy silty CLAY with much fine-coarse angular-subrounded flint gravel and some zones of clayey sand	0.9			VT (1.4) c = 158kN/m² CPT (1.5) N = 30 D3 (1.5) VT (2.1) c = 150kN/m² CPT (2.2) N = 39 D4 (2.2) VT (2.8) c = 160kN/m² CPT (3.0) N = 39 D5 (3.0) CPT (3.7) N = 38 CPT (4.5) N = 37 D6 (4.5) CPT (6.0) N = 40 D7 (6.0) CPT (7.5) N = 37 D8 (7.5) CPT (9.0) N = 38 D9 (9.0) D10 (10.0) CPT (10.0) N = 40	+39.2	GLACIAL TILL CL soil c = 140-180kN/m² c = 180-200kN/m²
END	10.0				+30.1	

REMARKS

Gas Tests at 1.5m:		
	Pressure	998mb
	Oxygen	20.7%
	Carbon Dioxide	<0.1%
	Methane	<0.1%

WATER OBSERVATIONS

Date/time	Water level	Casing depth
21.10.98/1200	DRY	pulled

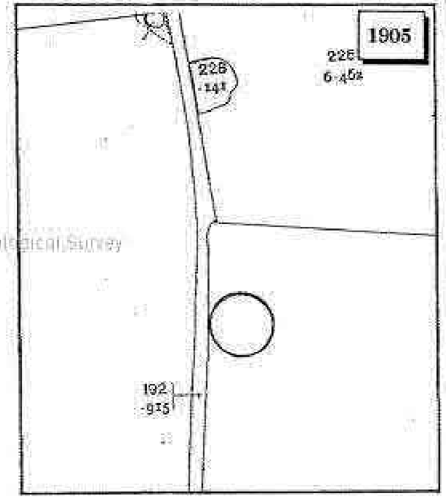
KEY (units: blows, m, kN/m²)

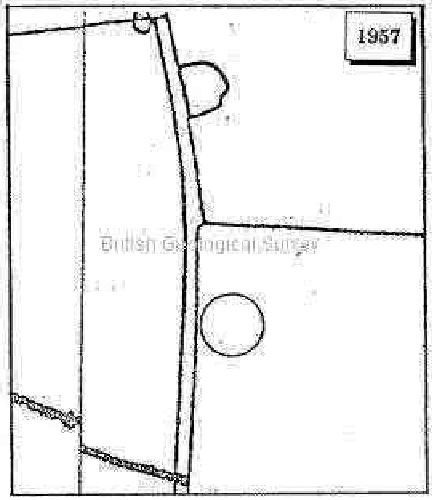
D	Disturbed sample
B	Bulk sample
U	Undisturbed sample
W	Water sample
VT	Vane Test
SPT	Standard Penetration Test
CPT	Cone Penetration Test
N	N-Value (*blowing)
(M)	includes seating
c	Shear strength

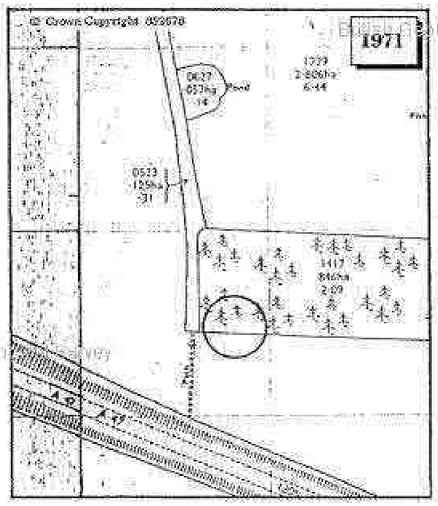
S.I.C. MAP EXTRACTS

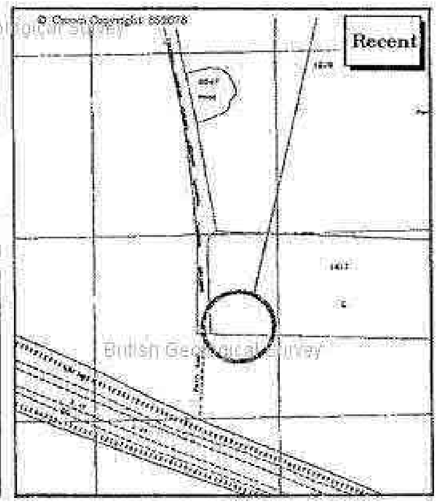
S.I.C.(East Anglia) Limited

Location	Job No.	Scale
HONINGHAM Proposed Antenna Mast	7392	









OD 156

(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA — If measurements start below ground surface, state how far ..	Thickness Feet	Thickness Inches	Depth Feet	Depth Inches	
Lowestoft Till	Clay + Stone	16		16		+ 140
Corton Beds	Sand + Shingle	15		31		+ 125
? Corton Beds + N. Bk	Sand	43		74		+ 82
Crag	Stone	19		93		+ 63
Crag	Pea Shingle	2		95		+ 61
uck	Chalk	41		136		

4.8.61

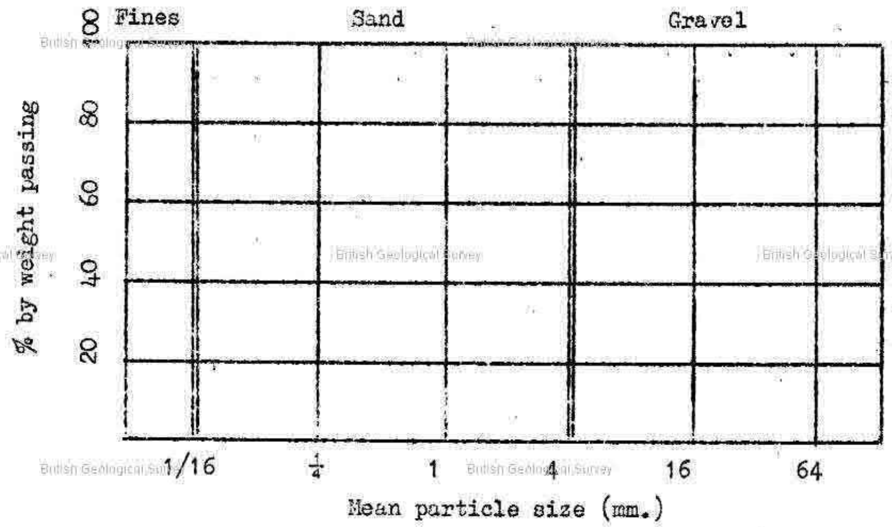
Ins[redacted]e of Geological Sciences
Mineral Assessment Unit
Sand and Gravel Survey
BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/12
Temporary designation:
Nat. Grid Ref.: 12431348
Locality: Blackbreck Plantation, Ringland.
Date: 31-10-69
Recorded by: A. R. Clayton.

	Horizon	Thickn. m	ft.	Nature
Drilled by: Fitzpatrick Drill Type: Wirth B1				
Hole diameter: 8"	Overburden		1	~~Sandm~~ Soil
Ground level (O.D.): 128	Mineral		51	Sand
Water struck at (O.D.): Dry	Baserock		9	Clay & Chalk

Remarks

Grading Curve (from Sampling Analysis Sheet)	Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	1	1	
Med. sand w. fine-med. gravel Sand Med. w. tr. co. SA light brown Gravel Fine &med. SA flint LPS 30	7	6	N969-970
Med. sand w. fine & med. gravel Sand Med. w.co. SA dark brown. Gravel Fine & med. SA irreg. flint w. co. SA occ. SR flint tr. fine SR qtz LPS 40	22	15	N971-975
Med. sand w. fine & med. gravel. Sand } Gravel } As N975 but light brown	25	3	N976
Med. sand w. fine & med. gravel. Sand. As N976 Gravel. As N976 but w. tr. SR irreg. flint cobbles LPS 80	31	6	N977-978

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.
Med. sand w. fine-med. gravel. Gravel. Fine and med. . SA irreg. flint w. SR qtz. LPS 45 Sand. Med. w. tr. co. SA lightbrown.	34 co. SA	3 flint &	N979 tr. fine
Med. sand w. fine-med. gravel. Sand. } Gravel. } As N980 but dark brown	37	3	N980
Med. sand w. fine-med. gravel &tr. cobbles. Sand. Med. w. tr. co. SA light brown. Gravel. Fine & med. SA irreg. flint w. co. &fine SRqtz. LPS 12o	52 &tr. co	15 bble SA	N981-985 flint
Grey Chalky Boulder Clay	58	6	-
Chalk	61	3	

TG 11 SW 12 1243 1348 Blackbeck Plantation, Ringland

Surface level (+39.0 m) +128 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (0.3 m) 1 ft
Mineral (15.6 m) 51 ft
Waste (1.8 m) 6 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil.	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	Pebbly sand. Gravel occasionally absent. Gravel: coarse with fine, subangular with traces of subrounded, mainly flint with traces of fine subrounded quartz, with occasional flint cobbles in parts. Sand: fine and medium with traces of coarse, subangular; light to dark brown.	(15.6)	51	(15.9)	52
Boulder Clay	Grey chalky clay.	(1.8)	6	(17.7)	58
Upper Chalk	Chalk.	(0.9+)	3+	(18.6)	61

	%	mm	%
		+64	0
Gravel	20	-64+16	13
		-16+4	7
		-4+1	5
Sand	78	$-1+\frac{1}{4}$	39
		$-\frac{1}{4}+1/16$	34
Fines	2	-1/16	2

Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	2	76	22
4 - 7	1	62	37
7 - 10	0	63	37
10 - 13	1	78	21
13 - 16	1	74	25
16 - 19	2	98	0
19 - 22	3	83	14
22 - 25	6	94	0
25 - 28	0	67	33
28 - 31	8	62	30
31 - 34	2	98	0
34 - 37	1	64	35
37 - 40	0	72	28
40 - 43	0	100	0
43 - 46	2	67	31
46 - 49	2	94	4
49 - 52	11	64	25

161/92 Breck Farm, Honingham

(a) (Disused). Surface +183. Shaft. Depth unknown. Date unknown.

R.W.L. +113. Aug. 1947. A TG 1128 1331 TG11/51

(b) Surface +180. Lining tubes: 168 x 4 in. Water struck at +50 and -20. R.W.L. +109½. ~~R.W.L. +109~~. Suction +90½. Yield 400 g.p.h. (8 h. test). I/c engine. Hewson, 1958. B TG 1125 1335

(b) Pleist. Drift	... ...	79	79
Boulder Clay	... ...	21	100
Sand and Gravel	... ...	32	132
UCk	... ...	83	215

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS	DEPTH
(A) ? PLEIST. DRIFT	SHAFT NO DETAILS KNOWN	70	70
(B) GLACIAL DRIFT: GLACIAL SAND + CLAY	SAND + CLAY RED SAND		
CHALKY BOULDER CLAY	DARK CLAY		
GLACIAL SAND + GRAVEL	DARK SAND + SHINGLE		
UPPER CHALK	CHALK FLINTS		

pp. F Cox.
1.1.69.

Version 2.0.6

BGS ID: 514796 : BGS Reference: TG11SW122
British National Grid (27700) : 611290,314570

Report an issue with this borehole

<< < Prev Page 2 of 7 Next > >>

TG 11 / 53

*147/417 Green Farm, Weston Longville

Surface +154. Lining tubes: 118 × 4 in from surface. Ck +72. R.W.L. +103.
Hewson, c. 1958. TG 1129 1457
Yield c. 1,000 g.p.w. I/c engine. *July 1960.*

Boulder Clay ...	...	42	42
? Sand and Gravel)	...	40	82
Crag)			
UCk ...	...	96	178

BOULDER CLAY.	STONES.	5	5
? SAND AND GRAVEL 42	BRICK EARTH	37	42
CRAG 40	SAND	40	82
U-CHALK. 96	CHALK.	96	180

1 147/144 **Bernard Matthews Ltd., Weston Green, Weston Longville** (formerly Air Ministry, Attlebridge) TG 1059 1451 TG11/134

Surface +167. Lining tubes: 133 × 6 in from surface. R.W.L. +123. Yield 2,200 g.p.h. Hardness: P. 170, T. 110. Anal. *Gosling, Sept. 1940.* P.W.L. +124¼. *July 1960;* +67. Yield 3,000 g.p.h. *Oct. 1962.* P.W.L. +69. Yield 3,850 g.p.h. *Oct. 1964;* 3,000 g.p.h. (test). *Feb. 1965.*

Sand and Gravel...	...	56	56
Boulder Clay ...	...	28	84
? Crag ...	...	11	95
UCk ...	...	135	230

SAND AND GRAVEL 56'	TOP SOIL	2	2
	SAND	54	56
BOULDER CLAY 28'	SAND AND CLAY	28	84
	FLINTS	2	86
? CRAG 11'	CHALK	2	88
	SAND AND BALLAST	7	95
~~U. CHALK~~ U. CHALK 135'	CHALK.	135	230

SEE ADD. INFORMATION SHEET.

Version 2.0.6

BGS ID: 514801 : BGS Reference: TG11SW127
British National Grid (27700) : 610590,314510

3.

RECORD OF WELL (SHAFT OR BORE)

TG11/134

147

144

At RAF Station

Town or Village Attlebridge

County ______ Six-inch quarter sheet ______

For Mr. (Richard Costain Ltd)

Exact site of well ______

Level of ground surface above sea-level (O.D.) + 154 feet.

Is well-top at ground level? ______ If not, state how far above/below ______ feet.

Shaft ______ ft., diameter ______ ft. Details of headings ______

Bore 230 ft.; diameter of bore: at top 6 ins.; at bottom ______ ins.

Lengths, diameters, perforations, etc., of lining tubes 133' × 6"

Water struck at depths, below well-top, of (feet) ______

TEST DETAILS
Month ______
Year ______

Rest-level of water 44 ft. ~~above~~ below well-top. Suction at ______ ft. Yield on ______ hours'/days' pumping ______ gallons per ______ (max. capacity of pump ______ g.p.h.), with depression of ______ feet. Recovery to ______ in ______ mins./hours.

WORKING CONDITIONS

Rest-level of water in ______ (month), ______ (year), ______ ft. above/below well-top.

Highest " in ______ (month), ______ (year), ______ ft. above/below "

Lowest " in ______ (month), ______ (year), ______ ft. above/below "

Suction at ______ ft. Rate of pumping ______ galls. per ______ for ______ hours per day.

with average depression of ______ ft. Recovery to ______ in ______ mins./hours

Quality of water (*attach copy of analysis if available*) ______

Well made by J.J. Gosling, Ipswich Date of well c 1940

Information from Do per AWW

ADDITIONAL NOTES.

LOG OF STRATA OVERLEAF.

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

Date received.	G.S.M. Office File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol) on 1" Map.	on 6" Map.
MAR 1941					

(17208) Wt.42901/0377 10,000 2/41 A.& E.W.Ltd. Gp.686

4.

OD 167

(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far... ...	THICKNESS Feet ...	Inches ...	DEPTH Feet	Inches	
Sand & Gravel 56	Top soil	2		2		+165
	Sand	54		56		+111
Boulder Clay 28	" & clay	28		84		+83
	Flints	2		86		+81
? Crag 11	Chalk	2		88		+79
	Sand Ballast	7		95		+72
UCk 135	Chalk	135		230		

RA 1965 . 61.

BGS ID: 514801 : BGS Reference: TG11SW127
British National Grid (27700) : 610590,314510

Report an issue with this borehole

<< < Prev Page 10 of 10 Next > >>

9 161/244 c.300 yd N. of Fransgreen Farm, East Tuddenham (formerly ~~Air~~ Ministry of Defence). (Sealed)

1X TG11/134

Surface +177¼. Lining tubes: 34½ x 21 in from 2 down; 179 x 15 in from 3 down. Water struck at +137¼, +17¼ and -52¾. R.W.L. +128¼. P.W.L. +43¼. Recovered to +128¼ in a few min. Yield 4,290 g.p.h. (6 d. test). Air lift.

Hardness: P. 25, T. 265. Anal. LeGrand, Dec. 1942.

Boulder Clay	... ...	20	20
Sand and Gravel	... ...	43	63
Boulder Clay	... ...	37	100
UCk	... ...	250	350

Boulder clay 20'	Top Soil	1	1
	Brown Sandy Clay + Stones	19	20
Sand + Gravel 43'	Sandy Gravel	20	40
	Blowing sand	23	63
Boulder clay 37'	Boulder clay	37	100
Upper chalk 250'	Chalk + Flints	250	350

pp. P.N. Hildreth
29.5.69

161/92 Breck Farm, Honingham

(a) (Disused). Surface +183. Shaft. Depth unknown. Date unknown.
R.W.L. +113. Aug. 1947. A TG 1128 1331 TG11/51

(b) Surface +180. Lining tubes: 168 x 4 in. Water struck at +50 and -20. R.W.L. +109½. ~~R.W.L. +109~~. Suction +90½. Yield 400 g.p.h. (8 h. test). I/c engine. Hewson, 1958. B TG 1125 1335

(b)	Pleist. Drift	... ...	79	79
	Boulder Clay	... ...	21	100
	Sand and Gravel	... ...	32	132
	UCk	... ...	83	215

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS	DEPTH
(A) ? PLEIST. DRIFT	SHAFT NO DETAILS KNOWN	70	70
(B) GLACIAL DRIFT: GLACIAL SAND + CLAY	SAND + CLAY RED SAND		
CHALKY BOULDER CLAY	DARK CLAY		
GLACIAL SAND + GRAVEL	DARK SAND + SHINGLE		
UPPER CHALK	CHALK FLINTS		

pp. F Cox.
1.1.69.

TG 11 SW 13 1234 1271 **Ringland Clump, Ringland**

Surface level (+52.8 m) +173 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (0.3 m) 1 ft
Mineral (21.9 m) 72 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil.	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	Sand. Gravel almost absent. Gravel: coarse, with fine, mainly subangular flint with fine subrounded quartz. Sand: fine and medium, subangular, with traces of coarse chalk in the upper half of the deposit; light brown to orange.	(21.9)	72	(22.2)	73
Upper Chalk	Chalk.	(0.9+)	3+	(23.1)	76

	%	mm		%
		+64	:	0
Gravel	3	-64+16	:	2
		-16+4	:	1
		-4+1	:	2
Sand	94	$-1+\frac{1}{4}$	:	42
		$-\frac{1}{4}+1/16$	:	50
Fines	3	-1/16	:	3

Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	1	99	0
4 - 7	3	97	0
7 - 10	5	95	0
10 - 13	4	96	0
13 - 16	3	97	0
16 - 19	1	99	0
19 - 22	4	96	0
22 - 25	0	100	0
25 - 28	14	86	0
28 - 31	2	98	0
31 - 34	3	97	0
34 - 37	3	61	36
37 - 40	2	98	0
40 - 43	1	99	0
43 - 46	7	73	20
46 - 49	9	91	0
49 - 52	3	97	0
52 - 55	0	100	0
55 - 58	2	98	0
58 - 61	2	98	0
61 - 64	9	91	0
64 - 67	1	99	0
67 - 70	2	98	0
70 - 73	0	86	14

Institute of Geological Sciences

Mineral Assessment Unit

Sand and Gravel Survey

BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/13

Temporary designation:

Nat. Grid Ref.: 1234 1276.

Locality: Ringland Clump, Ringland.

Date: 23-10-69.

Recorded by: A.L. Clayton.

Drilled by: Fitzpatrick

Drill Type: Wirth B1

Hole diameter: 8"

Ground level (O.D.): c160

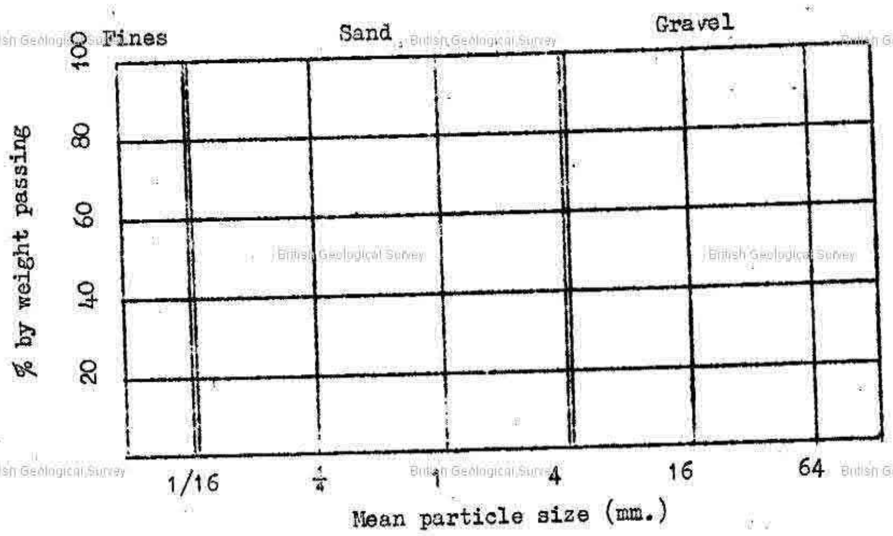
Water struck at (O.D.): —

Horizon	Thickn. m	Thickn. ft.	Nature
Overburden		1	Soil
Mineral		72	Sand
Baserock		3	Chalk

Remarks

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	1	1	-
Med. & fine sand occ. fine gravel Sand Med. & fine SA light brown Gravel fine SA flint occ. fine SR qtz	10	9	N857-859
Med. & fine sand Sand Med. & fine SA light brown-cream	22	12	N860-863
Med. w. co. sand tr. fine gravel Sand Med. & fine w. co. (chalk) SA brown Gravel fine SA flint w. fine SR qtz occ. med. SA flint tr. chalk	31	9	N864-866
Med. w. co. sand tr. fine gravel Sand Med. w. co. (chalk) SA light brown Gravel fine-med. SA flint w. chalk & granule of SA-SR flint occ. fine SR qtz	37	6	N867-868
			→

[50]

TG 11 SW 13 1234 1271 Ringland Clump, Ringland

Surface level (+52.8 m) +173 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (0.3 m) 1 ft
Mineral (21.9 m) 72 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil.	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	Sand. Gravel almost absent. Gravel: coarse, with fine, mainly subangular flint with fine subrounded quartz. Sand: fine and medium, subangular, with traces of coarse chalk in the upper half of the deposit; light brown to orange.	(21.9)	72	(22.2)	73
Upper Chalk	Chalk.	(0.9+)	3+	(23.1)	76

	%	mm	%
		+64	0
Gravel	3	-64+16	2
		-16+4	1
		-4+1	2
Sand	94	$-1+\frac{1}{4}$	42
		$-\frac{1}{4}+1/16$	50
Fines	3	-1/16	3

Depth below surface (ft)	Fines	Sand	Gravel
1 - 4	1	99	0
4 - 7	3	97	0
7 - 10	5	95	0
10 - 13	4	96	0
13 - 16	3	97	0
16 - 19	1	99	0
19 - 22	4	96	0
22 - 25	0	100	0
25 - 28	14	86	0
28 - 31	2	98	0
31 - 34	3	97	0
34 - 37	3	61	36
37 - 40	2	98	0
40 - 43	1	99	0
43 - 46	7	73	20
46 - 49	9	91	0
49 - 52	3	97	0
52 - 55	0	100	0
55 - 58	2	98	0
58 - 61	2	98	0
61 - 64	9	91	0
64 - 67	1	99	0
67 - 70	2	98	0
70 - 73	0	86	14

For Institute use only Licence No. E7/34/11/9/425
N. 14778

TG11/73

161/701

RECORD OF WELL

EXACT SITE OF WELL

At Manor Farm

Town or Village Ringland, Nr Norwich

County Norfolk

Six-inch County Sheet -- 161/701

Six-inch National Grid sheet and reference NGR TG 1332 1435 SW.

For Messrs. Ringland Thorogood Farming Partnership

State whether owner, tenant, builder, contractor, consultant, etc.:— Owner

Address (if different from above) --

-- --

Level of ground surface above sea level (O.D.) Not Known ?+c.60 ft (-- m)

*DELETE AS NECESSARY

If well top is not at ground level, state how far above:* below: -- ft (-- m)

SHAFT -- ft (-- m); diameter -- ft (-- m);

HEADINGS (please attach details—dimensions and directions)

BORE -- ft (80 m); diameter: at top -- in (48 cm); at bottom -- in (48 cm)

Full details of permanent lining tubes (position, length, diameter, plain, slotted, etc.)

508 mm O.D. x 12.5 mm W.T. Plain steel lining tube installed to 16 m B.G.L. the top being left at ground level and fitted with flange.

Water struck at depths of NOT KNOWN ft (-- m) below well top

TEST CONDITIONS

Rest level of water -- ft (7.42 m) ~~above~~* below well top. Suction at -- ft (40 m)

Yield on 58 hours* ~~days~~ test pumping at 36,000 galls (-- m³) per Hour with depression to -- ft (12.25 m) below well top. Recovery to rest level in 7.58 m B.G.L. 10 ~~mins~~* hours

Capacity of pump 36,000 g.p.h. (-- m³/h)

Date of measurements 13th to 18th June 1980.

NORMAL CONDITIONS

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type -- Motive power --

Capacity -- galls (-- m³) per hour. Suction at -- ft (-- m) below well top. Amount pumped -- galls (-- m³) per day. Estimated consumption -- galls (-- m³) per week

Well made by F. Smith & Son (Grimsby) Ltd., Date of sinking May/June 1980.

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

LOG OF STRATA

Received from

Date

OVERLEAF

INSTITUTE OF GEOLOGICAL SCIENCES,
WATER DEPARTMENT,
SOUTH KENSINGTON,
LONDON, S.W.7.

Observation well ....
Recorder..
E.R. log ....
Site marked on
1" map ....⊙..........................
6" map ....⊙..........................
(use symbol)
Copy to ....
....
Date ....

161/706 SQ 6271

TG11/73

F. Smith & Son (Grimsby) Ltd.

Record of 500 mm nominal diameter x 80 metres deep borehole drilled for Messrs. Ringland Thorogood Farming Partnership, Manor Farm, Ringland, Near Norwich - N.G.R. TG 134 144 - Borehole No. 2.

	Strata	Thickness M.	Depth M.
	Top soil	0.50	0.50
GLACIAL SAND & GRAVEL	Sand and gravel	6.50	7.00
UPPER CHALK	Firm chalk	8.00	15.00
	Firm hard chalk with flints	35.00	50.00
	Hard chalk with soft bands and flints	30.00	80.00

Water Level

7.42 m B.G.L. Reading taken 13th June, 1980.

PR T.E LAWSON 29.7.80.

Lining Tube (Permanent)

508 mm O.D. x 12.5 mm W.T. plain steel lining tube installed to a depth of 16 m B.G.L.. The top of lining tube left at ground level and fitted with a flange.

Grouting

The lining tube was set in a grout plug and the annular space between the borehole wall and the lining tube filled with cement grout by means of upward displacement.

Pumping Test

The borehole was step-tested on the 13th June, 1980 and pumped continuously for hours, commencing on the 16th June, 1980, at the rate of approximately 36,000 G.P.H. from a pumping level of 13.25 M. B.G.L.. See separate report.

Date

Commenced - 7th May, 1980.

Completed - 18th June, 1980.

Rig

60 R.L. Cable Percussion

Driller

C. Billings

TG 11 SW 14 1267 1112

Dereham Road, Easton

Surface level (+29.0 m) +95 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Waste (18.3 m+) 60 ft+

		Thickness (m)	ft	Depth (m)	ft
Boulder Clay	Soil and brown chalky clay.	(11.3)	37	(11.3)	37
	Grey chalky clay.	(7.0+)	23+	(18.3)	60

Institute of Geological Sciences

Mineral Assessment Unit

Sand and Gravel Survey

BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/14
Temporary designation:
Nat. Grid Ref.: 1267 1112
Locality: Dereham Road, Easton.
Date: 20-10-69
Recorded by: A.R. Clayton.

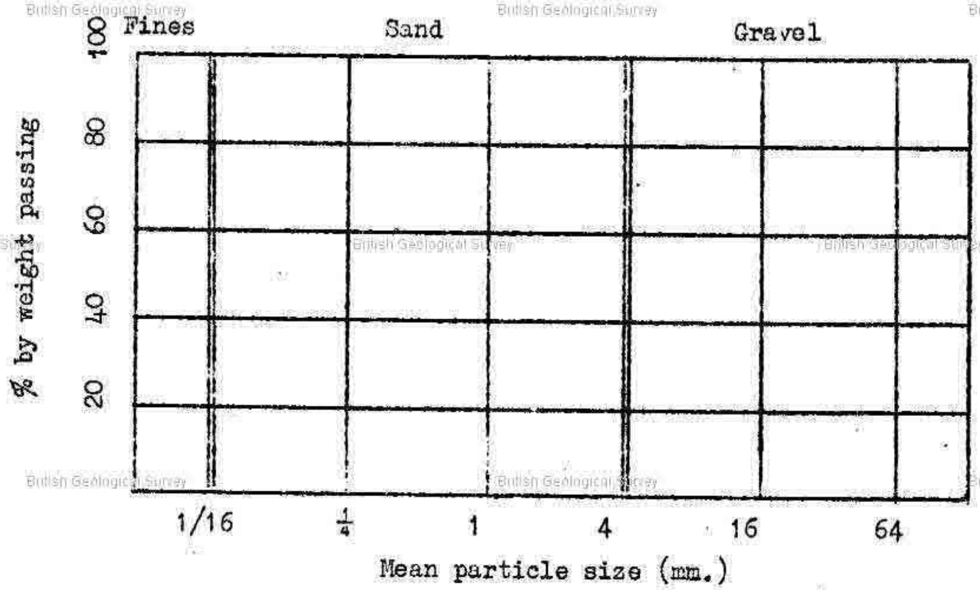
Drilled by: Fitzpatrick
Drill Type: Wirth B1
Hole diameter: 8"
Ground level (O.D.): c 95.
Water struck at (O.D.): ←

Horizon	Thickn. m	Thickn. ft.	Nature
Overburden		60 NP	Boulder clays
Mineral			
Baserock			

Remarks

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	2	2	-
Brown chalky boulder clay	37	35	-
Grey chalky boulder clay	60 NP	23 NP	-

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Site	Number
A47 HONINGHAM EXPRESS LANE	WS05

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		36.18	HIGHWAYS AGENCY	26588
	Location	**Dates**	**Engineer**	**Sheet**
	611228.522 E 311249.946 N	26/03/2012	ATKINS	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records
0.50	B1		
0.50	D2		
1.00	B3		
1.20-1.65	SPT N=20	Dry	4.4/7.5.4.4
1.20	D5		
1.20-1.65	D4		
1.70	D6		
2.00-2.45	SPT N=37	Dry	3.7/8.8.10.11
2.00	D9		
2.00-2.45	D7		
2.00-3.00	X8		
2.50	D10		
3.00-3.33	SPT 50/180	Dry	7.15/14.23.13
3.00	D13		
3.00-3.33	D11		
3.00-3.50	X12		
3.50	D15		
3.50-3.80	X14		
3.80-3.99	SPT 25*/95 50/90	Dry	12.13/38.12
3.80-3.99	D16		26/03/2012:DRY
			26/03/2012:

Level (mOD)	Depth (m) (Thickness)	Description
36.08	0.10	Brown slightly gravelly sandy SILT with frequent roots (10-20mm diam) and rootlets. Gravel is subangular to subrounded fine to coarse flint.
	(0.80)	Orangish brown silty gravelly SAND with occasional cobbles. Gravel is rounded to subangular fine to coarse flint.
35.28	0.90	
	(0.80)	Medium dense light orangish brown sandy angular and subangular fine to coarse flint and subangular and subrounded fine and medium chalk GRAVEL.
34.48	1.70	
	(0.15)	Stiff brown slightly sandy CLAY with frequent orangish brown silt partings.
34.33	1.85	
	(0.75)	Dense yellowish brown very silty fine and medium SAND.
33.58	2.60	
	(0.30)	Yellowish brown slightly silty sandy angular and subangular fine to coarse flint and chalk GRAVEL.
33.28	2.90	Orangish brown slightly silty fine and medium SAND.
33.18	3.00	
	(0.20)	
32.98	3.20	
	(0.30)	Very dense orangish brown slightly silty gravelly fine and medium SAND. Gravel is angular and subangular fine to coarse flint and chalk.
32.68	3.50	
	(0.49)	Very dense yellowish brown slightly silty fine and medium SAND.
32.19	3.99	Very desne yellowish brown slightly silty slightly gravelly fine and medium SAND. Gravel is angular and subangular fine to coarse flint and chalk.

Complete at 3.99m

Remarks	Scale (approx)	Logged By
	1:50	ED
	Figure No.	

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

			Site A47 HONINGHAM EXPRESS LANE	**Number** **WS06**
Excavation Method Drive-in Window Sampler	**Dimensions**	**Ground Level (mOD)** 34.17	**Client** HIGHWAYS AGENCY	**Job Number** 26588
	Location 611254.891 E 311239.523 N	**Dates** 26/03/2012	**Engineer** ATKINS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
				34.07	0.10	Brown slightly gravelly sandy SILT with frequent roots (10-20mm diam) and rootlets. Gravel is subangular to subrounded fine to coarse flint.
0.30	D1					
0.50	B2				(0.90)	Orangish brown slightly gravelly sandy SILT with occasional cobbles. Gravel is rounded to subangular fine to coarse flint.
1.00	B3			33.17	1.00	Stiff orangish brown slightly sandy CLAY.
1.20-1.65	SPT N=28	Dry	5,6/6,8,8,6		(0.60)	
1.20	D5					
1.20-1.65	D4			32.57	1.60	Stiff yellowish brown slightly gravelly sandy CLAY. Gravel is suabngular and subrounded fine and medium chalk.
1.30	D6					
2.00-2.45	SPT N=26	Dry	2,3/5,7,7,7			
2.00	D8					
2.00	D9					
2.00-2.40	D7					
2.50	D10				(2.00)	
3.00-3.41	SPT 50/255	Dry	12,11/15,12,13,10			
3.00	D12					
3.00	D13					
3.00-3.41	D11					
3.50	D14			30.57	3.60	Very dense orangish brown slightly silty sandy rounded to subangular fine to coarse flint GRAVEL with occasional cobbles.
4.00-4.40	SPT 25*/125 50/275	Dry	14,11/14,12,12,12		(0.80)	
4.00	D15					
4.00-4.40	D16		26/03/2012:DRY	29.77	4.40	Complete at 4.40m
			26/03/2012: 26/03/2012:			

Remarks
EQUIPMENT: Geotechnical Terrier 2000 rig. METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (98mm) 1.20-3.00m, (84mm) 3.00-4.00m. CASING: None used. BACKFILL: On completion, hole backfilled with bentonite pellets and arisings.

Scale (approx)	Logged By
1:50	ED

Figure No.

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Site	Trial Pit Number
A47 HONINGHAM EXPRESS LANE	TP06

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit		33.97	HIGHWAYS AGENCY	26588
	Location	**Dates**	**Engineer**	**Sheet**
	611252.693 E 311234.711 N	26/03/2012	ATKINS	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				33.87	(0.10) 0.10	Brown slightly gravelly sandy SILT with frequent roots (10-20mm diam) and rootlets. Gravel is subangular and subrounded fine to coarse flint.		
0.50	B1				(0.80)	Orangish brown silty very sandy rounded to subangular fine to coarse flint GRAVEL with occasional cobbles.		
0.50	D2							
1.00	B3			33.07	0.90 (0.30)	Light orangish brown sandy angular and subangular fine to coarse flint and subangular and subrounded fine and medium chalk GRAVEL.		
1.20	D4		Dry	32.77	1.20	Complete at 1.20m		

Plan

Remarks

Trial pit excavated by hand. Groundwater was not encountered. Trial pit sides remained stable. On completion, the trial pit was backfilled with arisings.

Scale (approx)	Logged By	Figure No.
1:25	ED	

TG 11 SW 16 1350 1467 Royal Hill, Ringland

Surface level (+36.2 m) +119 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (0.3 m) 1 ft
Mineral (11.9 m) 39 ft
Waste (5.5 m) 18 ft
Mineral (1.8 m) 6 ft
Bedrock (0.9 m+) 3 ft+

			Thickness (m)	Thickness ft	Depth (m)	Depth ft
		Soil	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	(a)	Pebbly sand. Gravel mainly in upper 9 ft (2.7 m). Gravel: coarse with fine, subangular flint. Sand: fine with medium and traces of coarse, subangular; light brown.	(11.9)	39	(12.2)	40
Boulder Clay		'Very clayey' sand. Traces of gravel, light brown clay and hard chalk.	(5.5)	18	(17.7)	58
Glacial Sand and Gravel	(b)	'Very clayey' pebbly sand. Gravel: fine with coarse, subangular to subrounded flint. Sand: fine and medium, subangular, with light brown and grey clay; light grey.	(1.8)	6	(19.5)	64
Upper Chalk		Chalk.	(0.9+)	3+	(20.4)	67

		%	mm	%
(a)	Gravel	16	+64	0
			-64+16	11
			-16+4	5
	Sand	82	-4+1	9
			$-1+\frac{1}{4}$	29
			$-\frac{1}{4}+1/16$	44
	Fines	2	-1/16	2
(b)	Gravel	5	+64	0
			-64+16	1
			-16+4	4
	Sand	70	-4+1	2
			$-1+\frac{1}{4}$	16
			$-\frac{1}{4}+1/16$	52
	Fines	25	-1/16	25

Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	0	38	62
4 - 7	0	62	38
7 - 10	0	32	68
10 - 13	1	99	0
13 - 16	1	99	0
16 - 19	1	99	0
19 - 22	7	93	0
22 - 25	9	91	0
25 - 28	3	82	15
28 - 31	2	98	0
31 - 34	0	100	0
34 - 37	1	71	28
37 - 40	1	99	0
58 - 61	29	66	5
61 - 64	20	74	6

[illegible]tute of Geological Sciences

[illegible]neral Assessment Unit

Sand and Gravel Survey

BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/16
Temporary designation:
Nat. Grid Ref.: 135/11468 7
Locality: Royal Hill, Ringland
Date: 30-10-69
Recorded by: A. R. Clayton.

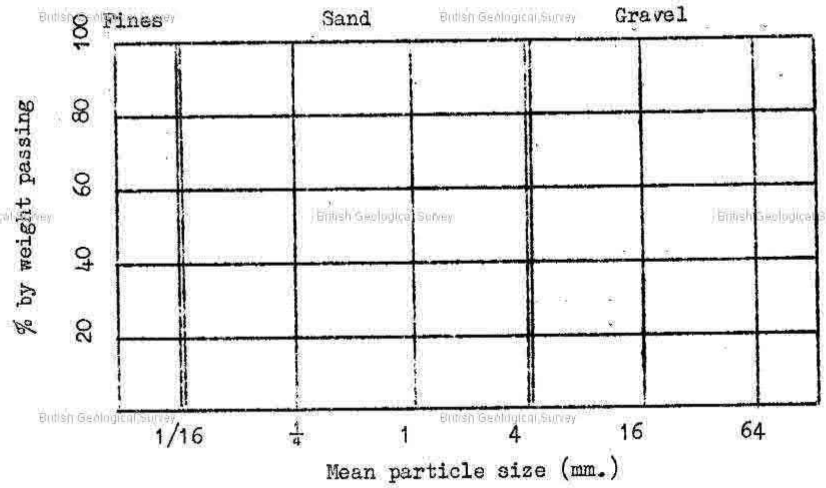
Drilled by: Fitzpatrick
Drill Type: Wirth B1
Hole diameter: 8"
Ground level (O.D.): 125
Water struck at (O.D.): Dry

Horizon	Thickn. m	Thickn. ft.	Nature
Overburden		1	Soil
Mineral	6.3	[illegible]	Sand & 15' Clay
Baserock		3	Chalk

Remarks

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil.	1	1	-
Clayey med.-co. sand & fine & med. gravel. Sand Med. SA-Co. SA & A (flint) tr. clay dark brown. Gravel Fine & med. w. co. SA-A flint LPS 40.	10	9	N948-950
Med. Sand tr. med.-co. gravel. Sand Med. SA light brown. Gravel Med.-co. w. fine SA flint LPS 30.	22	12	N951-954
Med. & fine sand tr. med.-co. gravel. Sand Med. & fine SA tr. brown clay. Gravel Med.-co. w. fine SA flint LPS 30.	25	3	N955
Med. sand tr. med.-co. gravel. Sand Med. SA light brown. Gravel Med.-co. w. fine SA & w. SR-SA irreg. flint cobbles LPS 70.	31	6	N956-957
Med. & co. sand w. tr. fine-med. gravel. Sand Med. SA & co. SA-A (w. chalk) light brown. Gravel Fine & med. SA flints LPS 25.	40	9	N958-960

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.
Clayey Med. & co. sand w. tr. fine-med. gravel. Sand Med. & co. SA w. light brown sl. chalky clay. Gravel Fine & med. SA flints LPS 25.	43	3	N 961
Light brown clay w. tr. chalk.	58	15	–
Very clayey med.-co. sand w. med.-co. gravel. Sand Med. co. SA w. dark brown (stoney) clay. Gravel Med. & co. SA-SR irreg. flints LPS 70.	61	3	N 962
Med. sand w. tr. med. & fine gravel and tr. clay. Sand Med. w. fine SA light grey w. tr. light grey clay. Gravel Fine & med. SA-SR irreg. flint.	64	3	N963
Chalk	67	3	–

U. E. A. Samples

UEA 168 .... 45'
UEA 169 .... 58'

TG 11 SW 17 1317 1374

Jennis's Wood, Ringland

Surface level (+19.7 m) +65 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (2.1 m) 7 ft
Mineral (3.7 m) 12 ft
Bedrock (1.8 m+) 6 ft+

		Thickness (m)	ft	Depth (m)	ft
Boulder Clay	Soil and light brown to grey sandy clay.	(2.1)	7	(2.1)	7
Glacial Sand and Gravel	'Clayey' pebbly sand. 'Clayey' in lower 6 ft (1.8 m). Gravel: fine to coarse, subangular flint. Sand: medium and fine, subangular; light brown.	(3.7)	12	(5.8)	19
Upper Chalk	Chalk with some sand and traces of gravel.	(0.9)	3	(6.7)	22
	Chalk.	(0.9+)	3+	(7.6)	25

	%	mm	%
		+64	: 0
Gravel	21	-64+16	: 9
		-16+4	: 12
		-4+1	: 3
Sand	66	$-1+\frac{1}{4}$	: 30
		$-\frac{1}{4}+1/16$	: 33
Fines	13	-1/16	: 13

Depth below surface (ft)	Percentage Fines	Sand	Gravel
7 - 10	6	59	35
10 - 13	4	65	31
13 - 16	19	75	6
16 - 19	21	68	11

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Mineral Assessment Unit

Sand and Gravel Survey

BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/17

Temporary designation: 7

Nat. Grid Ref.: 1318 1374

Locality: Jennis's Wood, Ringland.

Date: 30-10-69

Recorded by: A. R. Clayton.

Drilled by: Fitzpatrick

Drill Type: Wirth Bl

Hole diameter: 8"

Ground level (O.D.): c. 80

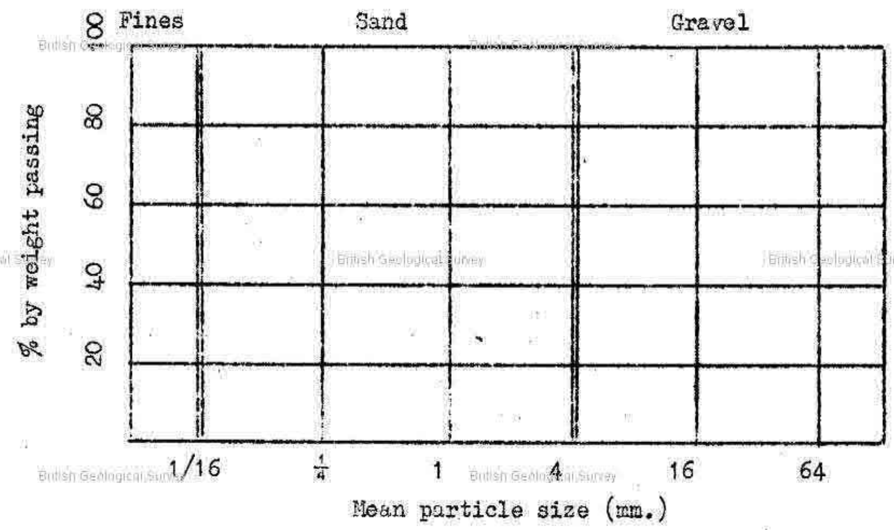
Water struck at (O.D.): Dry

Horizon	Thickn. m	Thickn. ft.	Nature
Overburden		7	Soil and Clay.
Mineral		15	Sand
Baserock		3	Chalk

Remarks N 968 - chalk. Put to chalk analysis

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	1	1	-
Light brown-grey sandy ~~[illegible]~~ clay.	7	6	-
Med. sand w. fine & med. gravel. Sand Med. w. fine & ~~mm~~ tr. co. SA light brown w. tr. light grey clay. Gravel Fine & med. SA flint occ. co. SA flint. ~~[illegible]~~	13	6	N964-965
Clayey med. sand w. fine gravel. Sand Med. SA occ. co. w. tr. brown clay. Gravel Fine tr. med. occ. co. SA flint LPS 30.	19	6	N966-967
Med. Sand w. fine gravel. Sand Med. SA occ. co. light brown tr. soft chalk. Gravel Fine tr. med. occ. co. SA flint LPS 30.	22	3	N968
Chalk	25	3	-

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.

TQ 11 SW | 28
1006.1205

LOG OF BOREHOLE Nº 1

GROUND LEVEL (40.96m) 134.4 A.O.D.
DATE STARTED 23/9/1966
DATE COMPLETED 23/9/1966

TYPE OF BORING SHELL & AUGER
DIA. OF BORING $7\frac{1}{4}$ ins
BOREHOLE LINED TO ..... ft. .... ins.

Geological Formation	Legend	Description of Strata	Depth	Samples	Water Levels	
		TOPSOIL	6" (0.15m)			
		STIFF GREY AND BROWN CLAY WITH FLINTS AND ROUNDED FRAGMENTS OF CHALK	11' 0" (3.35m)	▮ ▮ ▮		Chalky Boulder Clay E.C. Cole.
		FIRM BROWN SANDY SILTY CLAY WITH SMALL NODULES OF CHALK	15' 0" (4.57m)	▮		

REMARKS:

NO GROUNDWATER OBSERVED

KEY:
▽ WATER STRUCK
▼ STANDING WATER LEVEL
▮ UNDISTURBED SAMPLE
↓ STANDARD PENETRATION TEST
(25) Nº OF BLOWS FOR 12" PENETRATI[ON]
⊓ [illegible]

TG 11 SW 3 1057 1234 **Star Covert, Honingham**

Surface level (+43.0 m) +141 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (5.5 m) 18 ft
Mineral (11.0 m) 36 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Boulder Clay	Soil and brown chalky clay, with sandy seam from 9 to 12 ft (2.7 to 3.7 m).	(5.5)	18	(5.5)	18
Glacial Sand and Gravel	'Clayey' pebbly sand. Gravel almost absent from lower 12 ft (3.7 m). Chalky near base. Gravel: coarse with fine (coarse predominant in upper 9 ft (2.7 m)), subangular with subrounded, mainly flint. Sand: medium and fine, subangular; brown to orange.	(11.0)	36	(16.5)	54
Upper Chalk	Chalk.	(0.9+)	3+	(17.4)	57

	%	mm	%
Gravel	13	+64	0
		-64+16	8
		-16+4	5
Sand	73	-4+1	5
		$-1+\frac{1}{4}$	35
		$-\frac{1}{4}+1/16$	33
Fines	14	-1/16	14

Depth below surface (ft)	Fines	Sand	Gravel
18 - 21	15	70	15
21 - 24	11	54	35
24 - 27	1	66	33
27 - 30	16	75	9
30 - 33	24	68	8
33 - 36	20	70	10
36 - 39	24	63	13
39 - 42	1	70	29
42 - 45	48	50	2
45 - 48	2	98	0
48 - 51	4	91	5
51 - 54	5	95	0

31

LOG OF BOREHOLE Nº 4

1060. 1182

GROUND LEVEL 76.4 A.O.D. (23.28m)
DATE STARTED 26/9/1966
DATE COMPLETED 26/9/1966

TYPE OF BORING SHELL & AUGER
DIA. OF BORING 7¼ ins.
BOREHOLE LINED TO 45 ft. 0 ins.

Geological Formation	Legend	Description of Strata	Depth	Samples	Water Levels	
		VERY SOFT TO SOFT BROWN ORGANIC CLAY AND PEAT	5' 0" (1.52m)	▮	▽▼	Alluvium
		MEDIUM DENSE BROWN AND GREY CLAYEY OR SILTY SANDY GRAVEL WITH ROUNDED FRAGMENTS OF CHALK	16' 0" (4.88m)	↓18, ↓12		
		SOFT GREY CLAY WITH GRAVEL AND FRAGMENTS OF CHALK	18' 6" (5.64m)	▮		
		MEDIUM TO DENSE MEDIUM GREY SAND BECOMING COARSE WITH DEPTH, WITH FLINTS AND ROUNDED FRAGMENTS OF CHALK	(8.84m) 29' 0"	↓20, ↓17		
		FIRM GREY SANDY CLAY AND FRAGMENTS OF CHALK	30' 0" (9.14m)			
		DENSE COARSE GREY SAND WITH GRAVEL AND FLINT COBBLES	34' 0" (10.36m)	↓46		
		MEDIUM GREY SAND WITH FINE GRAVEL	36' 0" (10.97m)			
		STIFF GREY FISSURED CLAY (WEATHERED CHALK)	39' 0" (11.89m)	▮	36	UCK
		MEDIUM-HARD WHITE CHALK ROCK IN A MATRIX OF VERY STIFF GREY CLAY	50' 0" (15.24m)	↓13, ▮, ▮		

REMARKS:

KEY:
▽ WATER STRUCK
▼ STANDING WATER LEVEL
▮ UNDISTURBED SAMPLE
↓ STANDARD PENETRATION TEST
(25) Nº OF BLOWS FOR 12" PENETRATION

32

1063, 1180

LOG OF BOREHOLE Nº 5

GROUND LEVEL 75.7 (23.07m) A.O.D.

DATE STARTED 27 / 9 / 1966

DATE COMPLETED 37 / 9 / 1966

TYPE OF BORING SHELL & AUGER

DIA. OF BORING 7¼ ins.

BOREHOLE LINED TO 39 ft. 0 ins.

Geological Formation	Legend	Description of Strata	Depth	Samples	Water Levels	
		SOFT BROWN ORGANIC CLAY AND PEAT	3' 0" (0.91m)		▼▽	
		COARSE BROWN SANDY GRAVEL WITH TRACES OF ORGANIC CLAY	6' 0" (1.83m)	↓39		7'
		SOFT TO FIRM GREY CLAY	7' 0" (2.13m)			
		MEDIUM DENSE GREY SILTY FINE TO MEDIUM SAND WITH GRAVEL AND ROUNDED FRAGMENTS OF CHALK	19' 0" (5.79m)	↓18 ↓16		glacial sand
		FIRM GREY CLAY WITH ROUNDED FRAGMENTS OF CHALK	25' 0" (7.62m)	▮		chalky [illegible]
		SOFT WHITE FISSURED CHALK ROCK IN A MATRIX OF STIFF WHITE CLAY (WEATHERED CHALK)	37' 0" (11.28m)	↓11 ▮ ↓20	25'	[illegible]
		MEDIUM HARD GREY FISSURED CHALK ROCK WITH VERY STIFF GREY CLAY	41' 0" (12.50m)	▮		

REMARKS:

KEY:
- ▽ WATER STRUCK
- ▼ STANDING WATER LEVEL
- ▮ UNDISTURBED SAMPLE
- ↓ STANDARD PENETRATION TEST
- (25) Nº OF BLOWS FOR 12" PENETRATION
- n

35

LOG OF BOREHOLE Nº 8 1119. 1123

GROUND LEVEL 124.2 A.O.D. (37.85m)	TYPE OF BORING SHELL & AUGER
DATE STARTED 16/9/1966	DIA. OF BORING 7¼ ins.
DATE COMPLETED 19/9/1966	BOREHOLE LINED TO 13 ft. 6 ins.

Geological Formation	Legend	Description of Strata	Depth	Samples	Water Levels	
		TOPSOIL	6" (0.15m)			
		SOFT TO FIRM BROWN CLAYEY SILT WITH FINE SAND	(1.98m) 6'6"	▮ ▮		
		SOFT TO FIRM YELLOW-BROWN SILT WITH FINE SAND	8'0" (2.44m)			
		DENSE BROWN COARSE SANDY GRAVEL	15' 0" (4.57m)	↓97 ↓50		ELP.

REMARKS:

NO GROUNDWATER OBSERVED

KEY:
- ▽ WATER STRUCK
- ▼ STANDING WATER LEVEL
- ▮ UNDISTURBED SAMPLE
- ↓ STANDARD PENETRATION TEST
- (25) Nº OF BLOWS FOR 12" PENETRATION

TG 11 SW 36

LOG OF BOREHOLE Nº 9

GROUND LEVEL (27·49m) 90·2 A.O.D

DATE STARTED 20/9/1966

DATE COMPLETED 22/9/1966

TYPE OF BORING SHELL & AUGER

DIA. OF BORING 6 ins

BOREHOLE LINED TO 53 ft. 0 ins.

Geological Formation	Legend	Description of Strata	Depth	Samples	Water Levels	
		FIRM BROWN ORGANIC CLAY (TOPSOIL)	4' 6" (1·37m)	50		
		DENSE COARSE BROWN SANDY GRAVEL WITH FLINT COBBLES	9' 6" (2·40m)	27		
		MEDIUM DENSE BROWN SANDY GRAVEL WITH FLINTS, CHALK COBBLES AND SEAMS OF SOFT TO FIRM SANDY CLAY	15' 6" (4·72m)	15	▼	
		MEDIUM DENSE BROWN SANDY GRAVEL WITH POCKETS OR SEAMS OF FIRM BROWN CLAY AND OCCASIONAL FLINTS	(8·84m) 29' 0"	26, 17		
		FIRM GREY SANDY CLAY WITH FRAGMENTS OF CHALK	30' 6" (9·30m)			
		SOFT WHITE FISSURED CHALK ROCK IN A MATRIX OF FIRM TO STIFF WHITE CLAY WITH FLINTS, BROWN DISCOLORATIONS AT 45'	50' 0" (15·24m)	▮, 7, ▯, 19, ▮, 10	▽	
		MEDIUM HARD FISSURED CHALK ROCK, WITH FLINTS	55' 0" (16·76m)	▯, 22		

REMARKS:

KEY:
- ▽ WATER STRUCK
- ▼ STANDING WATER LEVEL
- ▮ UNDISTURBED SAMPLE
- ↓ STANDARD PENETRATION TEST
- (25) Nº OF BLOWS FOR 12" PENETRATION

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Version 2.0.6

BGS ID: 514708 : BGS Reference: TG11SW37/A
British National Grid (27700) : 611240,312460
Report an issue with this borehole

161/35 TG11SW/37

161/35 The Hall, Honingham

(c) W.S. Nk. p. 96. Surface +95. (29.95m) Bore 68. Gidney, c. 1910. 1124 . 1248

I/o engine. Hardness: total 251. Anal. 1936.

(d) W.S. Nk. p. 96. Surface +110. (33.52m) Lining tubes: 75 x 4 in from surface.

R.W.L. +104¾. Fake, 1912.

I/o engine. 1960.

(d) Pleist. Drift	...	...	35	35
UCk	...	...	141¾	176¾

(C)

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS	DEPTH
	MADE SOIL	3	3
BOULDER CLAY	BLUE CLAY	20	23
GLACIAL SAND AND GRAVEL	GRAVEL	15	38
	LIGHT COLOURED SAND	10	48
	QUICK SAND	9	57
UPPER CHALK	CHALK + FLINTS	11	68 (20.72m)

p.p. J.C.Cox. 2.2.69

(D)

GEOLOGICAL CLASSIFICATION		NATURE OF STRATA	THICKNESS	DEPTH
GLACIAL DRIFT	SANDY WASH	LOAMY SAND	4	4
	CHALKY BOULDERCLAY	GREY CLAY	4	8
	GLACIAL SAND + GRAVEL	ROUGH SAND + FINE SHINGLE	27	35
UPPER CHALK		MARL + FLINT-STONE	7	42
		YELLOW MARL	3	45
		SOFT CHALK & GREEN L[?] MARL	10	55
		CLOSE HARD CHALK FLINT FLOORS AT 72 + 84 FEET	30	85
		GOOD CHALK. FLINT FLOORS AT 93, 98, 108, 117, 126, 130 to 134, 148 and 167 FEET	91⅔	176⅔ (53.84M)

pp FLK 2.2.69

6" Quarter Sheet
62, NE

161/35 161/35 The Hall, Honingham TG11/75A,B

161/35(c) W.S. Nk. p. 96. Surface +95. Bore 68. Gidney, c. 1910.

I/c engine. Hardness: total 251. Anal. 1936.

(d) W.S. Nk. p. 96. Surface +110. Lining tubes: 75 x 4 in from surface.

R.W.L. +104¾. Fake, 1912.

I/c engine. 1960.

161/35(d)				
Pleist. Drift	...	...	35	35
UCk	...	...	141¾	176¾

(C) 161/35a

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS	DEPTH
	MADE SOIL	3	3
BOULDER CLAY	BLUE CLAY	20	23
GLACIAL SAND AND GRAVEL	GRAVEL	15	38
	LIGHT COLOURED SAND	10	48
	QUICK SAND	9	57
UPPER CHALK	CHALK + FLINTS	11	68

p.p. F.C. Cox. 2.2.69

(D) 161/35b

GEOLOGICAL CLASSIFICATION		NATURE OF STRATA	THICKNESS	DEPTH
GLACIAL DRIFT	SANDY WASH	LOAMY SAND	4	4
	CHALKY BOULDERCLAY	GREY CLAY	4	8
	GLACIAL SAND + GRAVEL	ROUGH SAND + FINE SHINGLE	27	35
UPPER CHALK		MARL + FLINT-STONE	7	42
		YELLOW MARL	3	45
		SOFT MALLGEAN [?] MARL	10	55
		CLOSE HARD CHALK FLINT FLOORS AT 72 + 84 FEET	30	85
		GOOD CHALK FLINT FLOORS AT 93, 98, 108, 117, 126, 130 to 134, 148 and 167 FEET	91⅔	176⅔

pp F Cox 2.2.69

Version 2.0.6

BGS ID: 514708 : BGS Reference: TG11SW37/A
British National Grid (27700) : 611240,312460
Report an issue with this borehole

For Institute use only

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA *If measurements start below ground surface, state how far.*	THICKNESS Feet	Inches	Metres	DEPTH Feet	Inches	Metres
	Boulder clay			7·01			7·01
	Sand and gravel			10·36			17·37
	Upper chalk			3·35			20·72

Version 2.0.6

BGS ID: 514708 : BGS Reference: TG11SW37/A
British National Grid (27700) : 611240,312460
Report an issue with this borehole

~~161~~
35

TG11/75A

C/

Honingham.

Ordnance Map 161, new ser. (Norfolk 62, N.E.). Geologic Map 66, N.W.

The Hall.

Driven tube-well, made and communicated by MESSRS. GIDNEY.

		Thickness. Feet.	Depth. Feet.
Made soil		3	—
Blue [Boulder] clay		20	23
[Glacial Sand and Gravel]	Gravel	15	~~21~~
	Light-coloured sand	10	~~48~~
	Quick sand	9	57
[Upper] Chalk and flints		11	68

agreed
F.G.C.
2.2.69

Water supply for 50 people. Never fails.

Analysis (1936)

Free & saline ammonia ·0028

albuminoid ammonia ·002.

combined chlorine 1·4.

N. as nitrates & nitrites nil

Hardness 17·6.

Free from pollution, fit to drink.

From letter July 27/40. from Sir Eric Teichman.

TG11/75C ~~(?)~~ A. (see tracing) Surface spring well. Analysis 1940 (Norwich County Analyst. Free & saline ammonia. trace. : album. amm. ·0077 : combined Cl. 2·2. N as nitrates ·055 : nitrites nil. : H. 19·6 : free from pollution & fit to drink

TG11/75D B) (do) Old hand pump. Believed made 1910–1920.

TG11/75A C) = 161/35 above. Present supply for Hall. Pumped by engine to reservoir on hill. 11 July 1940,

TG11/75B D.) Well in Hall farm (probably old.)

[E) Tube well (1937) at Hall Garden Cottages] (= 161/146.)

d) Visited, site corrected OD + c. 110 · Bore. Supply for Hall Farm + 3 cottages. Petrol pump. Consumption not known. 16/8/60 RK

a) b) c) OD + c. 95. In absence of man who looks after water supply unable to obtain any information about wells except that the Hall is supplied from its own well or wells.
16/8/60 RK

Published in
'The Water Supply
of Norfolk,'
Page 96

161/35 161/35 The Hall, Honingham TG11 SW/37 1144 1246

(c) W.S. Nk. p. 96. Surface +95. (28.95m) Bore 68. Gidney, c. 1910.

I/o engine. Hardness: total 251. Anal. 1936.

(d) W.S. Nk. p. 96. Surface +110. (33.52m) Lining tubes: 75 x 4 in from surface.

R.W.L. +104¾. Fake, 1912.

I/o engine. 1960.

(d)	Pleist. Drift	35	35
	UCk	141¾	176¾

(C)

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS	DEPTH
	MADE SOIL	3	3
BOULDER CLAY	BLUE CLAY	20	23
GLACIAL SAND AND GRAVEL	GRAVEL	15	38
	LIGHT COLOURED SAND	10	48
	QUICK SAND	9	57
UPPER CHALK	CHALK + FLINTS	11	68 (20.72m)

p.p. F.C. Cox. 2.2.69

(D)

GEOLOGICAL CLASSIFICATION		NATURE OF STRATA	THICKNESS	DEPTH
GLACIAL DRIFT	SANDY WASH	LOAMY SAND	4	4
	CHALKY BOULDERCLAY	GREY CLAY	4	8
	GLACIAL SAND + GRAVEL	ROUGH SAND + FINE SHINGLE	27	35
UPPER CHALK		MARL + FLINT-STONE	7	42
		YELLOW MARL	3	45
		SOFT [illegible] GREAN [?] MARL	10	55
		CLOSE HARD CHALK FLINT FLOORS AT 72 + 84 FEET	30	85
		GOOD CHALK FLINT FLOORS AT 93, 98, 108, 117, 126, 130 to 134, 148 and 167 FEET	91⅔	176⅔ (53.84m)

pp FCC 2.2.69

6" Quarter Sheet 62, NE

161/35 161/35 The Hall, Honingham TG11/75A,B

161/35(c) W.S. Nk. p. 96. Surface +95. Bore 68. Gidney, c. 1910.

I/c engine. Hardness: total 251. Anal. 1936.

(d) W.S. Nk. p. 96. Surface +110. Lining tubes: 75 x 4 in from surface.

R.W.L. +104¾. Fake, 1912.

I/c engine. 1960.

161/35(d)	Pleist. Drift	... ...	35	35
	UCk	... ...	141¾	176¾

(C) 161/35a

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS	DEPTH
	MADE SOIL	3	3
BOULDER CLAY	BLUE CLAY	20	23
GLACIAL SAND AND GRAVEL	GRAVEL	15	38
	LIGHT COLOURED SAND	10	48
	QUICK SAND	9	57
UPPER CHALK p.p. J.C. Cox. 2.2.69	CHALK + FLINTS	11	68

(D) 161/35b

GEOLOGICAL CLASSIFICATION		NATURE OF STRATA	THICKNESS	DEPTH
GLACIAL DRIFT	SANDY WASH	LOAMY SAND	4	4
	CHALKY BOULDERCLAY	GREY CLAY	4	8
	GLACIAL SAND + GRAVEL	ROUGH SAND + FINE SHINGLE	27	35
UPPER CHALK		MARL + FLINT-STONE	7	42
		YELLOW MARL	3	45
		SOFT MALLGEAN [?] MARL	10	55
		CLOSE HARD CHALK FLINT FLOORS AT 72 + 84 FEET	30	85
		GOOD CHALK FLINT FLOORS AT 93, 98, 108, 117, 126, 130 to 134, 148 and 167 FEET	91⅔	176⅔

pp. F Cox 2.2.69

RECORD OF WELL

For Institute use only Licence No.

N

TG11/75 B

161/35 D

At Hall Farm

Town or Village Honingham

County Norfolk

EXACT SITE OF WELL

Six-inch National Grid sheet and reference TG 1085 1206 HA 34 Anglian WA.

For

State whether owner, tenant, builder, contractor, consultant, etc.:

Address (if different from above)

Level of ground surface above sea level (O.D.) ft (33.52 m)

*DELETE AS NECESSARY

If well top is not at ground level state how far above:* below: ft (m)

SHAFT ft (m); diameter ft (m);

HEADINGS (please attach details—dimensions and directions)

BORE ft (53.8 m); diameter: at top in (101 mm);

at bottom in (mm)

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.):

22.86 m x 101 mm from surface

TEST CONDITIONS

Water struck at depths of ft (m) below well top

Rest level of water ft (31.92 m) above* ~~below~~ OD ~~well top~~. Suction at ft (m)

Yield on hours'* days' test pumping at galls per (l/s) with depression to ft (m) below well top. Recovery to rest level in mins* hours

Capacity of pump g.p.h. (l/s)

Date of measurements 1912

NORMAL CONDITIONS

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type Motive power

Capacity galls (m^3) per hour. Suction at ft (m) below well top. Amount pumped galls (m^3) per day. Estimated consumption galls (m^3) per week

Well made by Fake Date of sinking 1912

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

LOG OF STRATA OVERLEAF

Received from

Date

Observation well

Recorder

ER log

Site marked on

1" map

6" map—Grid Sheet

INSTITUTE OF GEOLOGICAL SCIENCES
HYDROGEOLOGY UNIT

EXHIBITION ROAD
LONDON SW7 2DE

IGS 2494 10 000 7/79

(use symbol)
Copy to.............................
....
Date................................

For Institute use only

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA *If measurements start below ground surface, state how far.*	THICKNESS Feet	THICKNESS Inches	THICKNESS Metres	DEPTH Feet	DEPTH Inches	DEPTH Metres
	Pleistocene Drift			10.66			10.66
	Upper chalk			43.22			53.88

161/146 Honingham Hall Garden Cottages, Honingham TG11SW/38
1102. 1203

Surface (32.00m) +105. Lining tubes: $68\frac{1}{2}$ x 4 in from surface. R.W.L. +84.

Buckingham, 1937.

Handpump. Aug. 1960.

Boulder Clay	...	...	15	15
Sand and Gravel	...	...	10	25
UCk	...	...	63	88

Boulder clay 15'	Yellow Clay	15	15
Sand + gravel 10'	Yellow sand	5	20
	Yellow sandstone Shingle	5	25
upper chalk 63'	Marl	10	35
	Chalk	53	88 (26.82m)

pp. F. Cox.
18.2.69
6" quarter Sheet
LX 11 NW/E
62

TG 11 SW / 39
1247·1249

161/147 Breck Barn Farm, Honingham. (Disused)

Surface +183. Bore 4 in. R.W.L. +69. P.W.L. +60. Yield 500 g.p.h.
(55·77m)

Barnham, 1939.

Sand and Gravel	120	120
UCk	40	160

Sand + Gravel 120'	Stones	16	16
	gravel	69	85
	Gravel + Brown Clay	15	100
	Very hard light Brown Sand	8	108
	Soft sand (Blowing)	3	111
	Rough Gravel (large stones)	9	120
Upper Chalk 40'	Chalk (medium hard	40	160 (48·76m)

pp. P. N. Hildreth
13.2.69
6" quarter sheet
LXII NE/W
62

161/176 Former Searchlight Station, Honingham TG 11 SW/41

1172 1159

Surface +120. Bore 4 in. R.W.L. +70. Yield 500 g.p.h. (test). Fake, Feb. 1941. (36·57m)

Handpump. 1947.

Sand and Gravel	19	19
Boulder Clay	15	34
Sand and Gravel	$1\frac{1}{2}$	$35\frac{1}{2}$
Boulder Clay	34	$69\frac{1}{2}$
UCk	$47\frac{1}{4}$	$116\frac{3}{4}$

Sand + Gravel 19'	Top soil	1 1/2	1 1/2
	Loam sand	17 1/2	19
Chalky Boulder clay 15'	Grey clay	15	34
Glacial sand 1½	Fine sand	1 1/2	35 1/2
Chalky Boulder Clay 34'	Brick-earth	2 1/2	38
	Light clay + stone	31 1/2	69 1/2
Upper Chalk 47¼'	Soft Chalk	10	79 1/2
	Hard Chalk	37 1/4	116 3/4 (35·58m)

pp P.N Hildreth

13.2.69

6" quarter Sheet 62 NW E

Version 2.0.6
BGS ID: 514714 : BGS Reference: TG11SW42
British National Grid (27700) : 610350,311650

1. 161/220 The Mill House, Honingham TG11SW/42

(25.29m)

Surface +83. Shaft x $3\frac{1}{2}$. R.W.L. $+78\frac{1}{2}$. Barnham, July 1939. 1035.1165

Anal. Nov. 1940. R.W.L. +77. Aug. 1947; $+76\frac{1}{2}$. Electric pump.

Aug. 1960.

Drift	...	...	$4\frac{1}{2}$	$4\frac{1}{2}$
Boulder Clay	...	...	$7\frac{1}{2}$	12

Alluvium 4'½'	Bog Soil	4 1/2	4 1/2
Chalky Boulder Clay 7'½'	Clay	4	8 1/2
	Clay + sand.	1	9 1/2
	Clay + Blue Clay	1	10 1/2
	Clay + sand	1 1/2	12
			(3.65m)

pp. F. Cox

2.1.69

6" Quarter Sheet
62 NW/E

BGS ID: 514718 : BGS Reference: TG11SW45
British National Grid (27700) : 610530,311540

161/277 Police House, Honingham. (Filled in) TG11SW/45

1053.1154

Surface +107. (32.61m) Lining tubes: 91 x 4 in. R.W.L. +84. P.W.L. +77.

Yield 750 g.p.h. (8 h. test). Buckingham, Jan. 1947.

Hardness: total 384. Ferruginous. Anal. Handpump. Oct. 1947.

Boulder Clay	10	10
Sand and Gravel	7	17
Boulder Clay	22	39
Sand and Gravel	7	46
UCk	74	120

Chalky Boulder Clay 10'	Top soil	1	1
	Brickearth	9	10
Sand + gravel 7'	Sand + stone	7	17
Chalky Boulder clay 22'	Yellow clay	22	39
Sand + gravel 7'	Sand	7	46
Upper Chalk 74'	Head & Chalk	74	120 (36.57m)

pp. F.Cox
19.2.69

TG11SW/48
1008.1444

161/357 c. Green Farm, Weston Longville

Surface c. +160. (48.76m) Shaft 30 x 4; rest bore 4 in. Lining tubes: x 4 in.

R.W.L. c. +122. P.W.L. c. +114. Yield 700 g.p.h. (8 h. test). Barnham, July 1950.

R.W.L. +135 (shaft). Yield c. 1,000 g.p.d. (winter); c. 400 g.p.d. (summer). I/c engine. Aug. 1960.

Boulder Clay / Sand and Gravel	74	74
Boulder Clay	32	106
UCk	64	170

74' Boulder clay / Sand + gravel	Undescribed	30	30
	Sand	44	74
Boulder clay 32'	Light clay	7	81
	Light clay + Sand	25	106
Upper Chalk 64'	Chalk + Flints	64	170 (51.81m)

pp. P.N Hildreth

4.6.69.

50 8w/E

BGS ID: 514726 : BGS Reference: TG11SW53
British National Grid (27700) : 610430,311640

1. 161/411 Hill Cottage, Honingham TG11SW/53

(29.56m)
Surface +97. Lining tubes: 56 x 4 in. R.W.L. +82. P.W.L. +81. 1043.1164

Yield 1,000 g.p.h. (8 h. test). Buckingham, Sept. 1950.

Electric pump. Aug. 1960.

Sand and Gravel	...	...	30	30
UCk	...	...	50	80

Sand + gravel 30'	Top soil	1	1
	Brickearth	6	7
	Brown sand + stone	8	15
	Brown sand	15	30
Upper Chalk 50'	Chalk	50	80 (24.38m)

p.p. F.C. Cox
2/1/69
6" quarter sheet
62 NW/E

161/527 Ivy House Farm, Weston Longville TG11SW/54
1083.1433

Surface +167. Lining tubes: x 4 in. Water struck at +122. R.W.L. +122. P.W.L. (50.90m) +79. Recovered to +122 in 4 min. Suction +7. Yield 750 g.p.h. (8 h. test). Barnham, Nov. 1955.

Suction +67. I/c engine. Nov. 1955. Yield 600 g.p.d. Aug. 1960.

Pleist. Drift	...	...	85	85
UCk	...	...	91	176
				(53.64m)

Estimated Classn.

6" quarter Sheet
50 SW/E

R. Gallois
June 1969.

1. 161/527 Ivy House Farm, Weston Longville TG11/109

Surface +167. Lining tubes: x 4 in. Water struck at +122. R.W.L. +122. P.W.L. +79. Recovered to +122 in 4 min. Suction +7. Yield 750 g.p.h. (8 h. test). Barnham, Nov. 1955. TG 1083 1433

Suction +67. I/c engine. Nov. 1955. Yield 600 g.p.d. Aug. 1960.

Pleist. Drift	...	...	85	85
UCk	...	...	91	176

Estimated classn.

R. Gallois

6" quarter sheet 80 SW/E

June 1969.

1.

RECORD OF WELL (SHAFT OR BORE)

TG11/109
For Survey use only
161/527
N. 4/22

EXACT SITE OF WELL

At Ivy House Farm,

Town or Village Weston Longville.

Licence No.

County Norfolk. Six-inch quarter sheet 50 SW/E

For Mr. W. Brand. State whether owner, tenant, builder, contractor, consultant, etc.:— Owner.

Address (if different from above)

Level of ground surface above sea-level (O.D.) +c.167. ft. If well-top is not at ground level, state how far .. above: below; ft.

SHAFT ft.; diameter ft.; Full details of headings (dimensions and directions)

BORE 176 ft.; diameter of bore: at top 4" ins.; at bottom 4" ins.

Full details of permanent lining tubes (position, length, diameter, plain, slotted etc.)

4" diameter galvanised x ½" steel tube.

Water struck at depths of 45 ft. below well-top.

TEST CONDITIONS

Rest level of water 45 ft. ~~above~~ below well-top. Suction at 160 ft. Yield on 8 hours' ~~days'~~ test pumping at 750 galls. per hour with depression to 88 ft. below well-top.

Recovery to rest-level in 4 mins. ~~hours~~ Capacity of pump 800 g.p.h. Date of measurements Nov.'55.

NORMAL CONDITIONS

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type Climax Fig. 52/2 Motive power Petrol Engine.

Capacity 250 gallons per hour. Suction at 100 ft.

Amount pumped 500 galls. per day. Estimated consumption 3,000 galls. per week.

Well made by A. W. Barnham. Date of well Nov. 1955.

Information from A. W. Barnham, Walsingham, Norfolk.

ADDITIONAL NOTES

ANALYSIS (please attach copy if available)

Sited by ⊙ on 6" Norfolk 50 SW/E. [illegible] 25/10/57

Visited site corrected on 6" map Norfolk 50 SW/E.
OD+ c.167.
Consumption 600 g.p.d (summer) less in winter.
9/8/60 BN.

37583 12,000 8/54 JC&S Gp669

LOG OF STRATA OVERLEAF

LOG OF STRATA OVERLEAF.

(1527) Dd574/Wt

Geological Survey and Museum, South Kensington, London, S.W.7.		Section 6.	Date Received	1" O.S. Map No.	Site marked on 1" Map	(use symbol) on 6" Map
			25.6.57		⊙	⊙

2

(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far ..	THICKNESS Feet	THICKNESS Inches	DEPTH Feet	DEPTH Inches
From Well sinker's description Class is:					
GLACIAL SAND & GRAVEL	Soil	1	-	1	
	Gravel	20	-	21	
	Sand.	39	-	60	
BC	Blue Clay.	25	-	85	
UChk	Soft.Chalk.	5	-	90	
	Soft Chalk with Flints.	30	-	120	
	Medium hard chalk with sand seams	10	-	130	
	Medium hard chalk with flints.	46	-	176	
				(176	-)

But the site shown is on stiff brown clay. (Chalky Boulder Clay)

∴ R. Gallois suggests that the class should be
Glacial Drift 85 ft
UCk - 91+ ft
June 1969.

F6 bry
20.2.69

DATA Bank

TG11SW/58
1161 · 1120

161/621 The Church Lodge, Honingham

(19.20m)

Surface +63. Lining tubes: 82 x 4 in. R.W.L. +55. P.W.L. +53.

Recovered to +55 in 1 min. Yield 800 g.p.h. (8 h. test). Page, Nov. 1959.

Electric pump. Ferruginous. June 1970.

Drift	...	9	9
Boulder Clay	...	27	36
Sand and Gravel	...	26	62
UCk	...	39	101

Drift (Alluvium) 9'	Top soil	2	2
	Sand + Stones	7	9
Chalky Boulder Clay 27'	Grey clay	27	36
Glacial Sand and Gravel 26'	Grey sand	22	58
	Stones	4	62
UCk 39'	Chalk	39	101 (30.78m)

P.P. F.C. Cox
2/2/68

6" quarter sheet
62 NW/E

Version 2.0.6

BGS ID: 514732 : BGS Reference: TG11SW59/A
British National Grid (27700) : 610810,313720

TG 11SW/59
1081 1372

161/622 Honingham Breck Farm, Honingham (formerly Ministry of Defence).

(Partly filled in)

(a) Surface +175. (53.34m) Bore 295 x 10 in. Lining tubes: 153 x 10 in from surface. R.W.L. +119. P.W.L. +54. Yield 3,600 g.p.h. (3 d. test). Diesel and electric pumps. Hardness: P. 43, T. 200. Anal. Gosling, Apr. 1943.

(b) Surface +175. (53.34m) Lining tubes: 31 x 15 in from surface; 206½ x 12 in from 2 above. Water struck at +5 to +0, -4 to -9 and at -125. R.W.L. +105. P.W.L. +52. Recovered to +88 in 3 min., to +93½ in 15 min. and to +94 in 35 min. Suction -25. Yield 5,000 g.p.h. (4 d. test). Hardness: P. 52, T. 205. Anal. Dando, Dec. 1944.

(b)			
	Sand and Gravel ...	90	90
	Boulder Clay ...	14	104
	UCk ...	296	400 (121.92m)

(A)

Glacial Drift / Glacial Sand	Top Soil	2	0	2	0
	Sand	5	0	7	0
	Sand and Soil	25	0	32	0
	S.Y.Sand	22	0	54	0
	Soft Sand	7	0	61	0
	Light Sand	31	0	92	0
BC	Clay	16	0	108	0
	Clay Black	8	0	116	0
UCK	Flint	2	0	118	0
	Chalk	177	0	295 (89.91m)	0

P.N.H.
19.6.69.

Glacial Drift / Glacial Sand	Top Soil	2	0	2	0
	Brown Sand	33	0	35	0
	Fine Yellow Sand	6	0	41	0
Gravel	Light Sand with Stones	43	0	84	0
	Fine Sand	6	0	90	0
BC	Grey Sandy Clay with Stones	14	0	104	0
UCK	Chalk and Flints	296	0	400	0

(B)

pp P.N.Hildreth
19.6.69

161/622 Honingham Breck Farm, Honingham (formerly Ministry of Defence).
(Partly filled in) A TG 1081 1872 TG11/93

(a) Surface +175. Bore 295 x 10 in. Lining tubes: 153 x 10 in from surface. R.W.L. +119. P.W.L. +54. Yield 3,600 g.p.h. (3 d. test). Diesel and electric pumps. Hardness: P. 43, T. 200. Anal. Gosling, Apr. 1943.

(b) Surface +175. Lining tubes: 31 x 15 in from surface; 206½ x 12 in from 2 above. Water struck at +5 to 40, -4 to -9 and at -125. R.W.L. +105. P.W.L. +52. Recovered to +88 in 3 min., to +93½ in 15 min. and to +94 in 35 min. Suction -25. Yield 5,000 g.p.h. (4 d. test). Hardness: P. 52, T. 205. Anal. Dando, Dec. 1944. B TG 1079 1373

(b)	Sand and Gravel	90	90
	Boulder Clay	14	104
	UCk	296	400

(A)

Glacial Drift / Glacial Sand	Top Soil	2	0	2	0
	Sand	5	0	7	0
	Sand and Soil	25	0	32	0
	S.Y.Sand	22	0	54	0
	Soft Sand	7	0	61	0
	Light Sand	31	0	92	0
BC	Clay	16	0	108	0
	Clay Black	8	0	116	0
UCK	Flint	2	0	118	0
	Chalk	177	0	295	0

P.N.H. 19.6.69.

(B)

Glacial Drift / Glacial Sand & gravel	Top Soil	2	0	2	0
	Brown Sand	33	0	35	0
	Fine Yellow Sand	6	0	41	0
	Light Sand with Stones	43	0	84	0
	Fine Sand	6	0	90	0
BC	Grey Sandy Clay with Stones	14	0	104	0
UCK	Chalk and Flints	296	0	400	0

pp. P.N.Hildreth
19.6.69

Version 2.0.6

BGS ID: 514733 : BGS Reference: TG11SW59/B
British National Grid (27700) : 610810,313720

Report an issue with this borehole

TG 11SW/59
1081 1372

161/622 Honingham Breck Farm, Honingham (formerly Ministry of Defence).

(Partly filled in)

(a) Surface +175. (53.34m) Bore 295 x 10 in. Lining tubes: 153 x 10 in from surface. R.W.L. +119. P.W.L. +54. Yield 3,600 g.p.h. (3 d. test). Diesel and electric pumps. Hardness: P. 43, T. 200. Anal. Gosling, Apr. 1943.

(b) Surface +175. (53.34m) Lining tubes: 31 x 15 in from surface; 206½ x 12 in from 2 above. Water struck at +5 to +0, -4 to -9 and at -125. R.W.L. +105. P.W.L. +52. Recovered to +88 in 3 min., to +93½ in 15 min. and to +94 in 35 min. Suction -25. Yield 5,000 g.p.h. (4 d. test). Hardness: P. 52, T. 205. Anal. Dando, Dec. 1944.

(b)			
Sand and Gravel	... .	90	90
Boulder Clay	... ...	14	104
UCk	... ...	296	400 (121.92m)

(A) Glacial Drift — Glacial Sand, BC; UCK

Top Soil		2	0	2	0
Sand		5	0	7	0
Sand and Soil		25	0	32	0
S.Y. Sand		22	0	54	0
Soft Sand		7	0	61	0
Light Sand		31	0	92	0
Clay	BC	16	0	108	0
Clay Black	BC	8	0	116	0
Flint	UCK	2	0	118	0
Chalk	UCK	177	0	295 (89.91m)	0

P.N.H.
19.6.69.

(B) Glacial Drift — Glacial Sand/Gravel, BC; UCK

Top Soil		2	0	2	0
Brown Sand		33	0	35	0
Fine Yellow Sand		6	0	41	0
Light Sand with Stones		43	0	84	0
Fine Sand		6	0	90	0
Grey Sandy Clay with Stones	BC	14	0	104	0
Chalk and Flints	UCK	296	0	400	0

PP P.N.Hildreth
19.6.69

BGS ID: 514733 : BGS Reference: TG11SW59/B
British National Grid (27700) : 610810,313720

161/622 Honingham Breck Farm, Honingham (formerly Ministry of Defence).

(Partly filled in) A TG 1081 1872 TG11/93

(a) Surface +175. Bore 295 x 10 in. Lining tubes: 153 x 10 in from surface. R.W.L. +119. P.W.L. +54. Yield 3,600 g.p.h. (3 d. test). Diesel and electric pumps. Hardness: P. 43, T. 200. Anal. Gosling, Apr. 1943.

(b) Surface +175. Lining tubes: 31 x 15 in from surface; 206½ x 12 in from 2 above. Water struck at +5 to 40, -4 to -9 and at -125. R.W.L. +105. P.W.L. +52. Recovered to +88 in 3 min., to +93½ in 15 min. and to +94 in 35 min. Suction -25. Yield 5,000 g.p.h. (4 d. test). Hardness: P. 52, T. 205. Anal. Dando, Dec. 1944. B TG 1079 1373

(b)	Sand and Gravel	90	90
	Boulder Clay	14	104
	UCk	296	400

(A)

Glacial Drift – Glacial Sand	Top Soil	2	0	2	0
	Sand	5	0	7	0
	Sand and Soil	25	0	32	0
	S.Y.Sand	22	0	54	0
	Soft Sand	7	0	61	0
	Light Sand	31	0	92	0
BC	Clay	16	0	108	0
	Clay Black	8	0	116	0
UCK	Flint	2	0	118	0
	Chalk	177	0	295	0

P.N.H. 19.6.69.

(B)

Glacial Drift – Glacial Sand gravel	Top Soil	2	0	2	0
	Brown Sand	33	0	35	0
	Fine Yellow Sand	6	0	41	0
	Light Sand with Stones	43	0	84	0
	Fine Sand	6	0	90	0
BC	Grey Sandy Clay with Stones	14	0	104	0
UCK	Chalk and Flints	296	0	400	0

pp. P.N.Hildreth 19.6.69

Version 2.0.6

BGS ID: 514733 : BGS Reference: TG11SW59/B
British National Grid (27700) : 610810,313720

3

De-classified 21/8/70 BH

RECORD OF WELL (SHAFT OR BORE)

~~CONFIDENTIAL~~

161

1" N.S. 161/244 D
1" O.S. 66 N.W
Grid Ref.

622

B

At U.S.A.A.F STATION "ATTLEBRIDGE"

Town or Village ~~ATTLEBRIDGE~~ Honingham parish County NORFOLK Six-inch quarter

Exact site see sketch [III]

in parish of HONINGHAM TG11/93

Level of ground surface above sea-level (O.D.) ?c.175' ft. If well starts below ground surface, state ho

Shaft — ft., diameter — ft. Bore 400 ft. Diameter of bore: at top 12 ins.; at bottom 12

Details of permanent lining tubes (internal diameters preferred) 15" I.D Surface to 30' 11"
12" I.D. Surface to 204' 5" cement filling between tubes

Water struck at depths of (feet) Small quantities at 170 & 179. 300' about

Rest-level of water below ~~above~~ top of well 70 feet. Suction at 200 feet. Yield on 4 ~~hours'~~ days' test

5000 gallons per hour (with pump of capacity 5000 g.p.h.); depressing water level to 123 feet below top. Time of recovery see below hrs. Amount normally pumped daily 10,000 g.p.h. for ? hours.

Quality (attach copy of analysis if available)

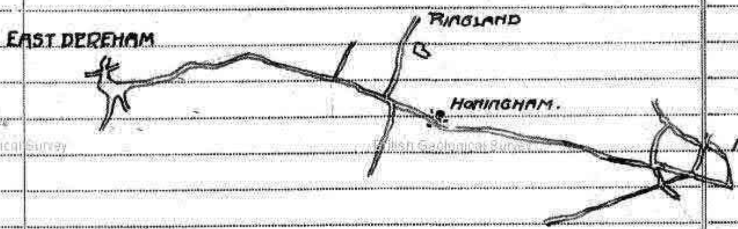
Sunk by Duke & Ockenden Ltd for Mr. AIR MINISTRY Date of well Dec/44.

Information from DUKE & OCKENDEN L^TD., WESTMINSTER & LITTLEHAMPTON

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	Top Soil	2	0	2	0
	Brown Sand	33	0	35	0
	Fine yellow Sand	6	0	41	0
	Light Sand with stones	43	0	84	0
	Fine Sand	6	0	90	0
	Grey Sandy clay with stones	14	0	104	0
	Chalk & Flints	296		400	0

W. L. Recovery

30' 0"	in 1 minute	-	93 below Surface
36 0"	3		87
39' 6	5		83' 6"
41' 7"	15		81' 5"
42' 0"	35		81' 0"



DATA Bank

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON. S.W.7.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)
11. V. 45		

(7993) Wt.36064/0349 5,000 12/38 A.&E.W.Ltd. Gp.686

TG 11 SW 6 1136 1457 **East of Weston Green**

Surface level (+46.9 m) +154 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Waste (19.8 m+) 65 ft+

		Thickness (m)	ft	Depth (m)	ft
Boulder Clay	Soil and brown stony clay.	(3.4)	11	(3.4)	11
Glacial Sand and Gravel	'Clayey' sandy gravel. Gravel: coarse with fine, subangular flint. Sand: fine with medium and traces of coarse, subangular ; brown.	(0.9)	3	(4.3)	14
Boulder Clay	Brown chalky clay with occasional flint cobbles.	(2.1)	7	(6.4)	21
Glacial Sand and Gravel	'Very clayey' pebbly sand. Gravel: fine, subangular, flint. Sand: fine with traces of medium, subangular; traces of chalk; brown.	(1.2)	4	(7.6)	25
Boulder Clay	Brown-grey chalky clay	(12.2+)	40+	(19.8)	65

	%	mm	%
		+64	0
Gravel	35	-64+16	24
		-16+4	11
		-4+1	5
Sand	47	$-1+\frac{1}{4}$	15
		$-\frac{1}{4}+1/16$	27
Fines	18	-1/16	18

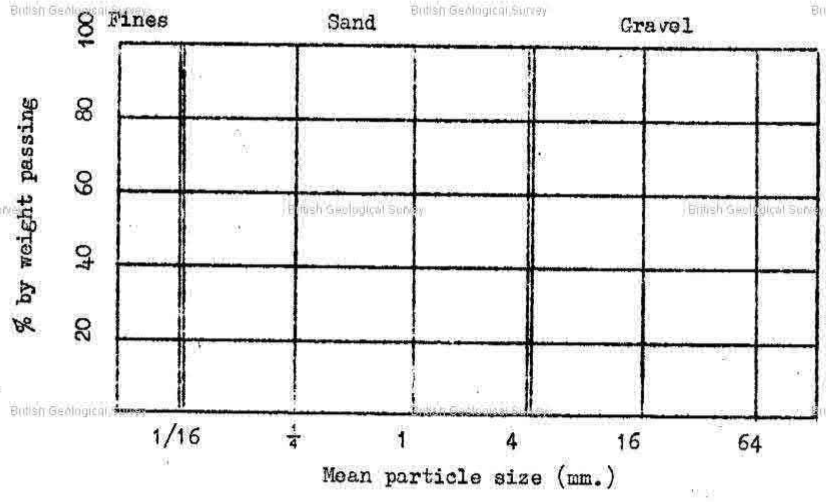
Depth below surface (ft)	Percentage Fines	Sand	Gravel
11 - 14	18	47	35

[redacted]stitute of Geological Sciences Mineral Assessment Unit Sand and Gravel Survey BOREHOLE RECORD SHEET	Borehole Reg. No.: TG 11 SW/6 Temporary designation: Nat. Grid Ref.: 1136 1457 . / Locality: East of Weston Green. Date: 29-10-69 Recorded by: A.R. Clayton.

Drilled by: Fitzpatrick	Horizon	Thickn. m	ft.	Nature
Drill Type: Wirth B1				
Hole diameter: 8"	Overburden		11	Clay.
Ground level (O.D.): c150.	Mineral		14	Sand w. 7' Clay.
Water struck at (O.D.):	Baserock		40	Clay.

Remarks 931. very clayey disregard in calculation GW. 17.3.70.

Grading Curve (from Sampling Analysis Sheet)	Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	1	1	-
Brown stoney boulder clay	11	10	-
Clayey med.-co. sand & fine med. & co gravel. Sand Clayey med.-co. SA-A (flint). Gravel Fine & med. w. co. SA-A flint LPS 40.	14	3	N930
Brown chalky boulder clay w. occ. flint cobbles.	21	7	-
Very clayey fine-med. sand. Sand Fine-med. SA w. brown clay & tr. chalk.	25	4	N931
Light brown chalky boulder clay.	39	14	-
Grey chalky boulder clay.	54	15	-
Brown boulder clay w. abundant chalk	65	9	-

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.

Version 2.0.6

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 514734 : BGS Reference: TG11SW60
British National Grid (27700) : 614280,314280
Report an issue with this borehole

TG11SW/60
1325.1628

(24.38m)
Surface +80. Lining tubes: 124 x 6 in from surface (perforated 94 to 124). R.W.L. +39. P.W.L. +38. Yield 3,000 g.p.h. (51 h. test). Hewson, Dec. 1963.

Sand and Gravel...	...	18	18
UCk ...	...	162	180

Sand + gravel 18'	Top soil	2	2
	Sand + loam	16	18
Upper Chalk 162'	Dry Chalk	27	45
	Chalk	135	180 (54.86m)
mp. F Cox. 11.69.			

6" quarter sheet
50 SE/W

Version 2.0.6

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 514742 : BGS Reference: TG11SW68
British National Grid (27700) : 611830,311220

Report an issue with this borehole

<< | < Prev | Page 1 of 1 | Next > | >>

.114-180/82

TG 11 SW/68

ENGINEER	G. MAUNSELL AND PARTNERS	GROUND LEVEL	21.20 m O.D.
LOGGED BY: FIELDWORK BY: LAB. TESTING BY:	GROUND ENGINEERING LIMITED	COORDINATES	611 830 E 311 220 N
PROJECT	A47 NORWICH SOUTHERN BYPASS	DATES	18/5/82
EXCAVATION METHODS	PERCUSSIVE (DANDO 150) 200mm casing to 5.30m	HOLE NO.	1
		FIGURE	A
		SHEET	1 OF 1

STRATA

DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	DESCRIPTION	LEVEL m O.D.	DEPTH m
18.5.82 11.30				21.20	0.00
			TOPSOIL	20.60	0.60
			Medium dense to dense mottled brown and dark brown fine to coarse very clayey silty SAND with some fine to coarse angular flint gravel (Glacial Sand and Gravel)		
			----- becoming light brown		2.20
	1.70	▽		18.90	2.30
			Very dense cream-brown slightly sandy silty fine to coarse rounded to angular chalk and flint GRAVEL (Glacial Sand and Gravel)		
			----- with grey silty sandy clay		3.00
				17.70	3.50
			Soft white structureless CHALK with fine to coarse angular flints (Upper Chalk) GRADE V to VI		
18.5.82 15.00	5.30	1.90		14.90	6.30
			BOREHOLE COMPLETED		

SAMPLING/ IN SITU TESTING

NO.	DEPTH m	TYPE	BLOWS
1	0.70	D	
2	0.80 1.25	U	(26)
3	1.30	D	
17	1.90	W	
4	1.70 2.15	U	(60)
5	2.20	D	
6	2.30	D	
7	2.30 2.75	BC	N=52
8	2.95	D	
9	3.00 3.45	BC	N=69
10	3.60	D	
11	4.00 4.45	BC	N=7
12	4.50 4.95	U	(17)
13	5.00	D	
14/15	5.30 5.75	DS/B	N=11
16	6.00	D	

LAB TESTING: % <425 | W % | PL % | LL % | MCV | γ Mg/m³ | Cu kN/m²

OTHER TESTS AND NOTES

Water added from 2.00m to 3.50m

Groundwater struck at 2.10m rising to 1.90m in 20mins and not sealed off

WATER: First water strike; Subsequent water strikes; Highest water level in open hole

PIEZOMETER: Upper seal; Response length; Lower seal (Installation details, readings elsewhere)

SAMPLE AND TEST KEY: D Small disturbed sample; B Bulk disturbed sample; W Water sample; U Undisturbed sample; P Piston sample; Rotary core recovery to scale; V Insitu vane test; S Standard penetration test; C Cone penetration test; K Permeability test; PR Pressuremeter test

Blows: N = N value; 26/150, blows for 150mm drive after seating; 26*, blows for part or whole of seating drive only; (26) Undisturbed sample blow count

V Vane strength kN/m² Natural / Remould; Cr Core recovery %; RQD Rock quality designation; <425 Sample % passing 425μm sieve

J. Tiplady BSC C Eng FICE, FIHE
Director (Transport)
Eastern Regional Office

SHEET 1 OF 1 | FIG. A | HOLE NO. 1

L114-18/01/82

TG 11 SW/69

ENGINEER G. MAUNSELL AND PARTNERS	PROJECT A47 NORWICH SOUTHERN BYPASS	GROUND LEVEL 28.70 m O.D.	HOLE NO.
LOGGED BY: GROUND ENGINEERING LIMITED	EXCAVATION METHODS WHEELED HYMAC	COORDINATES 611 890 E 311 130 N	FIGURE A
FIELDWORK BY: "			
LAB. TESTING BY: " " "		DATES 12/5/82	SHEET 1 O

DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	Piez.	STRATA DESCRIPTION	LEG.	LEVEL m O.D.	DEPTH m	SAMPLING/IN SITU TESTING NO.	DEPTH m	TYPE	BLOWS	V / Cr / RQD	LAB TESTING % <425	W %	PL %	LL %	MCV	γ Mg/m³	Cu kN/m²	OTHER TESTS AND NOTES
12.5.82 15.35				SEE FIGURE Ax FOR DETAILS				1	0.40	D										1) Pit completed
								12	0.60	CBR				13	16	23				2) Shored to 3.5
								2	0.70	B										3) Pit sides sta
								3	0.80	D										4) No water enco
								4	1.20	D										5) Photograph ta 2 and 4
								5	1.50	D										Sieve analysis
								6	1.60	B										CBR (0.60m)
								7	2.20	D										
								8	2.60	B										
								9	2.70	D										
								10	3.30	D										
								11	3.40	B										
13.5.82 17.20	3.50	DRY		TRIAL PIT COMPLETED																

WATER
1— First water strike
2— 3— Subsequent water strikes
▽ Highest water level in open hole

PIEZOMETER
Upper seal
Response length
Lower seal
(installation only, readings elsewhere)

SAMPLE AND TEST KEY
D Small disturbed sample
B Bulk disturbed sample
W Water sample
U Undisturbed sample
P Piston sample
Rotary core recovery to scale
V Insitu vane test
S Standard penetration test
C Cone penetration test
K Permeability test
PR Pressuremeter test

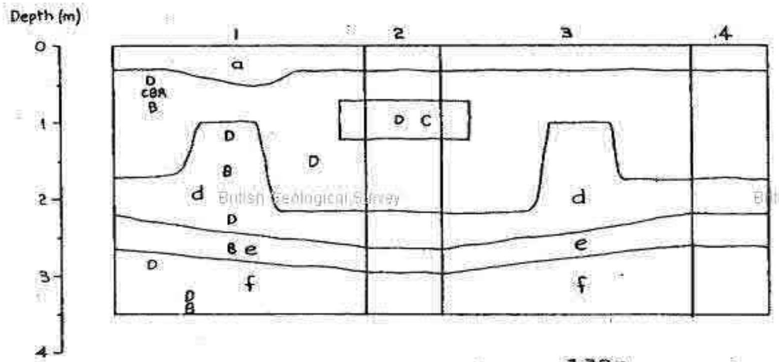
Blows N = N value
26/150, blows for 150mm drive after seating
26*, blows for part or whole of seating drive only.
[26] Undisturbed sample blow count

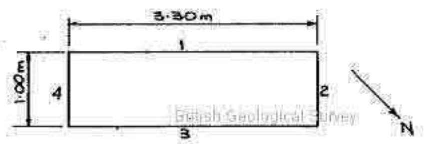
V Vane strength kN/m² Natural / Remould
Cr Core recovery %
RQD Rock quality designation
<425 Sample % passing 425μm sieve

J. Tiplady BSC. C.Eng. FICE, FIHE
Director (Transport)
Eastern Regional Office (Transport)
49-51 Goldington Road, Bedford

TG 11 SW | 69

ENGINEER: G. MAUNSELL AND PARTNERS	PROJECT A47 NORWICH SOUTHERN BYPASS	GROUND LEVEL 26.70 m O.D.	HOLE NO. 2
LOGGED BY: GROUND ENGINEERING LIMITED FIELDWORK BY: " " " LAB. TESTING BY:" " "	EXCAVATION METHODS WHEELED HYMAC	COORDINATES 611 890 E 311 130 N	FIGURE Ax
		DATES 12/5/82	SHEET 1 OF 1





STRATA

a) TOPSOIL (Dark brown sandy silty clay, with occasional fine to coarse subangular, subrounded gravel and rootl

b) Medium dense laminated light brown and orange brown si fine SAND becoming fine to coarse sand at 1.40 a littl to coarse subrounded subangular gravel and lenses of sandy clay with rare cobbles (Glacial Sand and Grav

c) Side 2. Medium dense mottled light brown and brown ve sandy fine to coarse subangular to subrounded GRAVEL w occasional cobbles. (Glacial Sand and Gravel)

d) Hard pale grey silty CLAY with occasional fine to coar chalk and flint gravel. (Boulder Clay)

e) Dense mottled light brown and orange brown clayey very cobble sized flints (Glacial Sand and Gravel)

f) Stiff mottled light grey and orange brown silty CLAY w occasional fine to coarse chalk and flint gravel with of clayey sand and rare cobble sized flints (Boulder C

DISCONTINUITIES Joint directions, 070/15 dip direction/dip in deg. Fracture spacing, Rf 20/50/200, minimum/average/maximum in mm. DEPTH All depths, levels and thicknesses in metres.	WATER 1→ First water strike 2→ Subsequent water strikes 3→	J. Tiplady BSC. C.Eng. FICE, FIHE, Director (Transport) Eastern Regional Office (Transport) 49-51 Goldington Road, Bedfor

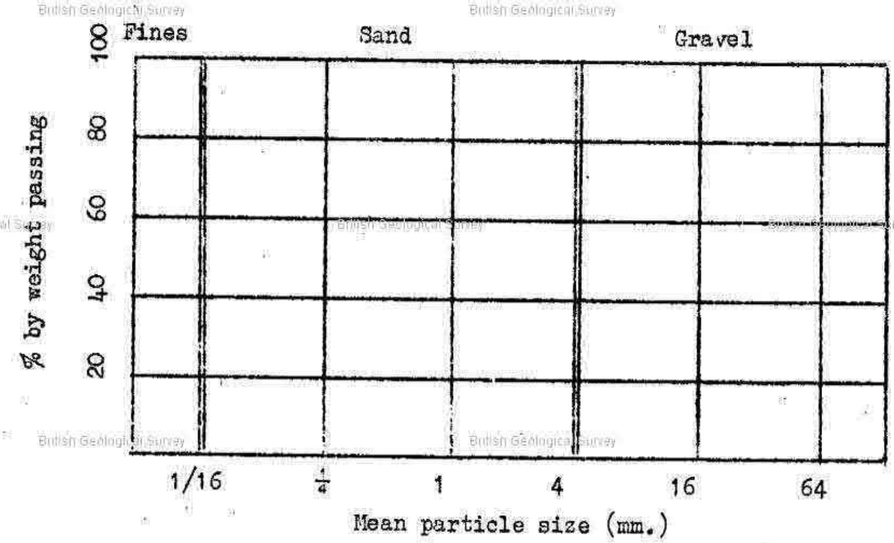
Institute of Geological Sciences	Borehole Reg. No.: TG 11 SW/7
Mineral Assessment Unit	Temporary designation: 4
Sand and Gravel Survey	Nat. Grid Ref.: 1165 1365.
BOREHOLE RECORD SHEET	Locality: Telegraph Hill, Honingham.
	Date: 24-10-69.
	Recorded by: A.R. Clayton.

	Horizon	Thickn. m	Thickn. ft.	Nature
Drilled by: Fitzpatrick				
Drill Type: Wirth Bl				
Hole diameter: 8"	Overburden		60 NP	Boulder Clays
Ground level (O.D.): c190	Mineral			
Water struck at (O.D.): –	Baserock			

Remarks

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	2	2	–
Brown & Grey Clay	21	19	–
Brown stoney boulder clay	35	14	–
Brown sandy boulder clay	42	7	
Grey stoney boulder clay	54	12	
Dark brown soft clay with tr. blue	60 NP	6 NP	–

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.

TG 11 SW 7 1164 1365 Telegraph Hill, Honingham

Surface level (+59. 5 m) +195 ft
Groundwater conditions not recorded
Wirth B1, 8 inch diam.
October 1969

Waste (18. 3 m+) 60 ft+

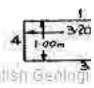
		Thickness (m)	ft	Depth (m)	ft
Boulder Clay	Soil and brown clay with traces of sand and gravel in places.	(12. 8)	42	(12. 8)	42
	Dark grey stony clay becoming dark brown with depth.	(5. 5+)	18+	(18. 3)	60

14-180182

TG 11 SW/70

ENGINEER	G. MAUNSELL AND PARTNERS
LOGGED BY:	GROUND ENGINEERING LIMITED
FIELDWORK BY:	" " "
LAB. TESTING BY:	" " "
PROJECT	A47 NORWICH SOUTHERN BYPASS
EXCAVATION METHODS	WHEELED HYMAC
GROUND LEVEL	30.70 m O.D.
COORDINATES	612 050 E 311 100 N
DATES	11/5/82
HOLE NO.	
FIGURE	A
SHEET	1 OF

DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	Pie.	STRATA: DESCRIPTION	LEG.	LEVEL m O.D.	DEPTH m	SAMPLING/ IN SITU TESTING: NO.	DEPTH m	TYPE	BLOWS	V / Cr / RQD	LAB TESTING: % <425	W %	PL %	LL %	MCV	γ Mg/m³	Cu kN/m²	OTHER TESTS AND NOTES
11.5.82 14.40						30.70	0.00													1)Pit completed 3.50m 2)No groundwater 3)Photographs ta 2
				TOPSOIL(Dark grey brown sandy silty claywith a little fine to coarse subangular gravel)		30.40	0.30	1	0.40	D										
				Firm mottled brown and light brown slightly sandy silty CLAY with occasional fine to coarse chalk and flint gravel (Boulder Clay)				2	0.50 0.60	B			85	16	17	38	19			
								3	0.90	D				14						
				Very stiff fissured mottled light grey, light brown andorange brown very silty CLAY with rare fine rootlets (Boulder Clay)		29.40	1.30	4	1.40	D										
								5	1.50 1.60	B			100	16	17	35				
				.... with silt laminations			2.00	6	1.90	D										
								7	2.40	D										
								8	2.50 2.60	B										
								9	2.90	D										
				Medium dense laminated light brown orange brown and brown silty fine SAND and light grey silty CLAY with occasional fine to medium rounded chalk gravel (Glacial Sand and Gravel)		27.40	3.30	10	3.40 3.50	B										
11.5.82 15.25		DRY				27.20	3.50	11	3.50	D										
				TRIAL PIT COMPLETED																



WATER
1 First water strike
2, 3 Subsequent water strikes
▽ Highest water level in open hole

PIEZOMETER
Upper seal
Response length
Lower seal
(Installation only, readings elsewhere)

SAMPLE AND TEST KEY
D Small disturbed sample
B Bulk disturbed sample
W Water sample
U Undisturbed sample
P Piston sample
R Rotary core recovery to scale
V Insitu vane test
S Standard penetration test
C Cone penetration test
K Permeability test
PR Pressuremeter test

Blows N = N value
26/150, blows for 150mm drive after seating
26*, blows for part or whole of seating drive only.
(26) Undisturbed sample blow count

V Vane strength kN/m² Natural / Remould
Cr Core recovery %
RQD Rock quality designation
<425 Sample % passing 425μm sieve

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- 180182

TG 11 SW/71

ENGINEER G MAUNSELL AND PARTNERS
LOGGED BY: GROUND ENGINEERING LIMITED
FIELDWORK BY: "
LAB. TESTING BY: "

PROJECT A47 NORWICH SOUTHERN BYPASS
EXCAVATION METHODS
PERCUSSIVE (DANDO 150)
200mm casing to 4.50m

GROUND LEVEL 31.75 m O.D.
COORDINATES 612195 E 311039 N
DATES 18/5/82 - 19/5/82

HOLE NO. 4
FIGURE A
SHEET 1 OF

STRATA

DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	DESCRIPTION	LEVEL m O.D.	DEPTH m
				31.75	0.00
18/5/82 15.30			TOPSOIL	31.45	0.30
			Brown mottled white fine and medium very clayey silty SAND with root traces and occasional fine round chalk gravel (Boulder Clay)	30.25	1.50
			Very dense cream brown slightly silty sandy fine to coarse angular flint and rounded chalk GRAVEL with small creamy-grey clay pockets (Glacial Sand and Gravel)		2.30
			---- becoming very clayey with flint cobbles	28.85	2.90
			Soft to firm cream-grey silty slightly sandy CLAY with fine and medium round chalk gravel (Boulder Clay)		
17.30 18/5/82	4.50	DRY	---- becoming grey with red-brown mottling		4.50
19/5/82 08.30		DRY			
19.5.82 10.30	4.50	4.50	With flint cobbles	24.75	7.00
			BOREHOLE COMPLETED		

SAMPLING/ IN SITU TESTING / LAB TESTING

NO.	DEPTH m	TYPE	BLOWS	V / Cr/RQD	% <425	W %	PL %	LL %	MCV	V Mg/m³	Cu kN/m²
1	0.50	D									
2	0.70 - 1.15	U	(46)								
3	1.20	D									
4	1.60	D									
5	1.70 - 2.15	BC	N=53								
6	2.30	D									
7	2.40 - 2.85	BC	N=110								
8	2.90	D			52	20	14	30		2.09	30 $\phi u=5°$
9	3.00 - 3.45	U	(60)								
10	3.50	D									
11	4.00 - 4.45	U	(60)								
12	4.50	D									
13	5.00 - 5.45	U	(62)								
14	5.50	D									
15	6.50 - 6.95	U	(63)								
16	7.00	D									

OTHER TESTS AND NOTES

Water added from 2.90m.
Sieve analysis

Standing water 4.50m on completion of hole.

WATER
First water strike
Subsequent water strikes
Highest water level in open hole

PIEZOMETER
Upper seal
Response length
Lower seal
(installation only, readings elsewhere)

SAMPLE AND TEST KEY
D Small disturbed sample
B Bulk disturbed sample
W Water sample
U Undisturbed sample
P Piston sample
R Rotary core recovery to scale
V Insitu vane test
S Standard penetration test
C Cone penetration test
K Permeability test
PR Pressuremeter test

Blows N = N value
26/150, blows for 150mm drive after seating
24*, blows for part or whole of seating drive only
(26) Undisturbed sample blow count

V Vane strength kN/m² Natural Remould
Cr Core recovery %
RQD Rock quality designation
<425 Sample % passing 425µm sieve

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?-180/82

TG 11 SW/72

ENGINEER G. MAUNSELL AND PARTNERS	PROJECT A47 NORWICH SOUTHERN BYPASS	GROUND LEVEL 30.30 m O.D.	HOLE NO. 5
LOGGED BY: GROUND ENGINEERING LIMITED FIELDWORK BY: " " LAB. TESTING BY: " " "	EXCAVATION METHODS WHEELED HYMAC	COORDINATES 612 420 E 311 040 N	FIGURE A
		DATES 11/5/82	SHEET 1 OF

STRATA

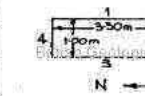
DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	PIEZ.	DESCRIPTION	LEVEL m.O.D.	DEPTH m
1.5.82 13.00					30.30	0.00
				TOPSOIL (Dark brown very sandy silty clay with rootlets and occasional fine to coarse sub-rounded to sub-angular gravel)	29.40	0.90
				Firm orange brown to brown sandy CLAY with occasional fine to coarse subangular gravel and sand lenses (Boulder Clay)		
				----- becoming firm to stiff light brown and with occasional fine to medium chalk and flint gravel		1.30
				-- becoming stiff friable, mottled light grey and light brown		1.50
				---- becoming fine to coarse gravel		2.15
				----- becoming sandy		2.80
				----- becoming firm to stiff		3.00
1.5.82 4.20		DRY			26.80	3.50
				TRIAL PIT COMPLETED		

SAMPLING/ IN SITU TESTING and LAB TESTING

NO.	DEPTH m	TYPE	BLOWS	V / Cr/RQD	% <425	W %	PL %	LL %	MCV	W Mg/m³	Cu kN/m²
1	0.50	D				16					
2	0.50 - 0.60	B									
3	0.90	D			90	15	14	34			
4	1.40	D									
5	1.50	B			99	22	18	39			
6	1.50										
7	1.90	U38				17				2.14	145 Qu=25
8	1.90	D									
9	2.40	D									
10	2.40 - 2.50	B				10					
11	2.90	D									
12	3.40 - 3.50	B									
13	3.50	D									

OTHER TESTS AND NOTES

1) Pit completed an[d] to 3.50m
2) No groundwater e[ncountered]
3) Photographs take[n] 2



WATER: First water strike; Subsequent water strikes; Highest water level in open hole

PIEZOMETER: Upper seal; Response length; Lower seal (Installation only, readings elsewhere)

SAMPLE AND TEST KEY: D Small disturbed sample; B Bulk disturbed sample; W Water sample; U Undisturbed sample; P Piston sample; Rotary core recovery to scale; V Insitu vane test; S Standard penetration test; C Cone penetration test; K Permeability test; PR Pressuremeter test

Blows: N = N value; 26/150, blows for 150mm drive after seating; 26*, blows for part or whole of seating drive only; (26) Undisturbed sample blow count

V Vane strength kN/m² Natural / Remould; Cr Core recovery %; RQD Rock quality designation; <425 Sample % passing 425µm sieve

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TG 11 SW/73

ENGINEER	G. MAUNSELL AND PARTNERS	PROJECT	A 47 NORWICH SOUTHERN BYPASS
LOGGED BY:	GROUND ENGINEERING LIMITED	EXCAVATION METHODS	PERCUSSIVE (DANDO 150)
FIELDWORK BY:	" " "		200mm casing to 1.50m
LAB. TESTING BY:	" " "		

GROUND LEVEL 30.75 m O.D.

COORDINATES 612 570 E 311 010 N

DATES 21/5/82

HOLE NO. 6

FIGURE A

SHEET 1 OF

STRATA

DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	Piez.	DESCRIPTION	LEG.	LEVEL m.O.D.	DEPTH m
21.5.82 0930						30.75	0.00
				TOPSOIL(Brown clayey silty fine and medium SAND with occasional fine subangular gravel		30.45	0.30
				Brown very clayey silty fine to medium SAND with occasional fine to coarse angular gravel (Boulder Clay)		29.80	0.95
				Stiff yellow brown silty sandy CLAY with fine to coarse, rounded to angular chalk and flint gravel (Boulder Clay)			
				--- without flint gravel			2.90
				--- with red brown staining			4.90
21.5.82 1230	1.50	DRY				23.75	7.00
				BOREHOLE COMPLETED			

SAMPLING/ IN SITU TESTING

NO.	DEPTH m	TYPE	BLOWS	V / Cr RQD
1	0.35	D		
2	0.40	U	(46)	
	0.85			
3	0.90	D		
4	1.40	U	(70)	
	1.85			
5	1.90	D		
6	2.40	U	(80)	
	2.85			
7	2.90	D		
8	3.40	U	(58)	
	3.85			
9	3.90	D		
10	4.40	D	(56)	
	4.85	D		
11	4.90			
12	5.90	U	(63)	
	6.35			
13	6.40	D		
14	7.00	D		

LAB TESTING: % <425 | W % | PL % | LL % | MCV | γ Mg/m³ | Cu kN/m²

OTHER TESTS AND NOTES

WATER
First water strike
Subsequent water strikes
Highest water level in open hole

PIEZOMETER
Upper seal
Response length
Lower seal
(Installation only, readings elsewhere)

SAMPLE AND TEST KEY
D Small disturbed sample
B Bulk disturbed sample
W Water sample
U Undisturbed sample
P Piston sample
R Rotary core recovery to scale
V Insitu vane test
S Standard penetration test
C Cone penetration test
K Permeability test
PR Pressuremeter test

Blows N = N value
26/150, blows for 150mm drive after seating
26*, blows for part or whole of seating drive only
(26) Undisturbed sample blow count

V Vane strength kN/m² Natural / Remould
Cr Core recovery %
RQD Rock quality designation
<425 Sample % passing 425μm sieve

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-180/82

TG 11 SW/74

GINEER G. MAUNSELL AND PARTNERS
GGED BY: GROUND ENGINEERING LIMITED
ELDWORK BY: " " "
AB. TESTING BY: " " "

PROJECT A47 NORWICH SOUTHERN BYPASS
EXCAVATION METHODS PERCUSSIVE (DANDO 150)
200mm casing to 1.40m

GROUND LEVEL 34.95 m O.D.
COORDINATES 612 760 E 310 805 N
DATES 17/5/82

HOLE NO. 7
FIGURE A
SHEET 1 OF 1

DATE/TIME AT DEPTH	DEPTH OF CASING	DEPTH TO WATER	Piez.	STRATA DESCRIPTION	LEG.	LEVEL m.O.D.	DEPTH m	NO.	DEPTH m	TYPE	BLOWS	V / Cr / RQD	% <425	W %	PL %	LL %	MCV	γ Mg/m³	Cu kN/m²	OTHER TESTS AND NOTES
						34.95	0.00													
.5.82				TOPSOIL		34.65	0.30	1	0.35	D										
30				Very stiff greenish brown silty sandy CLAY with chalk gravel (Boulder Clay)				2	0.40 0.85	U	(20)		78	12	19	33	9.3			
								3	0.90	D										
								4	1.40 1.85	U	(60)		69	17	7	35		2.11	157	
				becoming stiff grey brown and very sandy			1.90	5	1.90	D										
								6	2.40 2.85	U	(60)									
				becoming firm green-grey-brown silty CLAY with chalk gravel and orange-brown silty clay pockets			2.90	7	2.90	D										
								8	3.40 3.85	U	(71)		83	20	17	36		2.07	65	
								9	3.90	D										
								10	4.40 4.85	U	(82)									
								11	4.90	D										
								12	6.20 6.65	U	(38)									
17/5/82								13	6.70	D										
30	1.40	DRY				27.95	7.00	14	7.00	D										
				BOREHOLE COMPLETED																

WATER
1 First water strike
2, 3 Subsequent water strikes
▽ Highest water level in open hole

PIEZOMETER
Upper seal
Response length
Lower seal
(installation only, readings elsewhere)

SAMPLE AND TEST KEY
D Small disturbed sample
B Bulk disturbed sample
W Water sample
U Undisturbed sample
P Piston sample
Rotary core recovery to scale
V Insitu vane test
S Standard penetration test
C Cone penetration test
K Permeability test
PR Pressuremeter test

Blows N = N value
26/150, blows for 150mm drive after seating
26*, blows for part or whole of seating drive only
(26) Undisturbed sample blow count

V Vane strength kN/m²
Natural / Remould
Cr Core recovery %
RQD Rock quality designation
<425 Sample % passing 425μm sieve

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SHEET 1 OF 1 | FIG. A | HOLE NO 7

TG 11 SW 8 1175 1251 Hall Hills, Honingham

Surface level (+54. 7 m) +179 ft
Water not struck
Wirth B1, 8 inch diam.
November 1969

Overburden (0. 3 m) 1 ft
Mineral (24. 1 m+) 79 ft+

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
	Soil.	(0. 3)	1	(0. 3)	1
Glacial Sand and Gravel	Sand. Gravel concentrated from 16 to 28 ft (4. 9 to 8. 5 m), and 49 to 52 ft (14. 9 to 15. 8 m). Clayey from 49 to 52 ft (14. 9 to 15. 8 m). Traces of hard chalk in lower half of deposit. Gravel: fine to coarse becoming fine with depth, subangular with traces of subrounded, mainly flint. Sand: fine and medium with traces of coarse; light brown.	(24. 1+)	79+	(24. 4)	80

	%	mm		%
		+64	:	0
Gravel	4	-64+16	:	2
		-16+4	:	2
		-4+1	:	3
Sand	93	$-1+\frac{1}{4}$	:	43
		$-\frac{1}{4}+1/16$	:	47
Fines	3	-1/16	:	3

Depth below surface (ft)	Percentage Fines	Sand	Gravel
1 - 4	2	98	0
4 - 7	0	100	0
7 - 10	1	99	0
10 - 13	0	100	0
13 - 16	1	99	0
16 - 19	3	82	15
19 - 22	5	83	12
22 - 25	1	79	20
25 - 28	0	94	6
28 - 31	0	96	4
31 - 34	1	99	0
34 - 37	1	99	0
37 - 40	1	99	0
40 - 43	0	93	7
43 - 46	2	92	6
46 - 49	4	96	0
49 - 52	23	39	38
52 - 55	5	95	0
55 - 58	2	98	0
58 - 61	1	99	0
61 - 64	1	99	0
64 - 67	2	98	0
67 - 70	1	98	1
70 - 73	4	96	0
73 - 76	6	94	0
76 - 79	1	99	0
79 - 80	15	71	14

tute of Geological Sciences
ineral Assessment Unit
Sand and Gravel Survey
BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/8
Temporary designation:
Nat. Grid Ref.: 11751251
Locality: Hall Hills, Honingham.
Date: 4-11-69
Recorded by: A. R. Clayton.

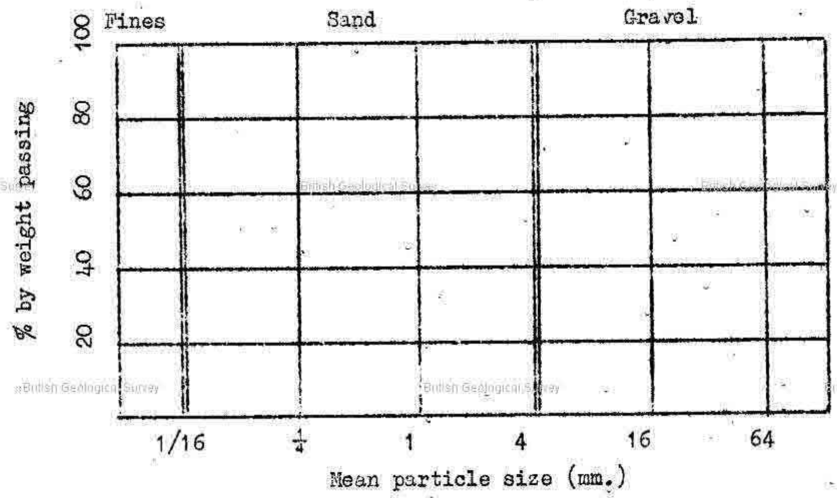
Drilled by: Fitzpatrick
Drill Type: Wirth Bl
Hole diameter: 8"
Ground level (O.D.):
Water struck at (O.D.): Dry

Horizon	Thickn. m	Thickn. ft.	Nature
Overburden		1	Soil
Mineral		79	Sand
Baserock			

Remarks

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	1	1	
Med. sand tr. med. gravel. Sand Med. tr. co. SA (White flint) light brown. Gravel Med. SA flint.	7	6	N2001-2002
Med. Sand tr. med. gravel. Sand) As N2002 Gravel)	10	3	N2003
Med. sand tr. med.-co. gravel. Sand Med. SA tr. co. SA white flint occ. chalk. Gravel Med. & fine w. co. SA light flint.	13	3	N2004
Med. sand tr. med.-co. gravel. Sand As N2004 Gravel Med. & fine w. co. SA light flint tr. SA flint cobbles LPS 90.	16	3	N2005
Med. w. co. Sand tr. fine-med. gravel.	19	3	N2006

→

[50]

Description of Strata (continued)	Depth to base ft.	Thickn. ft.	Sample Nos.
Sand Med. w. fine SA light brown. Gravel Fine & med. SA flint occ. fine SR chalk.			
Med. & co. sand w. med.-co. gravel. Sand Med. SA w. co. SA white flint tr. SR qtz granule. Gravel Med.-co. tr. cobble SR-SA flint LPS 90.	22	3	N2007
Med. w. co. sand w. med. & co. gravel Sand As N2007 Gravel As N2007 No cobble LPS 45.	25	3	N2008
Med. sand w. fine-co. gravel. Sand Med. SA tr. co. SA-SR light brown. Gravel Fine & med. SA dark flint w. co. SA-SR flint LPS 55.	31	6	N2009-2010
Med. sand occ. fine gravel. Sand Med. SA occ. co. chalk. Gravel Fine SA flint.	40	9	N2011-2013
Med. & co. sand. tr. fine-med. gravel. Sand Med. & co. SA brown tr. brown clay band. Gravel Fine & med. SA white flint w. chalk.	43	3	N2014
Med. & co sand tr. fine-med. gravel. Sand As N2014. Gravel As N2014 w. brown co. flint.	46	3	N2015
Med. sand tr. fine & med. gravel. Sand Med w./tr. co. SA light brown. Gravel As N2014.	49	3	N2016
Med. & co. chalky sand w. fine & med. chalky gravel. Sand Med. SA w. med.-co. SR chalk.(soft chalk pellets w. tr. carbonaceous matter). ~~Gravel Fine SA flint & SR chalk w. med. SR chalk.~~	52	3	N2017
Med. & fine sand occ. fine-med. gravel. Sand Fine & med. SA yellow-brown. Gravel Fine & med. SA light flints.	58	6	N2018-2019
As N2019 w. soft chalk pellets incl. carbonaceous matter.	61	3	N2020
As N2020 w.occ. co. sand.	64	3	N2021
Med. & fine sand. Sand Med. & fine light brown-cream.	70	6	N2022-2023
Fine sand. Sand Fine light brown cream-cream.	73	3	N2024
Fine & med. sand rare fine gravel Sand Fine & med. light brown. Gravel Fine SA flint.	76	3	N2025
Fine & med. sand tr. fine & med. gravel. Sand Fine & med. SA tr. co. light brown. Gravel Fine & med. SA flint. N2027 incl. tr. brown stoney clay.	80	4	N2026-2027

TG 11 SW 9 1188 1174 Church Plantation, Honingham

Surface level (+39.0 m) +128 ft
Water not struck
Wirth B1, 8 inch diam.
October 1969

Overburden (0.6 m) 2 ft
Mineral (9.1 m) 30 ft
Waste (10.4 m) 34 ft
Bedrock (0.9 m+) 3 ft+

		Thickness (m)	ft	Depth (m)	ft
	Soil.	(0.6)	2	(0.6)	2
Glacial Sand and Gravel	Pebbly sand. Gravel concentrated in lower 12 ft (3.6 m). Traces of hard chalk. 'Clayey' at base. Gravel: fine to coarse, subangular flint with traces of quartz. Sand: medium with fine and traces of coarse, subangular, flint; light brown.	(9.1)	30	(9.7)	32
Boulder Clay	Brown and light grey chalky clay with a 2 ft (0.6 m) thick sandy gravel seam at base.	(10.4)	34	(20.1)	66
	Dark brown clay	(0.9)	3	(21.0)	69
Upper Chalk	Chalk.	(0.9+)	3+	(21.9)	72

%		mm	%
		+64	0
Gravel	6	-64+16	3
		-16+4	3
		-4+1	7
Sand	88	$-1+\frac{1}{4}$	45
		$-\frac{1}{4}+1/16$	36
Fines	6	-1/16	6

Depth below surface (ft)	Fines	Sand	Gravel
2 - 5	4	96	0
5 - 8	3	96	1
8 - 11	2	98	0
11 - 14	9	91	0
14 - 17	5	95	0
17 - 20	1	99	0
20 - 23	1	74	25
23 - 26	10	77	13
26 - 29	10	86	4
29 - 32	18	61	21

Version 2.0.6

BGS ID: 514680 : BGS Reference: TG11SW9
British National Grid (27700) : 611800,311740
Report an issue with this borehole

[redacted]e of Geological Sciences
[redacted]ineral Assessment Unit
Sand and Gravel Survey
BOREHOLE RECORD SHEET

Borehole Reg. No.: TG 11 SW/9
Temporary designation: 8
Nat. Grid Ref.: 118~~9~~ 117~~6~~ .4
Locality: Church Plantn Honingham
Date: 22-10-69
Recorded by: AR. Clayton.

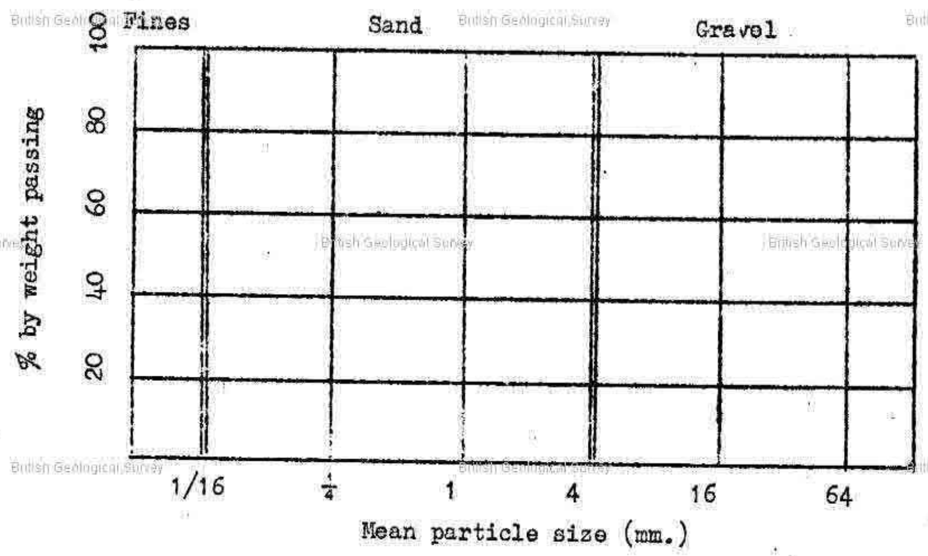
Drilled by: Fitzpatrick
Drill Type: Wirth B1
Hole diameter: 8"
Ground level (O.D.): c120
Water struck at (O.D.): –

Horizon	Thickn. m	Thickn. ft.	Nature
Overburden		2	Soil
Mineral		64	Sand with 32' clay
Baserock		6	Clay and Chalk

Remarks

Grading Curve (from Sampling Analysis Sheet)

Grading percentages:	Fines	Sand	Gravel



Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	2	2	–
Med. Sand Sand Med. SA light brown	11	9	N846-N848
Med. sand w tr. fine gravel Sand Med. SA occ. co. SA chalk & patina light brown Gravel fine SA flint w. tr. fine SA chalk	23	12	N849-852
Med sand w. fine gravel Sand } N852 q.v. Gravel }	26	3	N853

Clayey med. sand w. fine gravel Sand } Gravel } As N853	29	3	N854
Very clayey med. sand w. fine gravel Sand } Gravel} As N854 w. tr. brown chalky boulder clay	32	3	N855

[50]

TG11SW 94

For Institute use only GEOLOGICAL CLASSIFICATION	If measurements start below ground surface, state how far.	Feet	Inches	Metres	Feet	Inches	Metre
C	SAND.	12	0		12	0	
outwash	BRICK EARTH.	34	0		46	0	
Sander	SAND.	37	0		83	0	
GS+G	BRICK EARTH.	13	0		96	0	
+ Till	SAND.	14	0		110	0	
U.chk	CHALK.	70	0		180	0	

RECORD OF WELL

For Institute use only Licence No. E7/34/11/9/44
N. 15535

TG11/200
161/723

EXACT SITE OF WELL

At MERRY HILL FARM

Town or Village RINGLAND

County NORFOLK

Six-inch County Sheet 161

Six-inch National Grid sheet and reference 1232-1278 TG.11.SW.

For MR. A. AVERY

State whether owner, tenant, builder, contractor, consultant, etc.:— OWNER.

Address (if different from above) WINDY RIDGE. THE HEATH. HEVINGHAM. NORFOLK.

Level of ground surface above sea level (O.D.) + c. 180 ft (...m)

*DELETE AS NECESSARY

If well top is not at ground level, state how far above:* below: ...ft (...m)

SHAFT...ft (...m); diameter...ft (...m);

HEADINGS (please attach details—dimensions and directions)

BORE 180 ft (...m); diameter: at top 4 in (...cm); at bottom 4 in (...cm)

Full details of permanent lining tubes (position, length, diameter, plain, slotted, etc.)
4" S&S STEEL TUBE 140'
PLAIN BORE 40'

TEST CONDITIONS

Water struck at depths of ...ft (...m) below well top

Rest level of water 112 ft (...m) ~~above*~~ below well top. Suction at 140 ft (...m)

Yield on 5 hours'* ~~days'~~ test pumping at 400 galls (...m³) per HOUR with depression to 130 ft (...m) below well top. Recovery to rest level in — mins* hours

Capacity of pump 400 g.p.h. (...m³/h)

Date of measurements 27. 9. 83

NORMAL CONDITIONS

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type GRUNDFOS SP2/18. Motive power ELECTRIC

Capacity 400 galls (...m³) per hour. Suction at 147 ft (...m) below well top. Amount pumped...galls (...m³) per day. Estimated consumption...galls (...m³) per week

Well made by PANKS ENGINEERS NORWICH Date of sinking 27. 9. 83

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

LOG OF STRATA OVERLEAF

Received from PANKS ENGRS
Date 13/11/83
Observation well
Recorder
E.R. log
Site marked on
1" map O
6" map O
(use symbol)
Copy to E.A. & S.E.
Date

INSTITUTE OF GEOLOGICAL SCIENCES,
WATER DEPARTMENT,
SOUTH KENSINGTON,
LONDON, S.W.7.

Eastern L.S. Anglian Water Region, NRA 900066

TG11SW 99 128-133 TG11/212A

** GEORGE STOW & CO LTD ** Code: AW016

Reading Road - Henley-on-Thames - RG9 1DX

TG11SW

BOREHOLE RECORD

Borehole No: RW 1 Date completed: 24-09-90

161

All depths to be measured below Ground Level

Client: N.R.A. Anglian Region

Exact Site: RW 1 - Ringland (NGR: TG 128 133)

Ground Level (O.D.): ....m

Depth of Bore: 65 m Diameter: At Top 450 mm. Bottom 300 mm

Details of Permanent Lining Tubes

Diameter	Length Inserted					
450 mm	15.5 m Plain	..... m Slotted	Top At	0.5	m	A.G.L.
300 mm	8 m "	..... m "	"	13	m	B.G.L.
300 mm	..... m "	36 m "	"	21	m	B.G.L.
300 mm	8 m "	..... m "	"	57	m	B.G.L.

Rest Level of Water below Ground Level: 18.10 m

Yield on test 18 hours Pumping: 48 litres/sec Date:22-09-90

Pumping Water Level: 23 m below G.L.

Time of Recovery: ....

Remarks: ....

STRATA RECORD

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS METRES	DEPTH METRES
? Glacial Sand and Gravel	light brown sand & stones	2	2
	SAND & CHALK	2	4
Upper Chalk	CLAY / CHALK with flints	2	6
	brown puggy CHALK with flints	2	8
	creamy soft CHALK	7	15
	soft CHALK with flints	24	39
	firm CHALK with flints	26	65

Smm 17/4/91

2001

RECEIVED N.G.D.C.
DATE: 5 NOV 1990
SIG:

4th Floor
6 Devonshire Square
London
EC2M 4YE

wsp.com

Appendix D

NOISE ASSESSMENT REPORT

Figure D.1: Study Area / Calculation Area

Figure D.2: Baseline noise contours – Do-Minimum 2025

Figure D.3: Baseline noise contours – Do-Minimum Night-time 2040

Figure D.4: Option A noise contours – Do-Something 2025

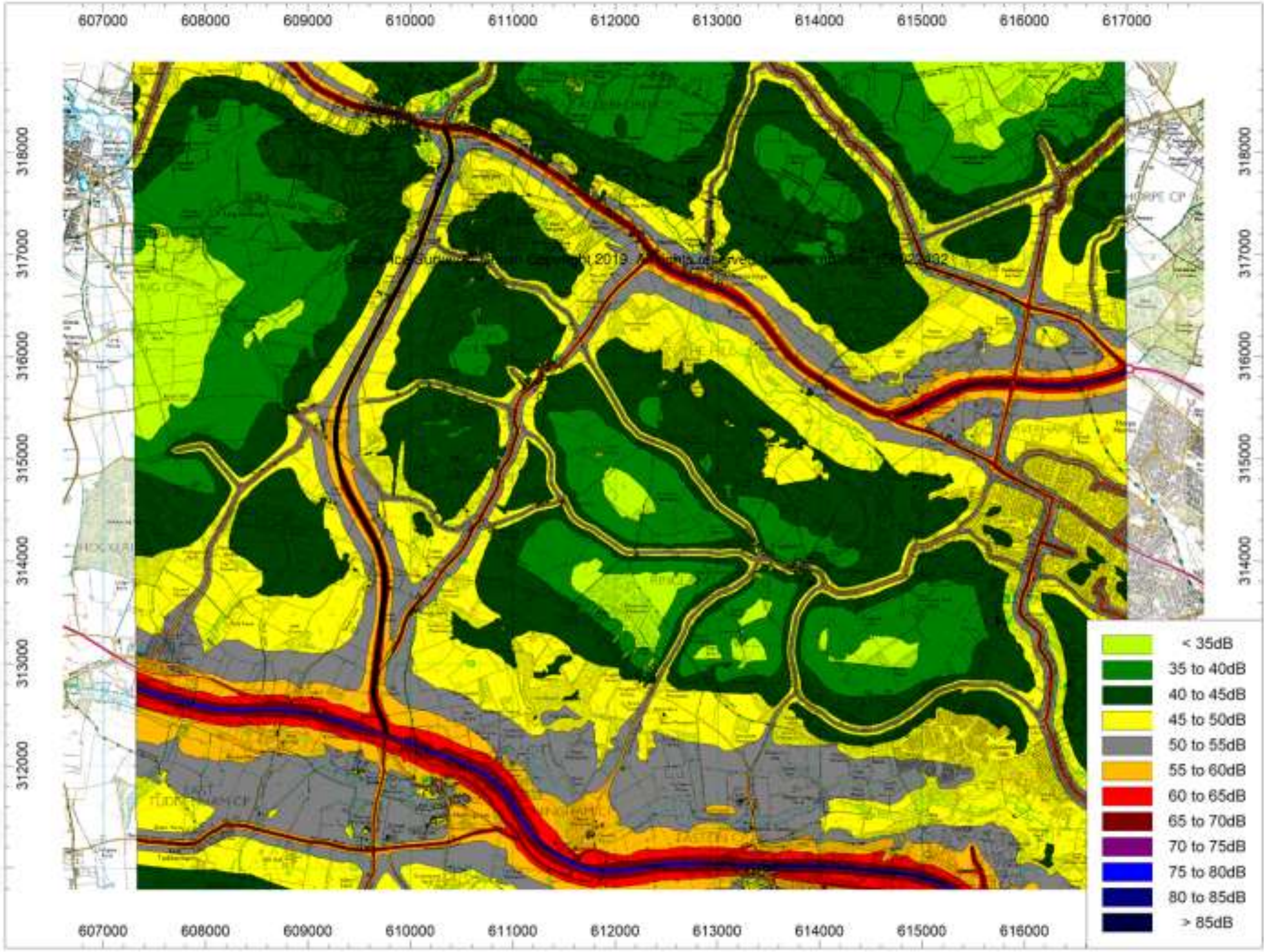


Figure D.5: Option A noise change contours – Do-Minimum 2025 to Do-Something 2025

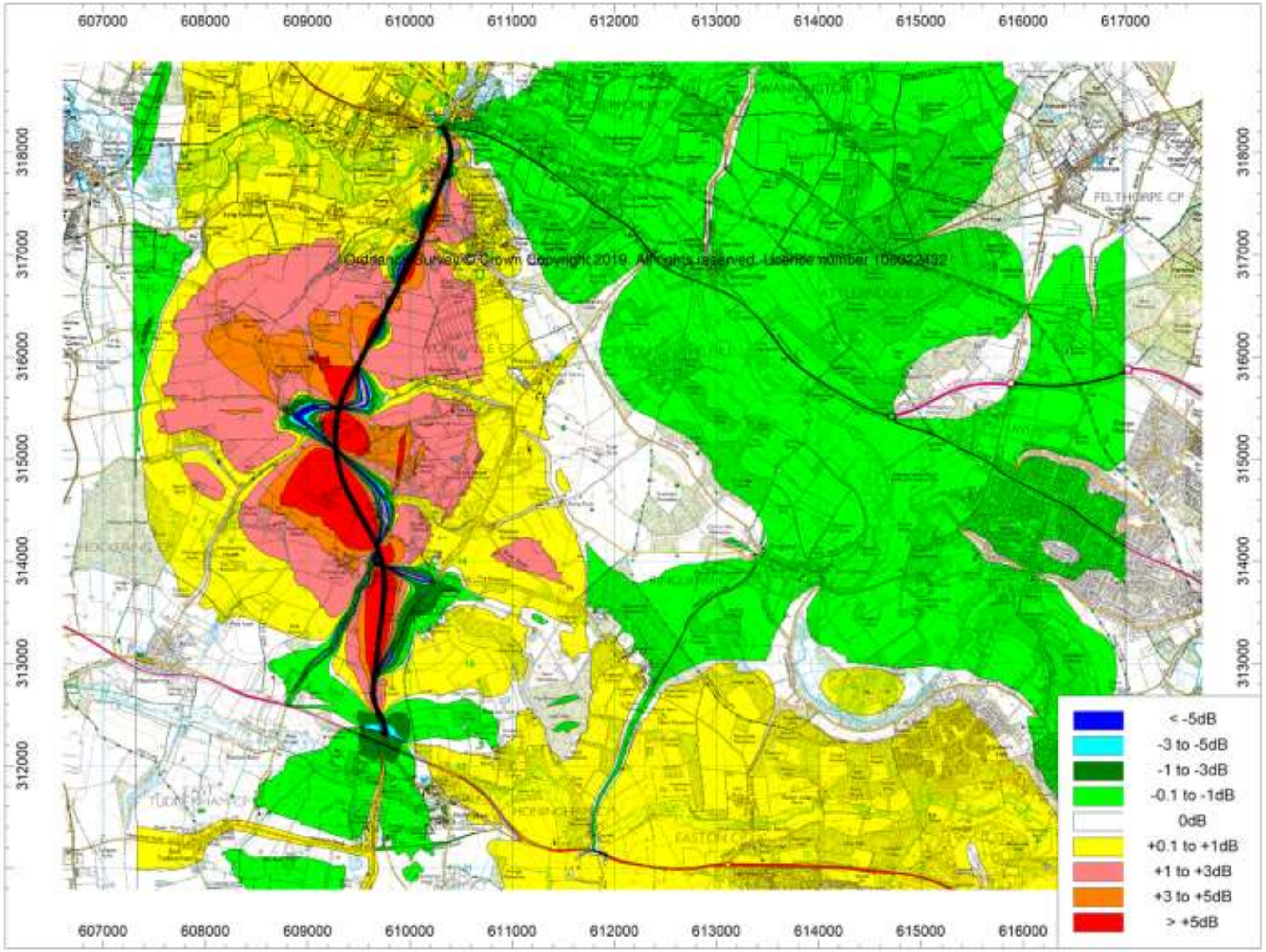


Figure D.6: Option A noise contours – Do-Something 2040

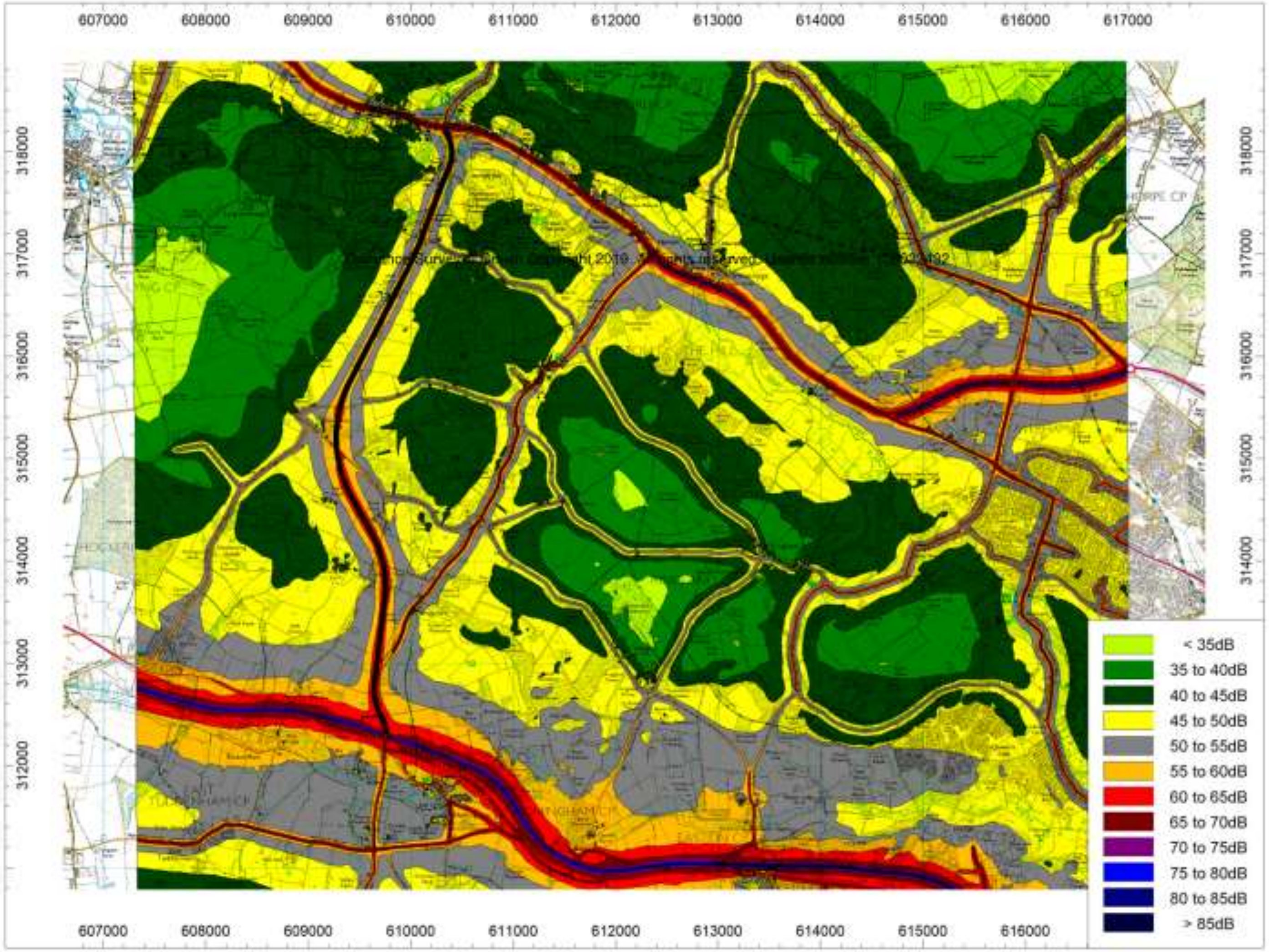


Figure D.7: Option A noise change contours – Do-Minimum 2025 to Do-Something 2040

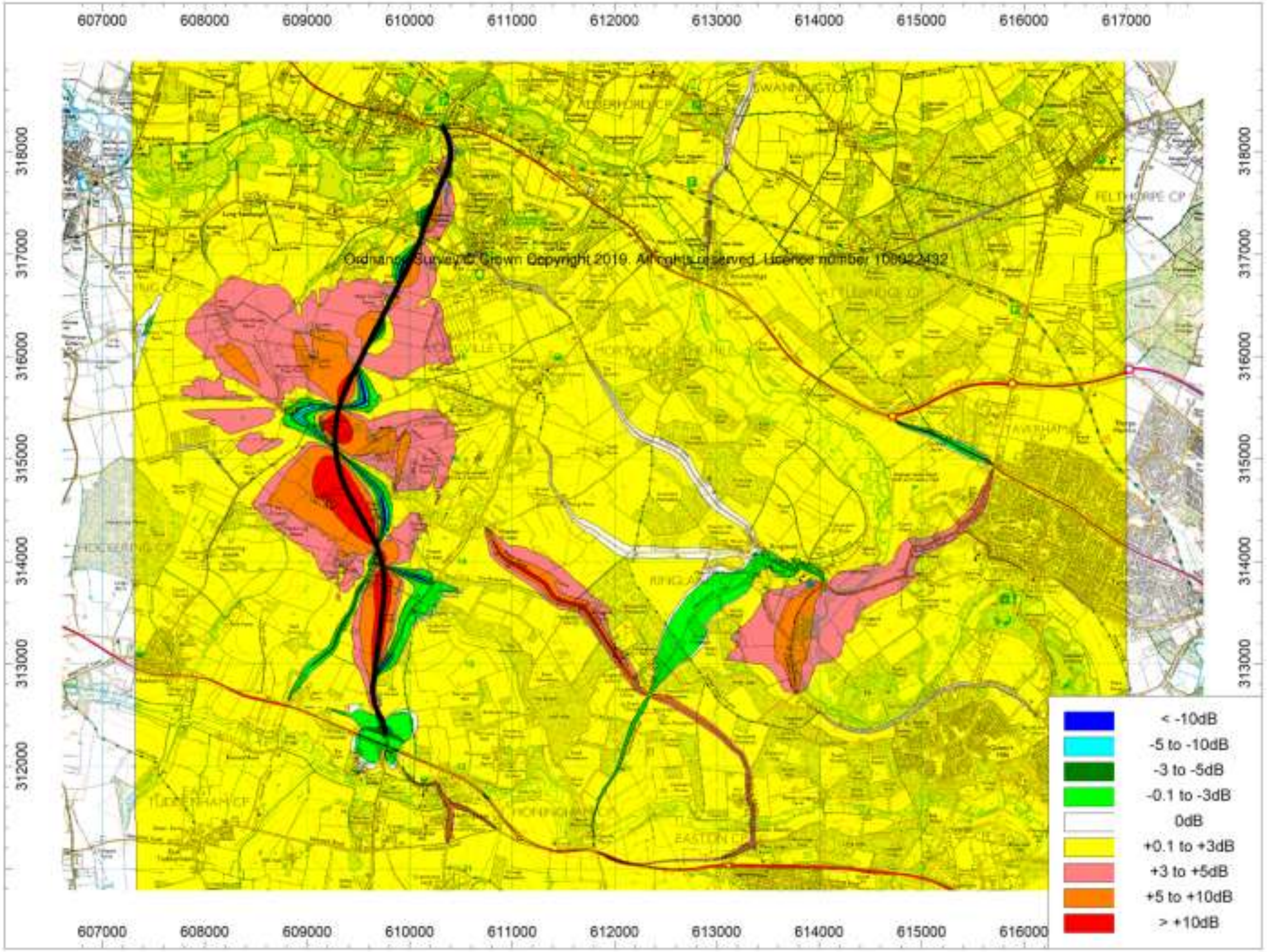


Figure D.8: Option A noise contours – Do-Something 2040 Night-time

Figure D.9: Option A noise change contours – Do-Minimum 2025 to Do-Something 2040 Night-time

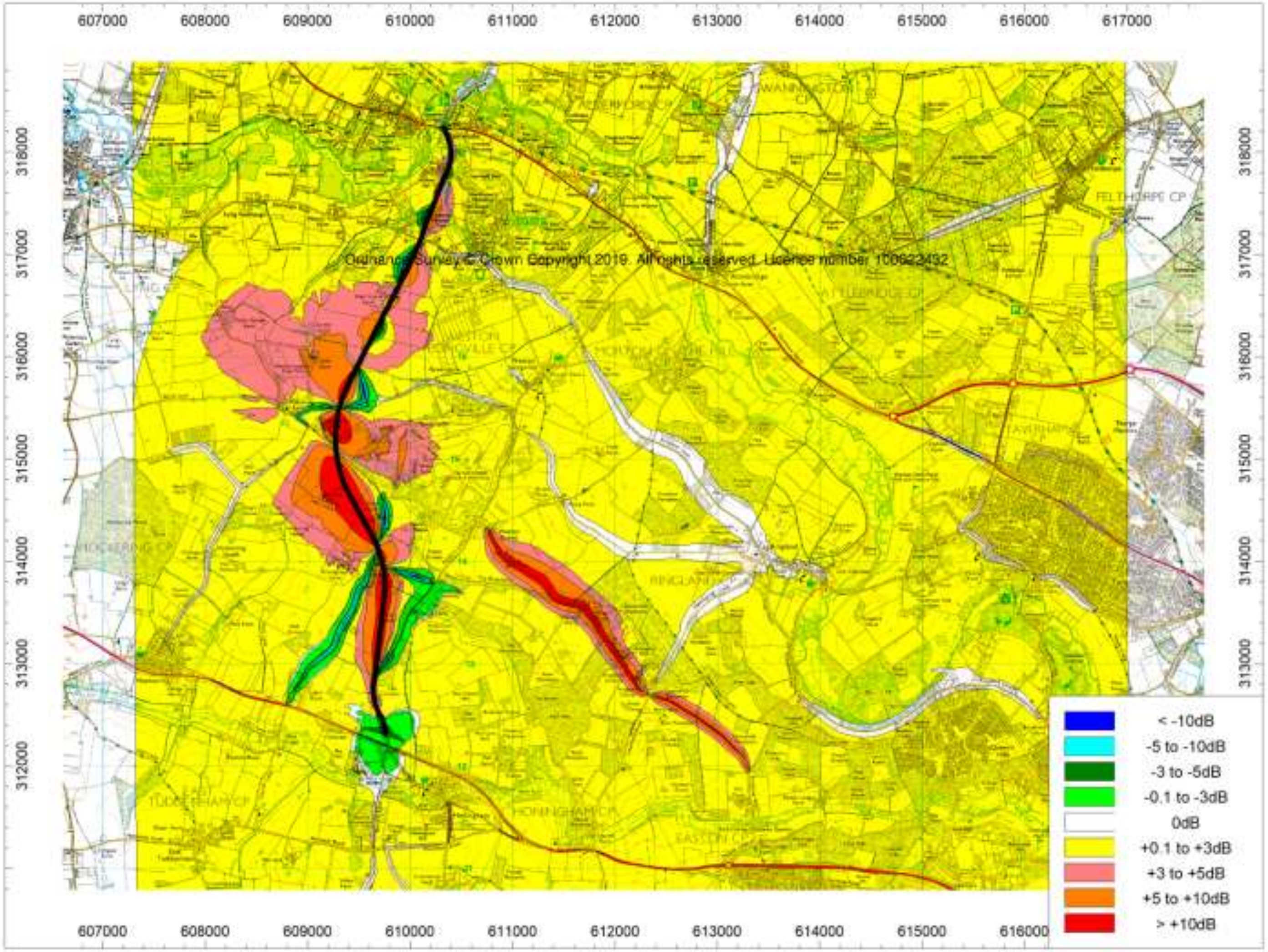


Figure D.10: Option B Western Variant noise contours – Do-Something 2025

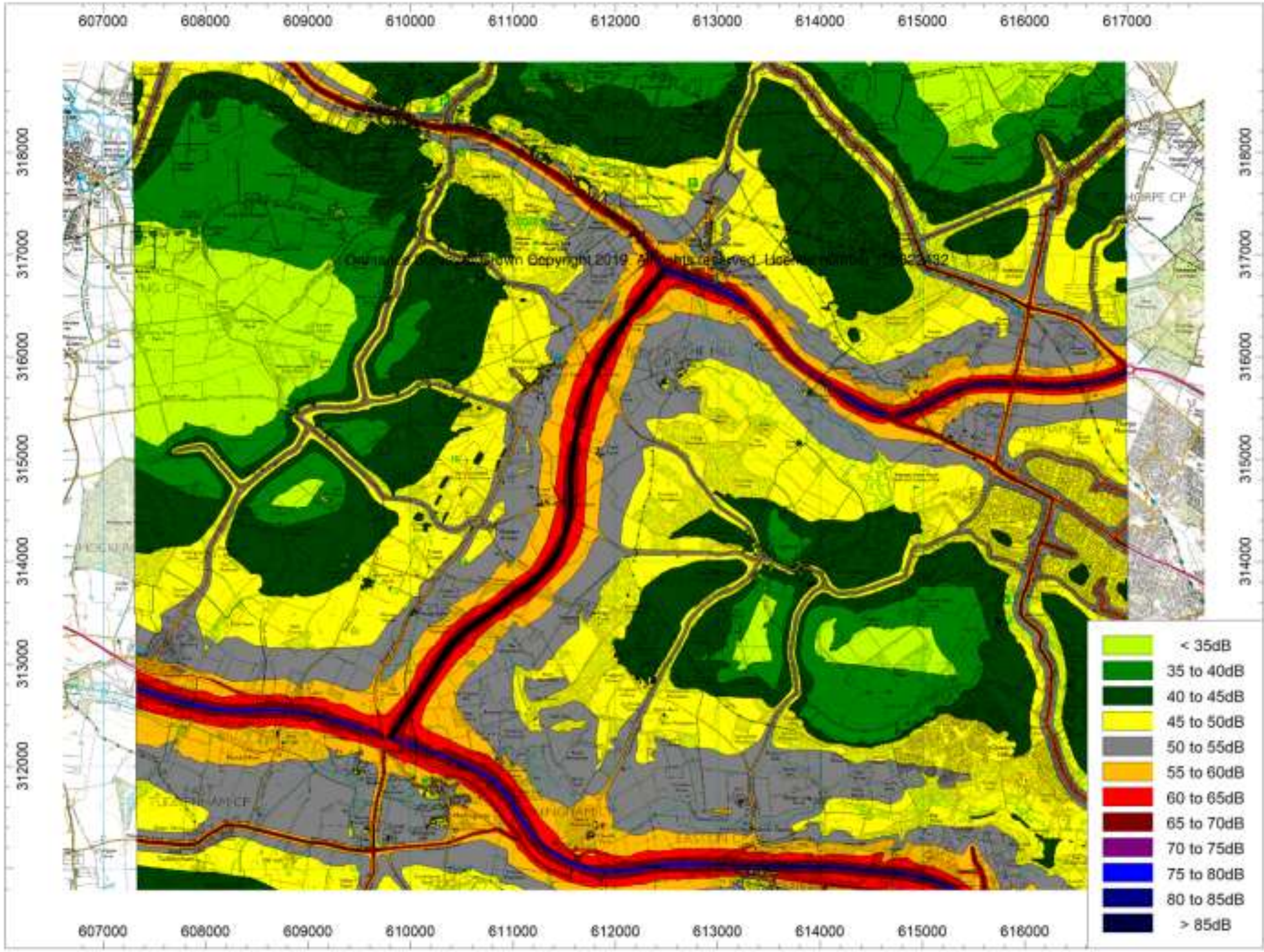


Figure D.11: Option B Western Variant – Do-Minimum 2025 to Do-Something 2025

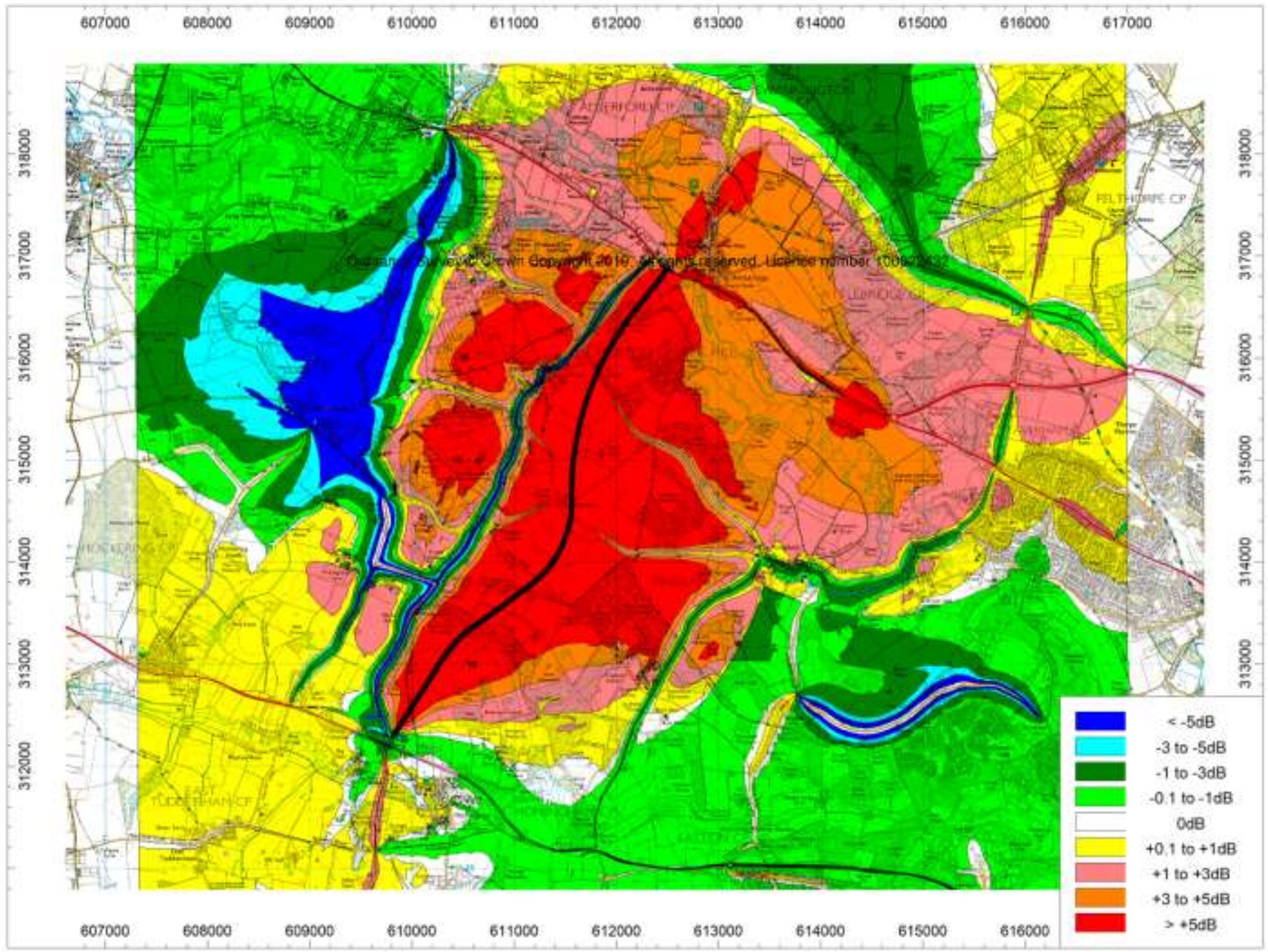


Figure D.12: Option B Western Variant noise contours – Do-Something 2040

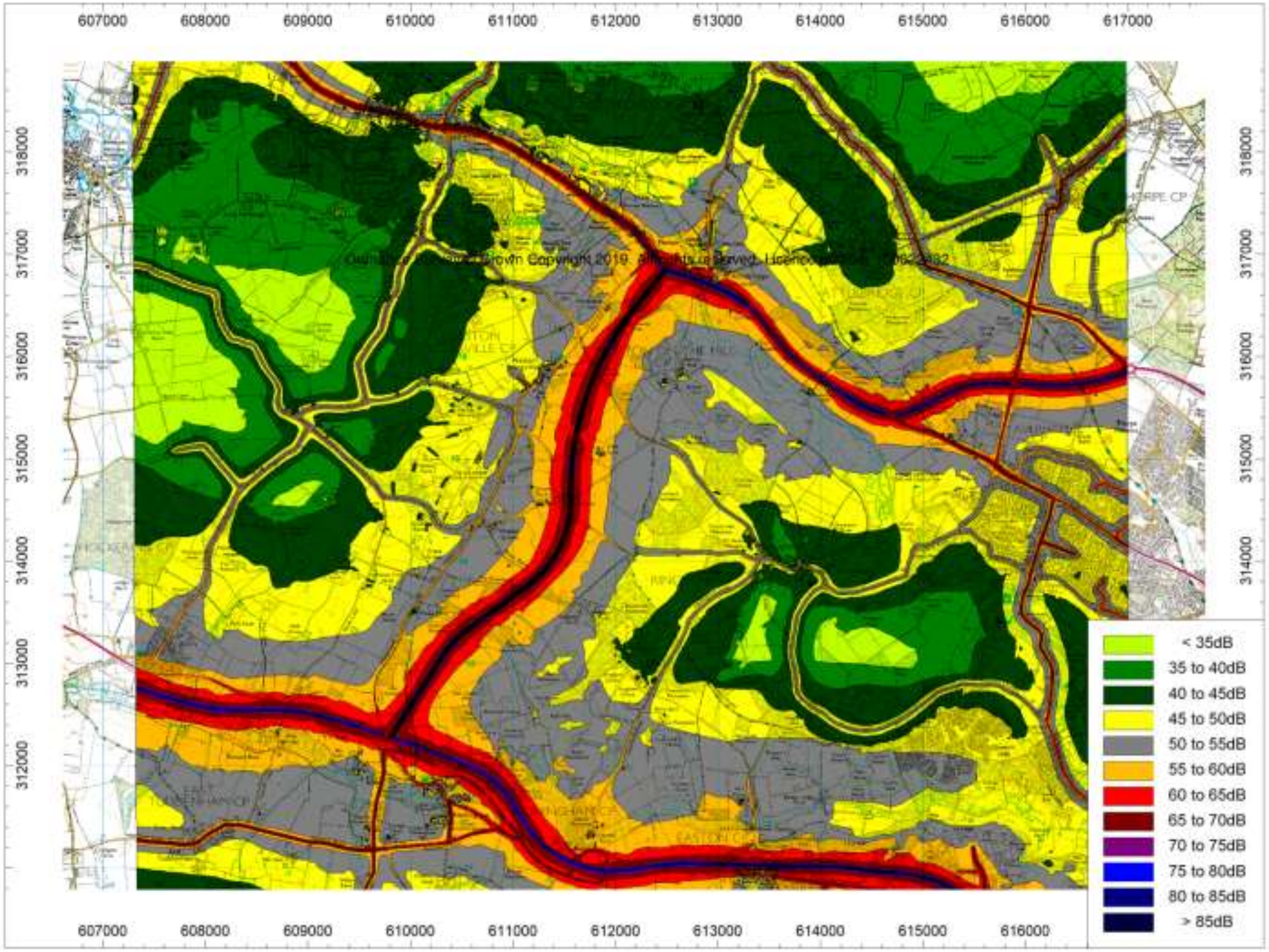


Figure D.13: Option B Western Variant noise change contours – Do-Minimum 2025 to Do-Something 2040

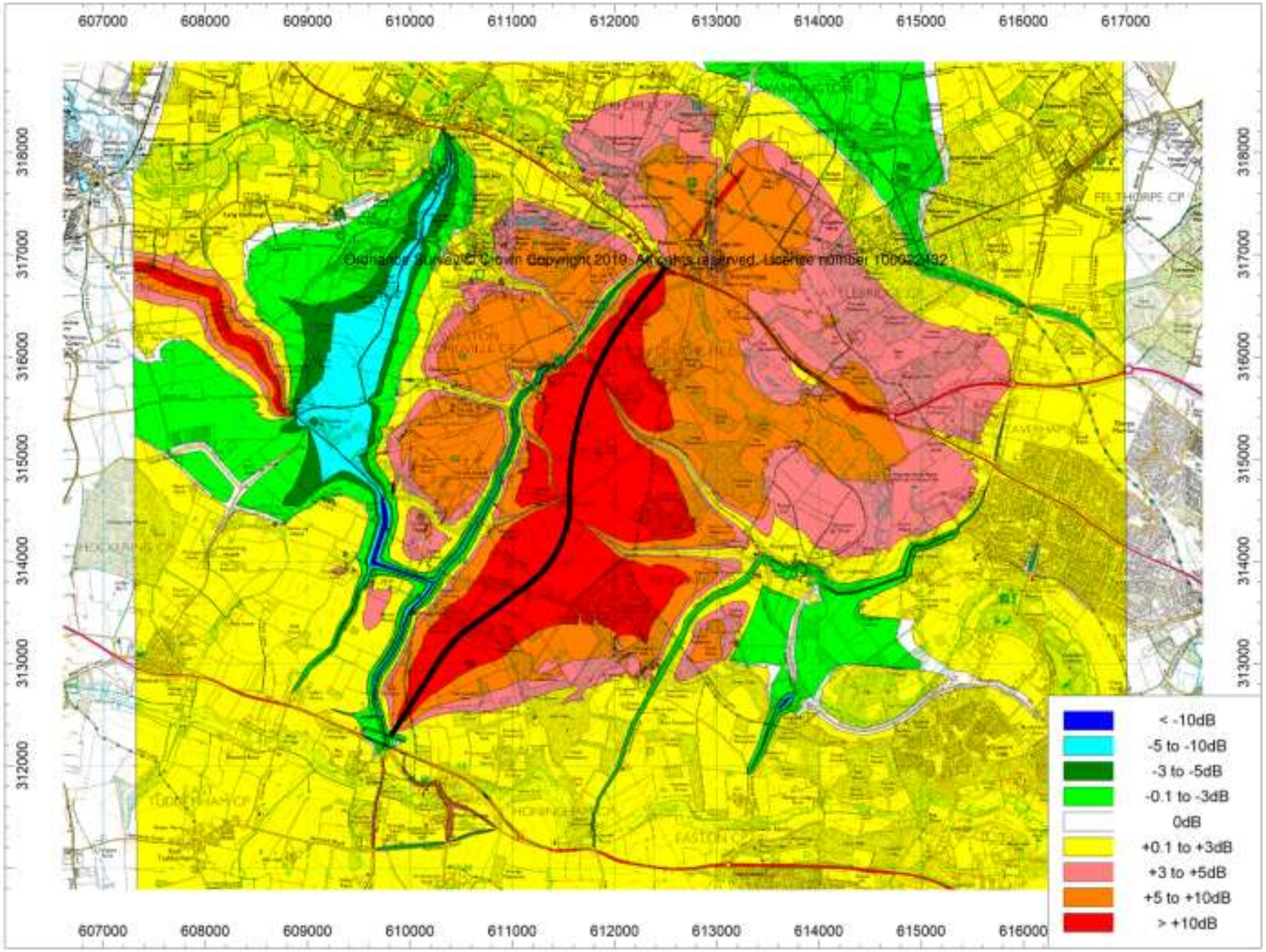


Figure D.14: Option B Western Variant noise contours – Do-Something 2040 Night-time

Figure D.15: Option B Western Variant noise change contours – Do-Minimum 2025 to Do-Something 2040 Night-time

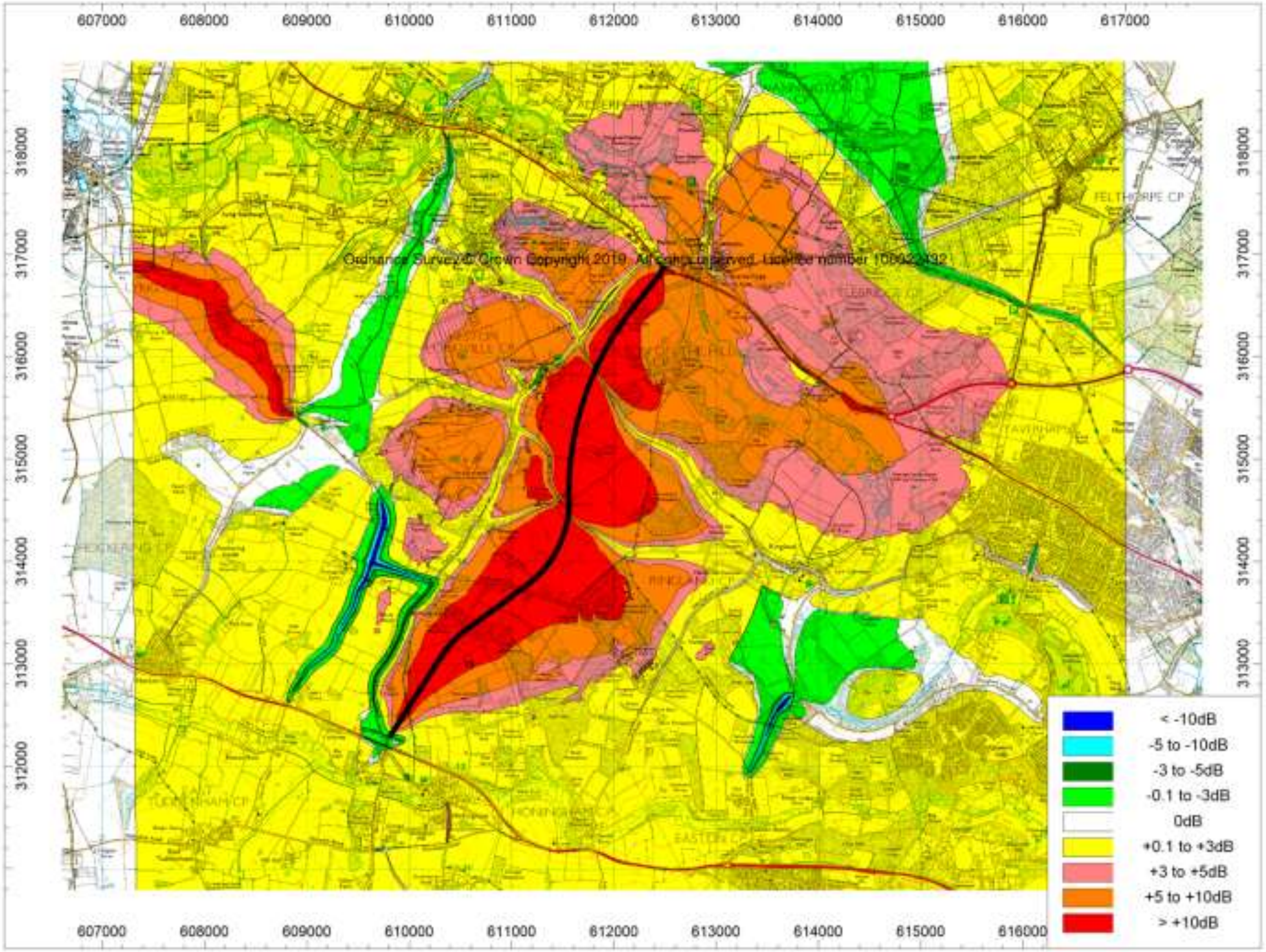


Figure D.16: Option B Eastern Variant noise contours – Do-Something 2025

Figure D.17: Option B Eastern Variant noise change contours – Do-Minimum 2025 to Do-Something 2025

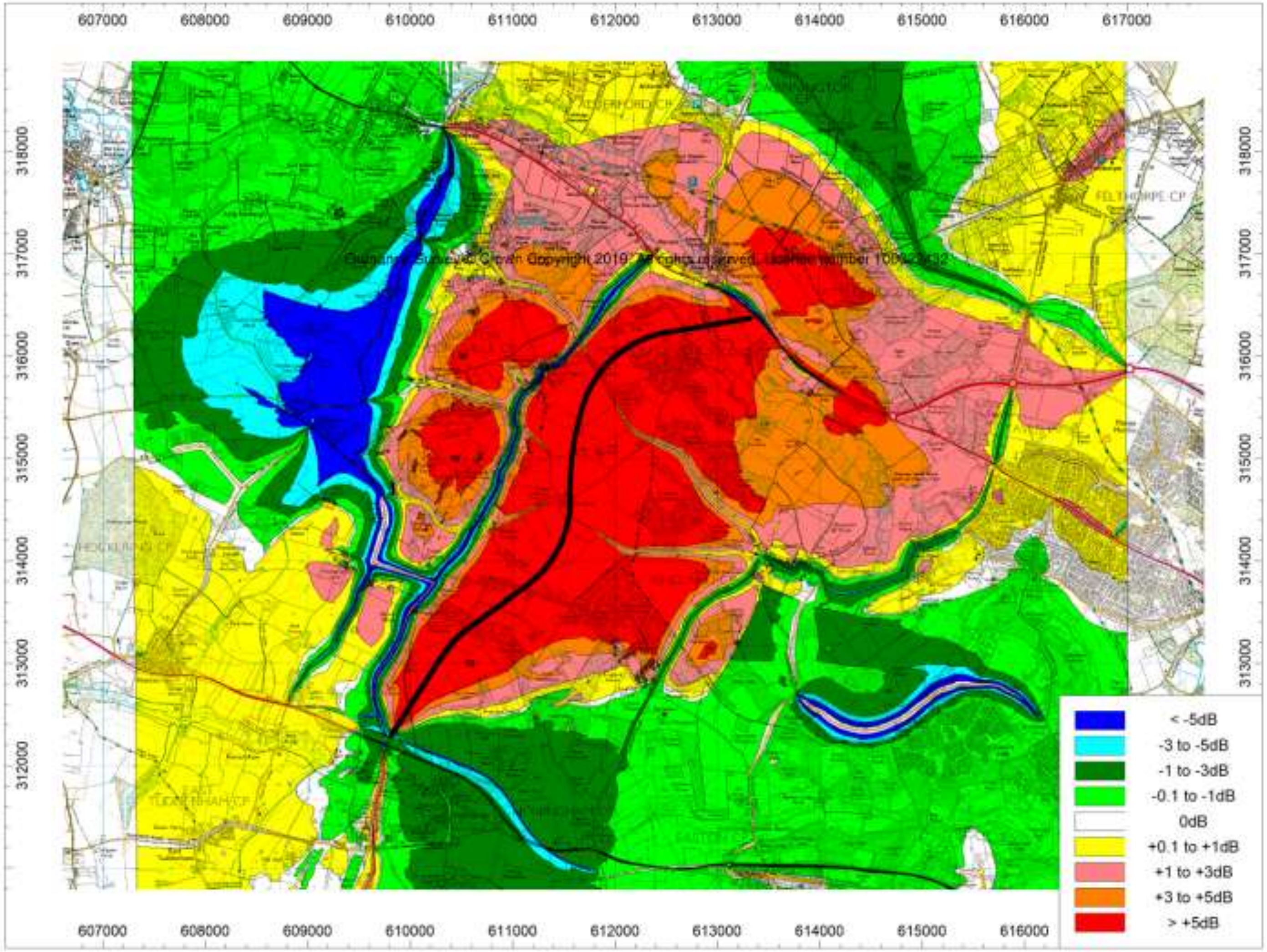


Figure D.18: Option B Eastern Variant noise contours – Do-Something 2040

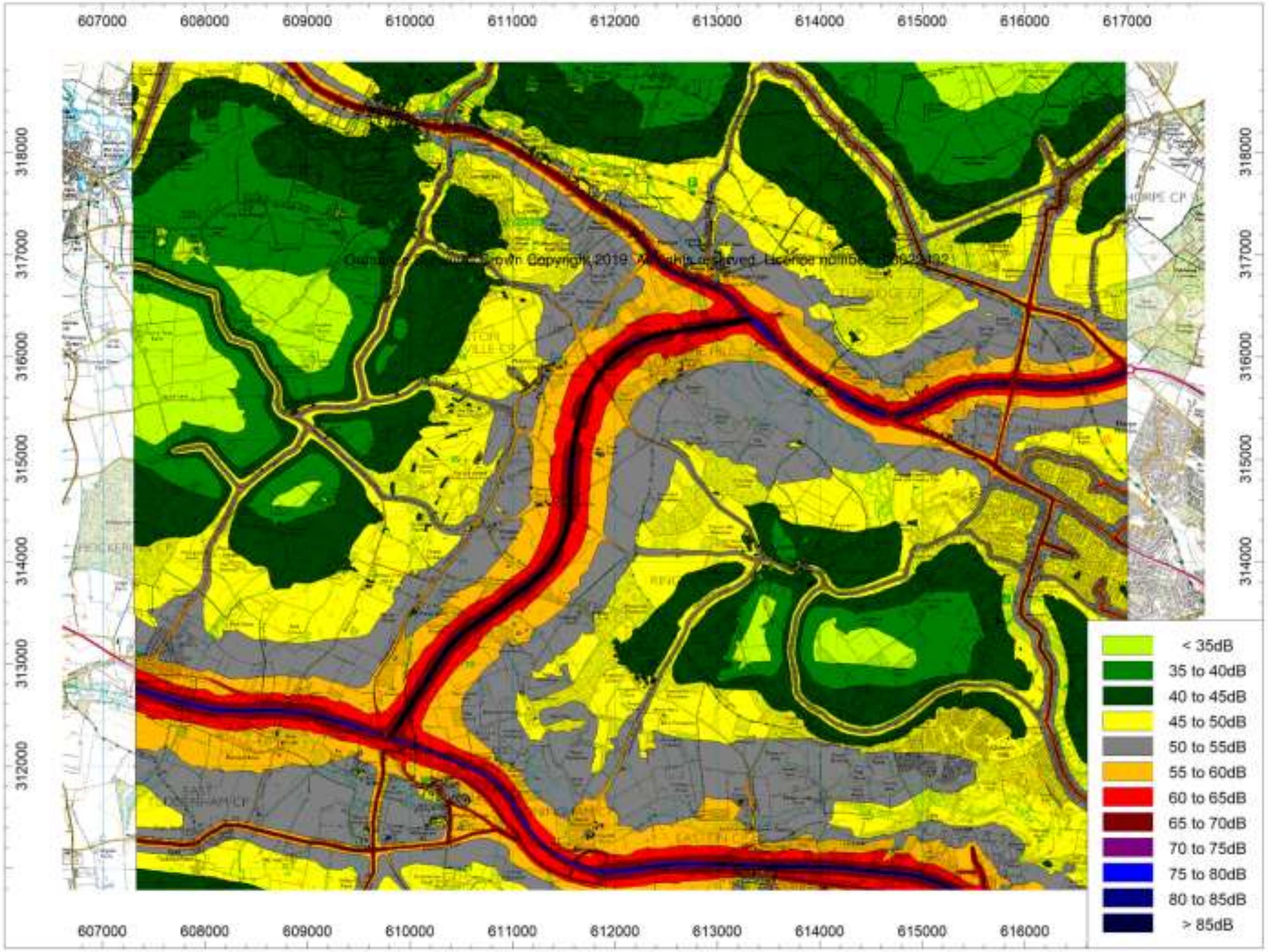


Figure D.19: Option B Eastern Variant noise change contours – Do-Minimum 2025 to Do-Something 2040

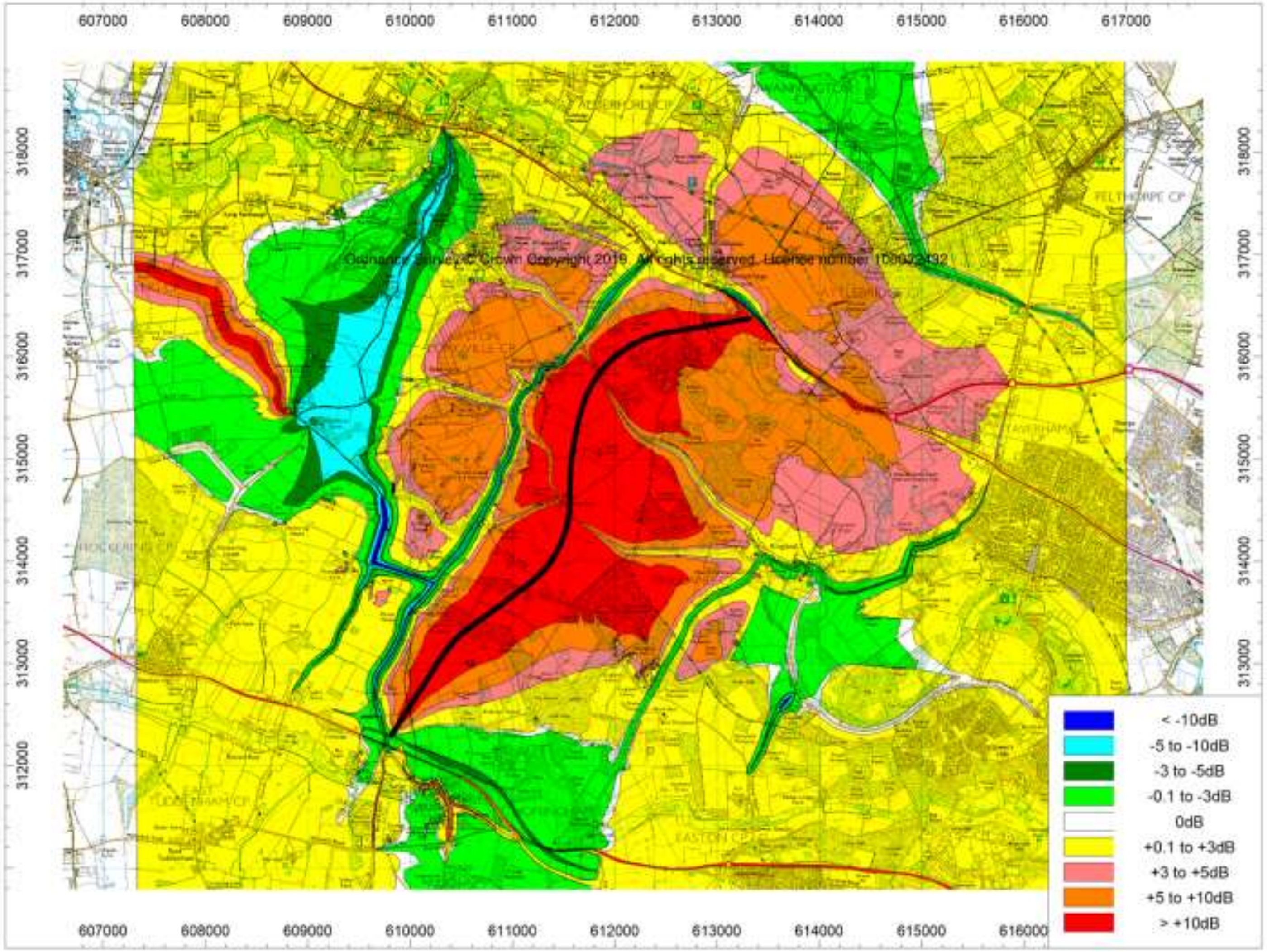


Figure D.20: Option B Eastern Variant noise contours – Do-Something 2040 Night-time

Figure D.21: Option B Eastern Variant noise change contours – Do-Minimum 2025 to Do-Something 2040 Night-time

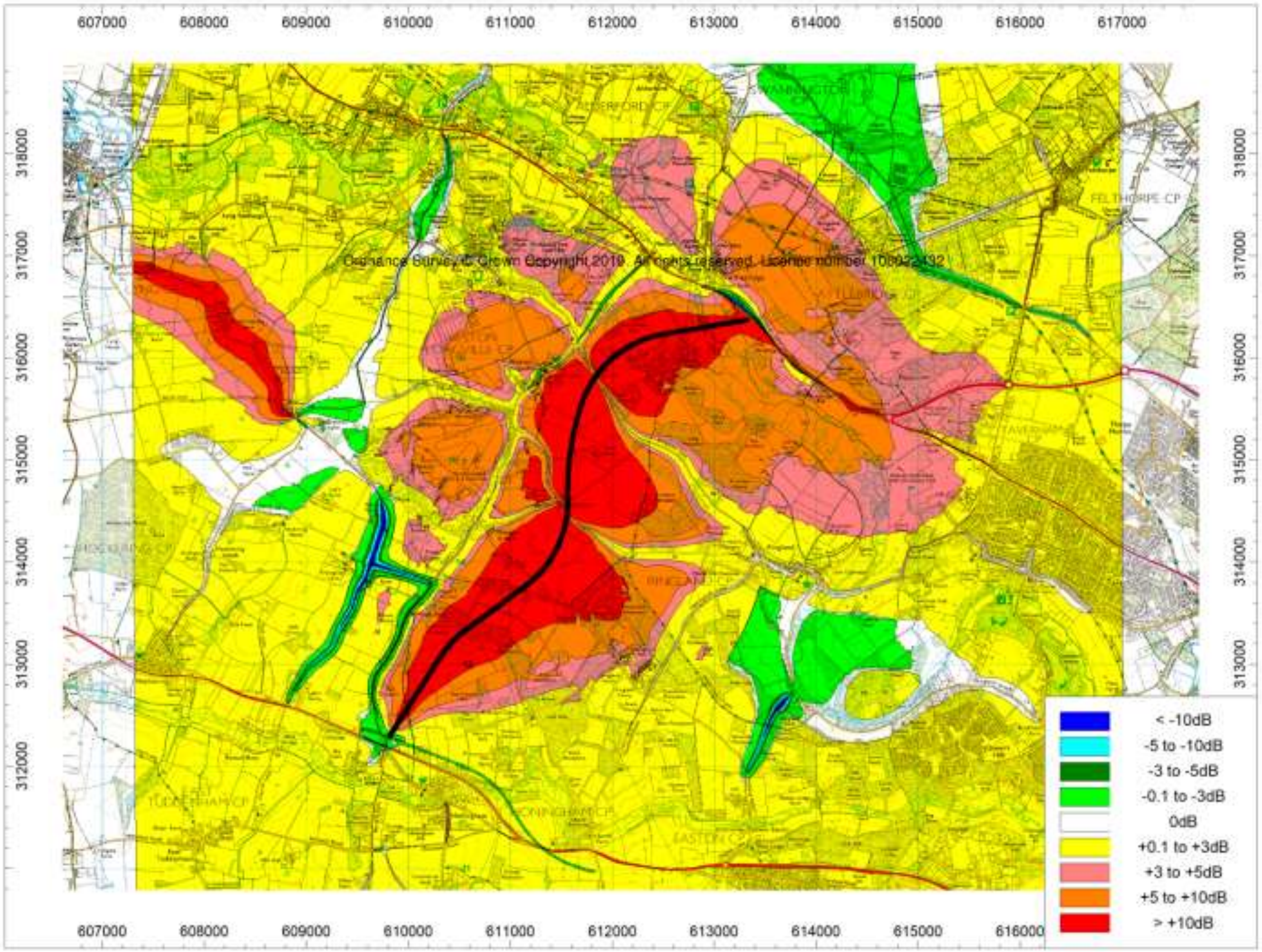


Figure D.22: Option C noise contours – Do-Something 2025

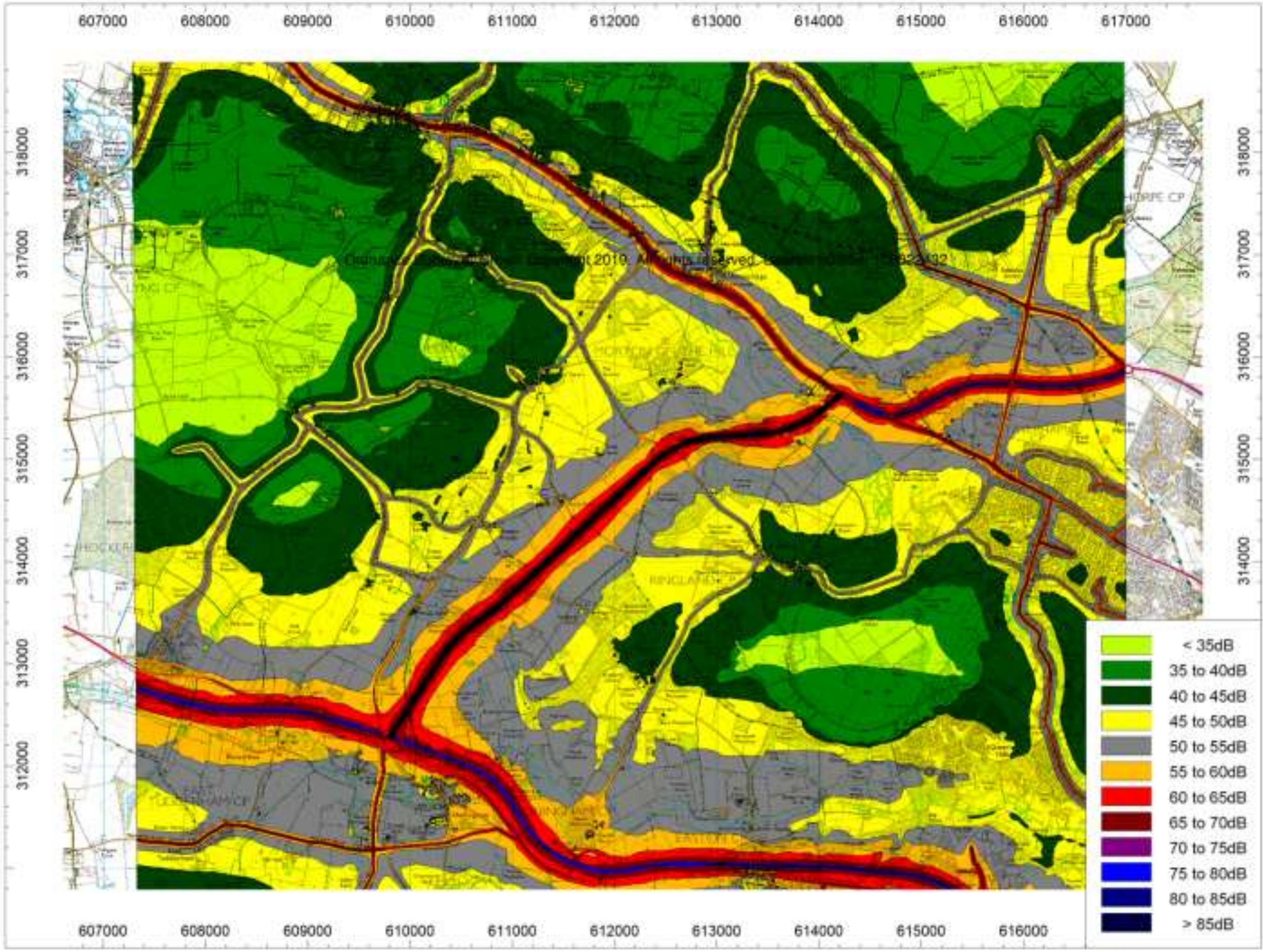


Figure D.23: Option C noise change contours – Do-Minimum 2025 to Do-Something 2025

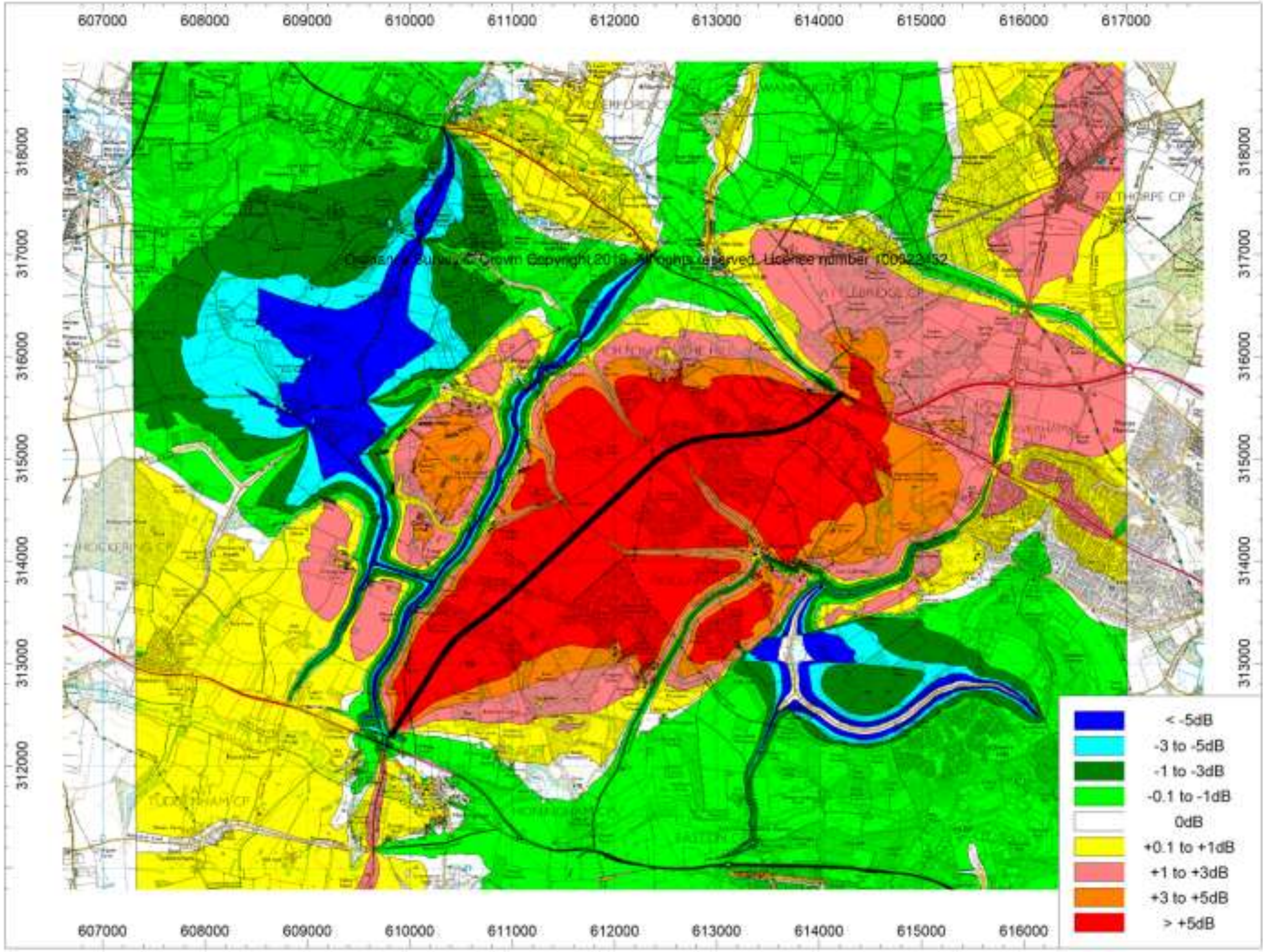


Figure D.24: Option C noise contours – Do-Something 2040

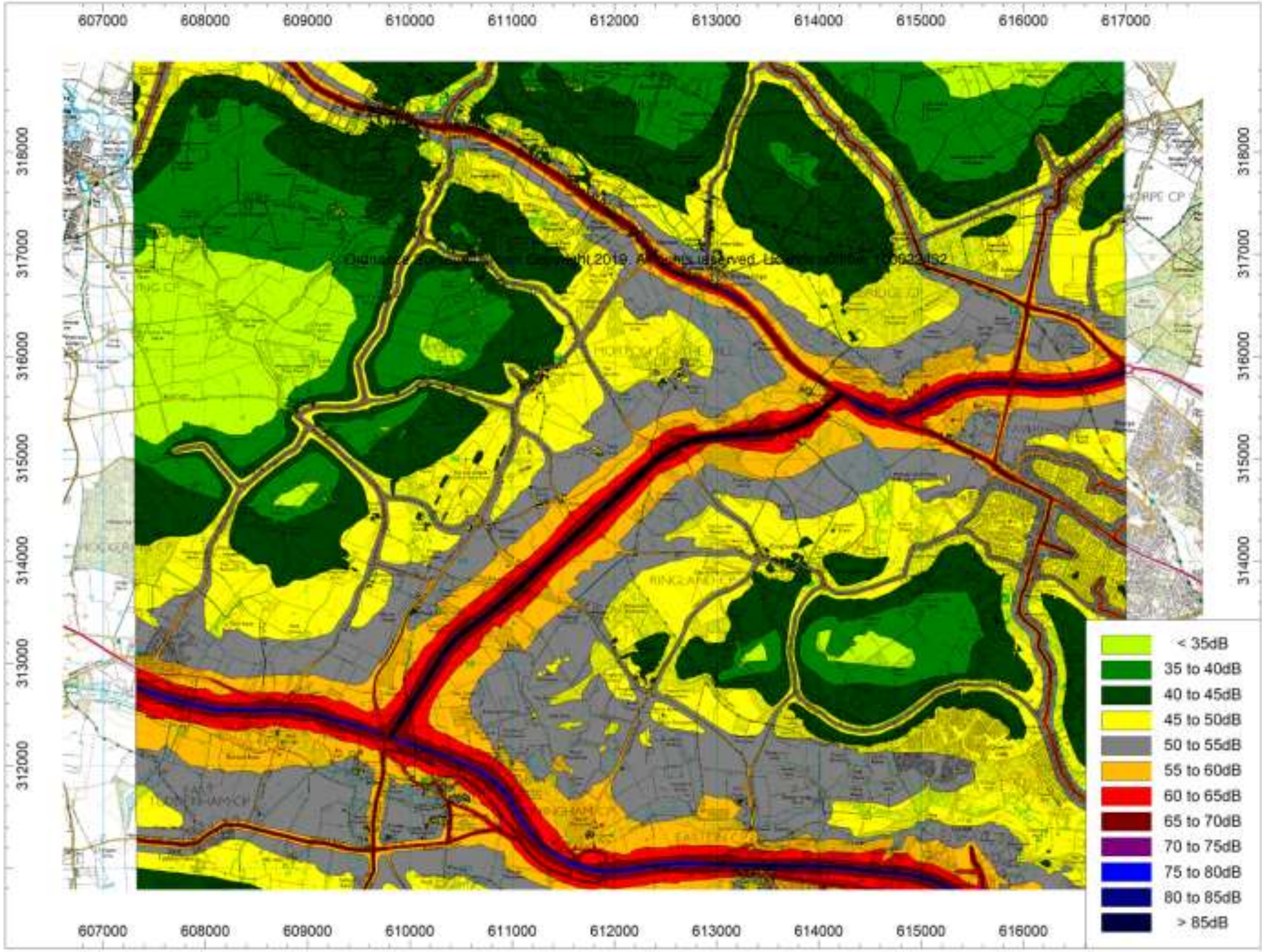


Figure D.25: Option C noise change contours – Do-Minimum 2025 to Do-Something 2040

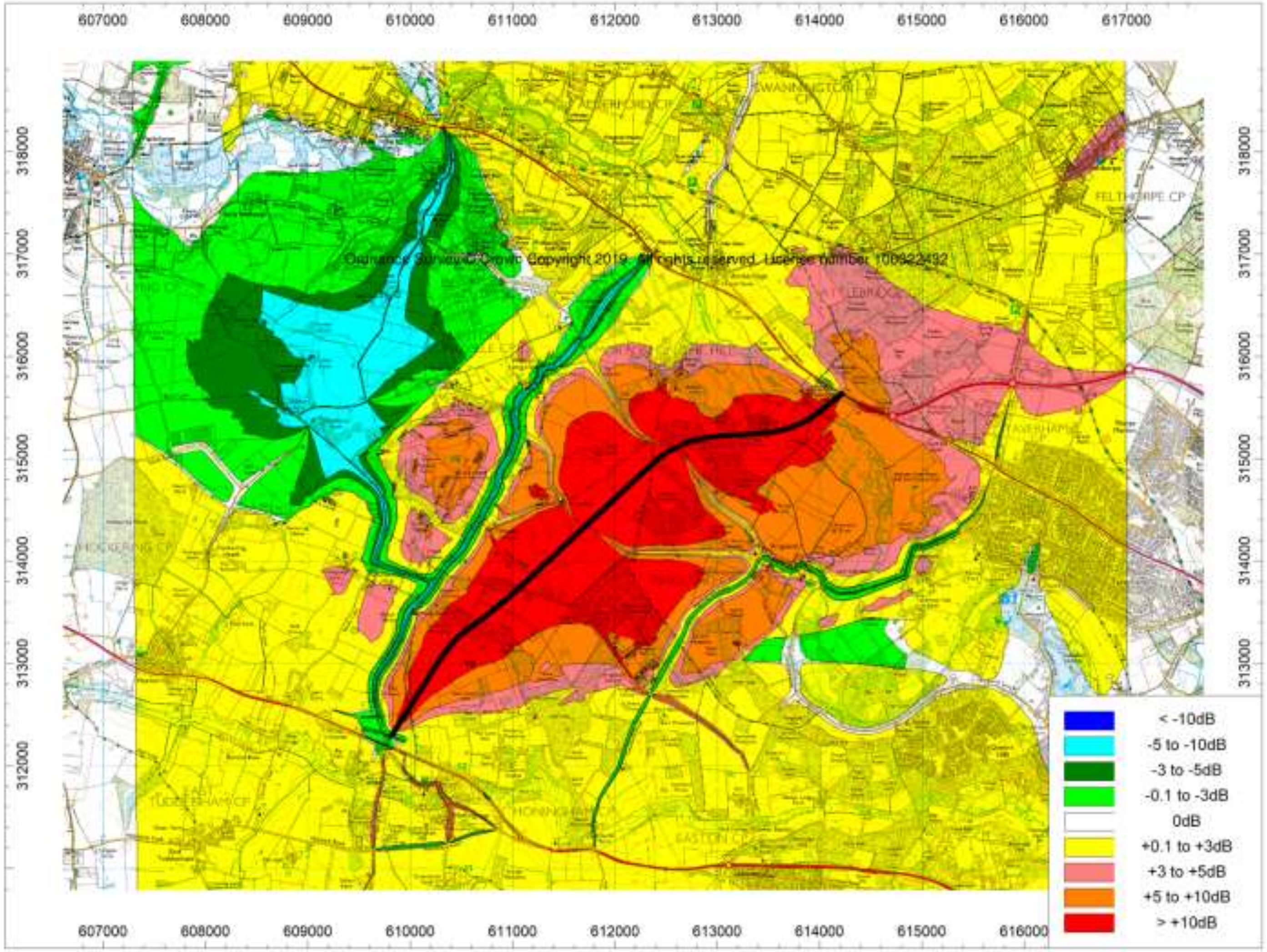


Figure D.26: Option C noise contours – Do-Something 2040 Night-time

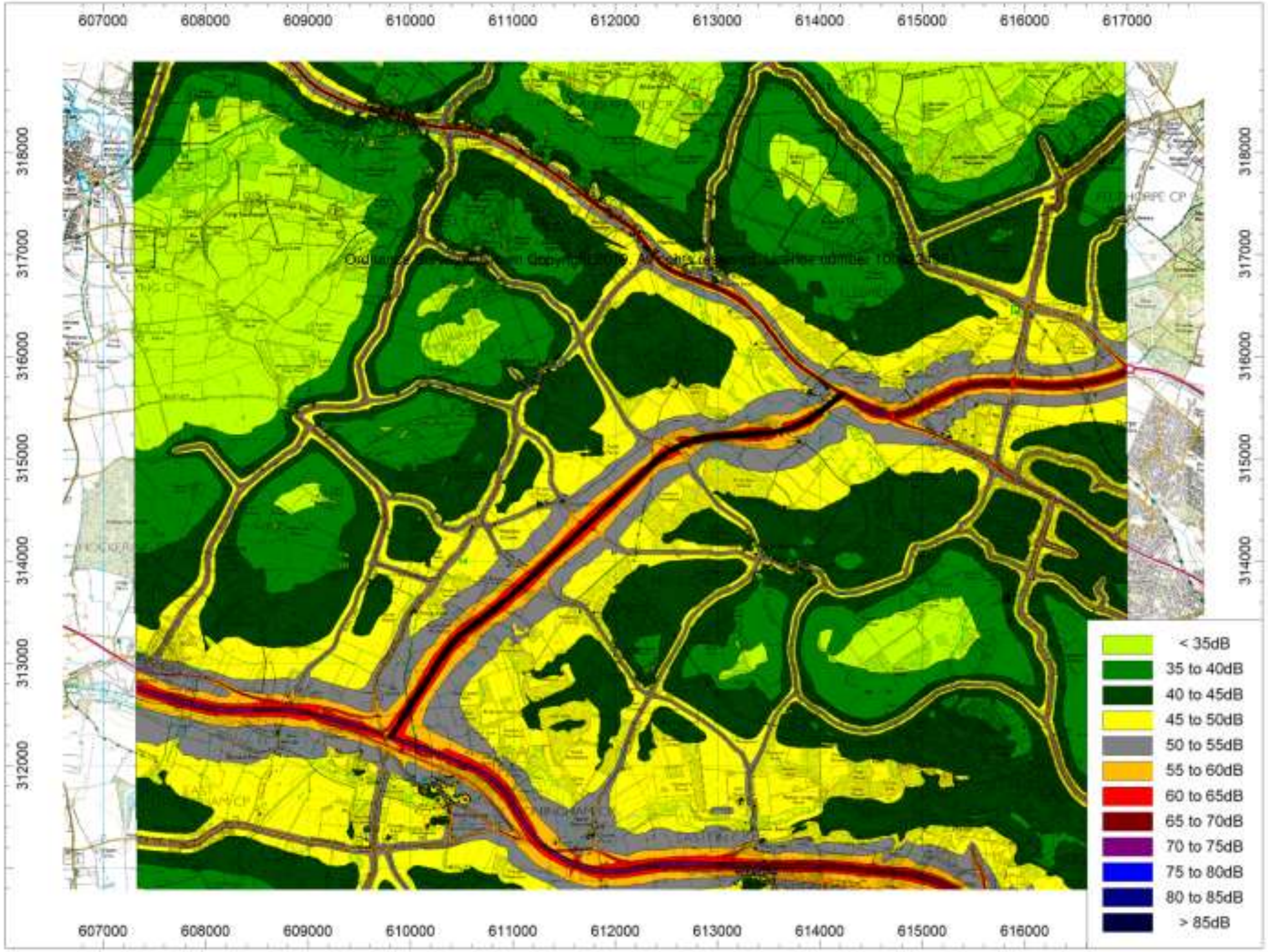


Figure D.27: Option C noise change contours – Do-Minimum 2025 to Do-Something 2040 Night-time

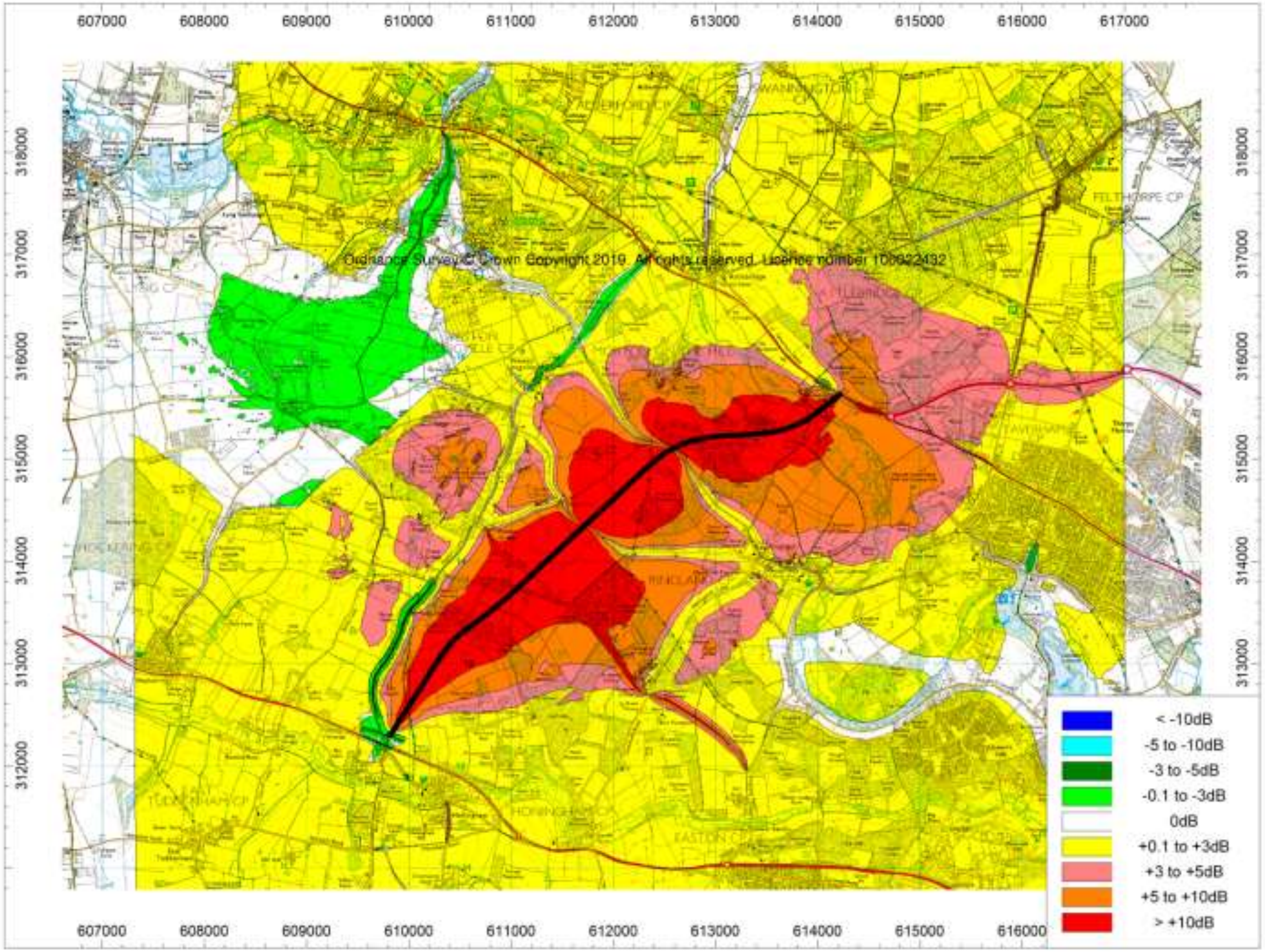


Figure D.28: Option D noise contours – Do-Something 2025

Figure D.29: Option D noise change contours – Do-Minimum 2025 to Do-Something 2025

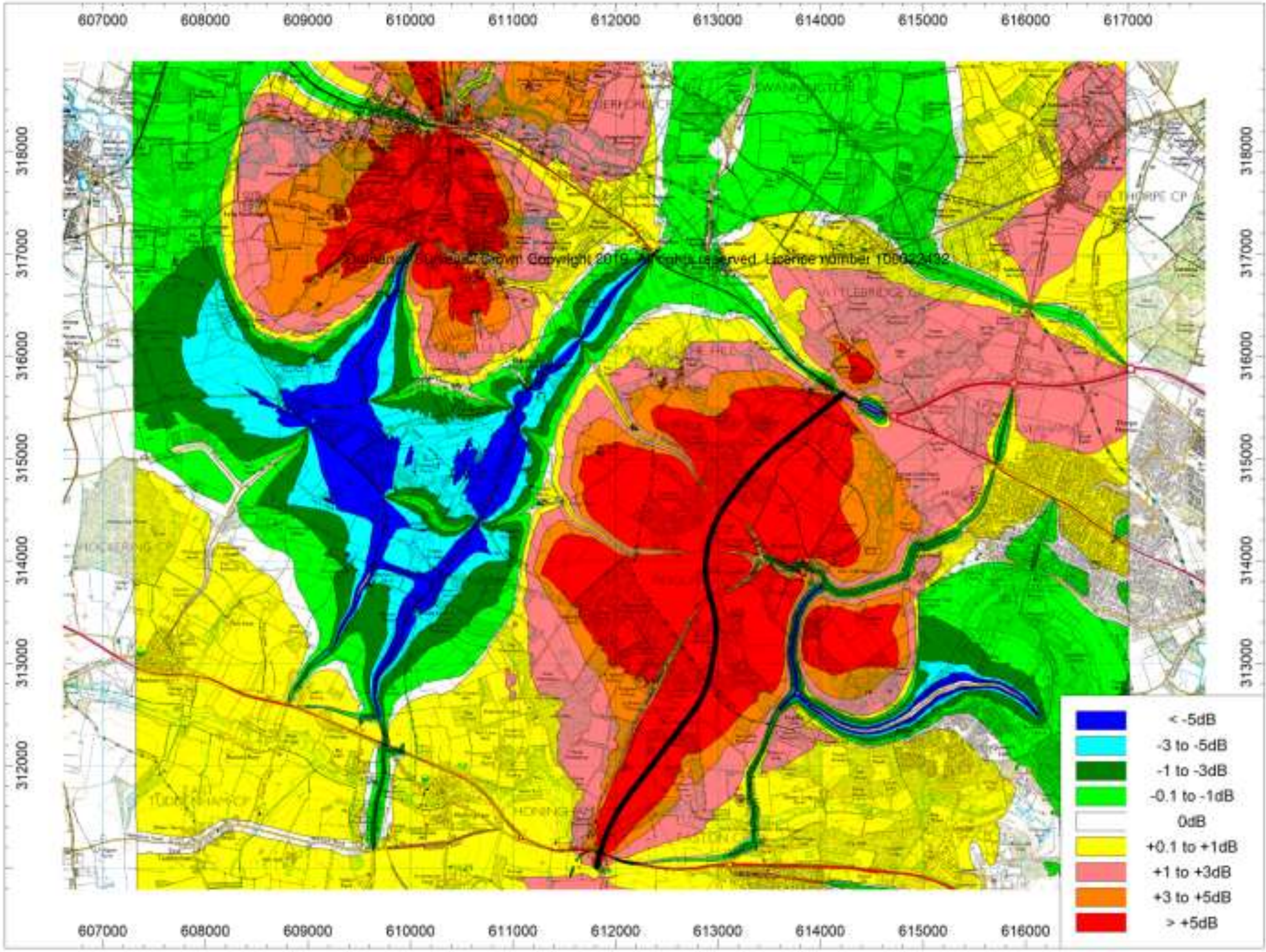


Figure D.30: Option D noise contours – Do-Something 2040

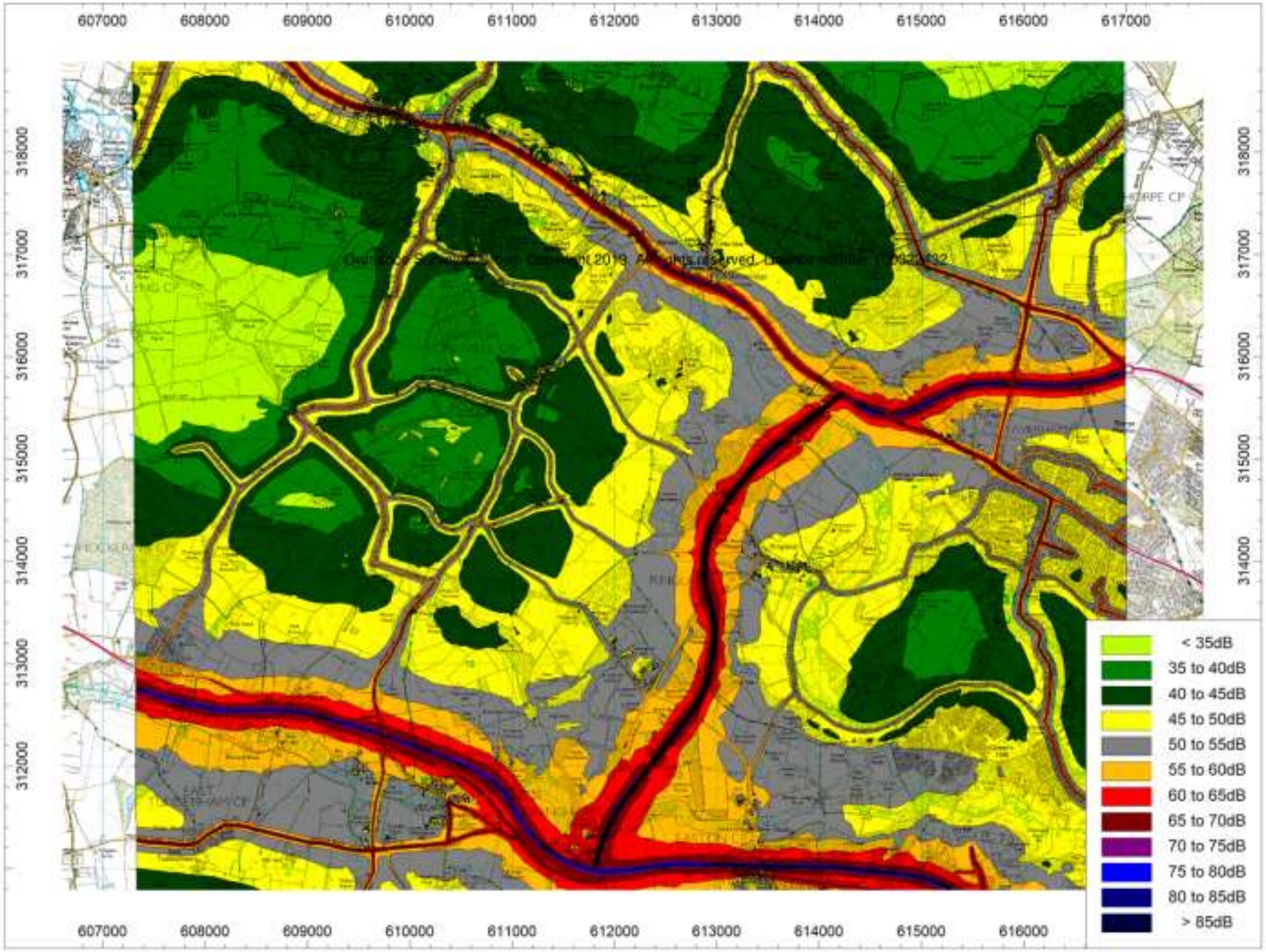


Figure D.31: Option D noise change contours – Do-Minimum 2025 to Do-Something 2040

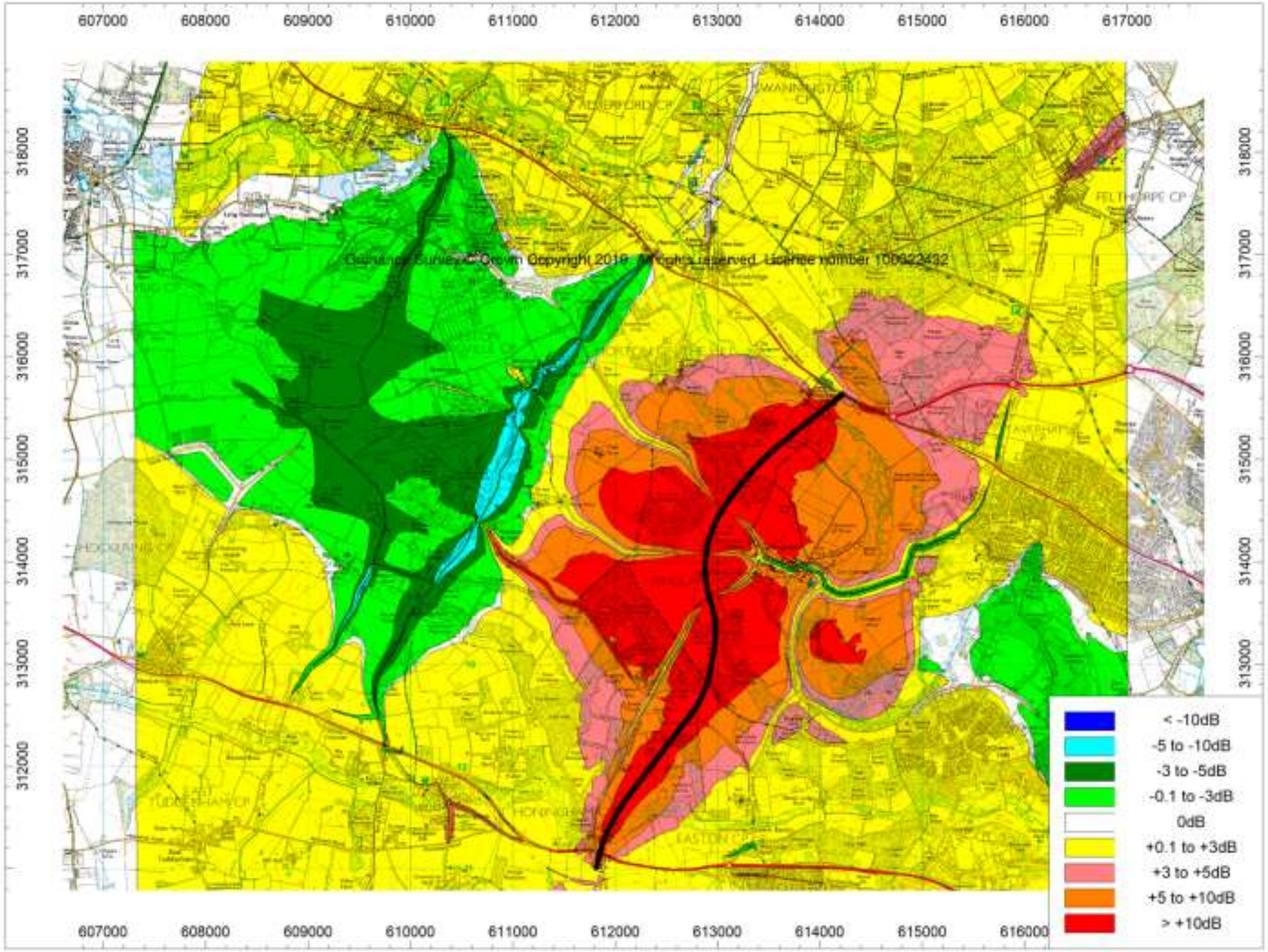
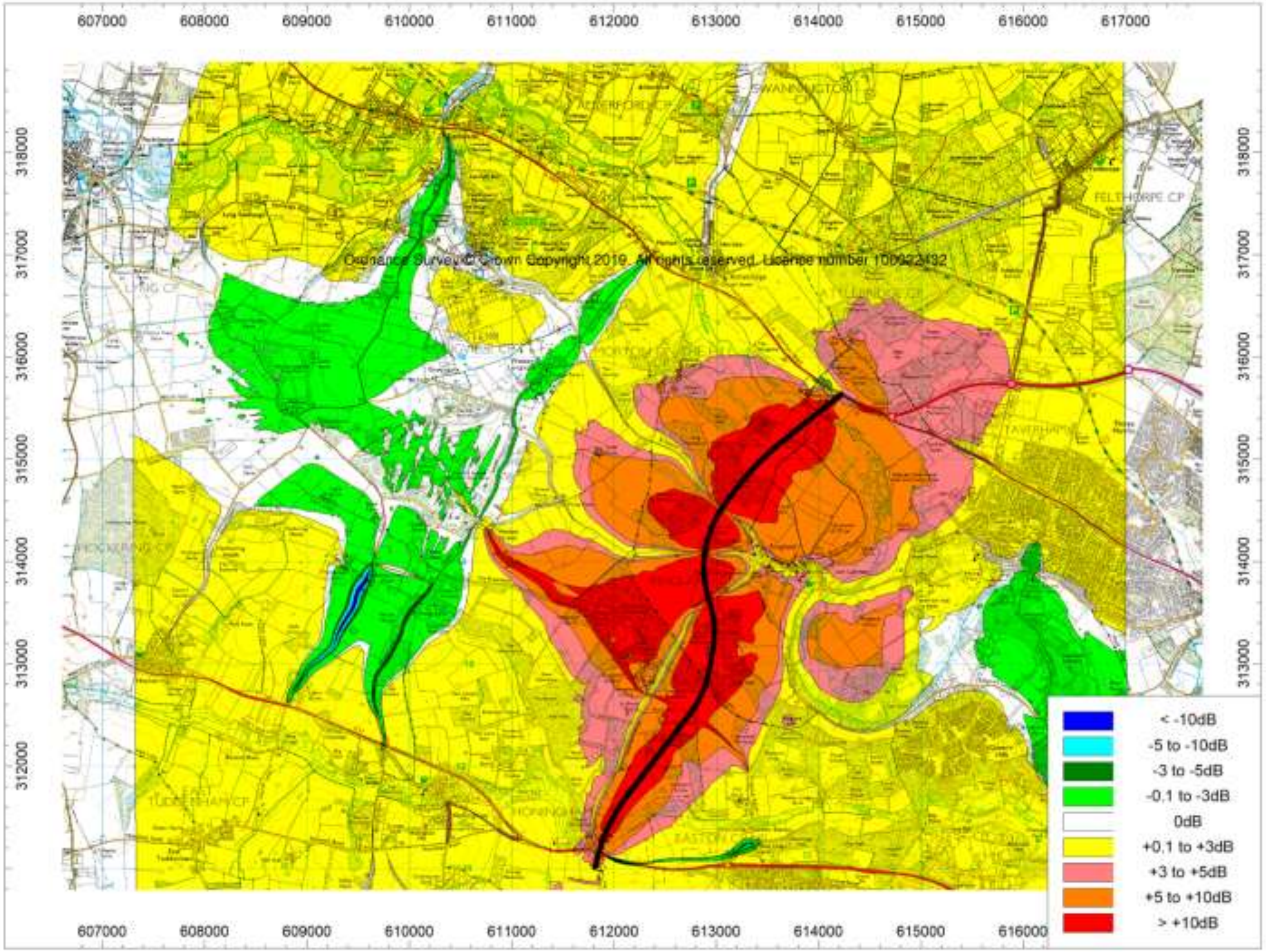


Figure D.32: Option D noise contours – Do-Something 2040 Night-time

Figure D.33: Option D noise change contours – Do-Minimum 2025 to Do-Something 2040 Night-time



Appendix E

APPRAISAL SUMMARY TABLES

Appraisal Summary Table

Date produced:	6th June 2019	**Contact:**	
Name of scheme:	Norwich Western Link Option A	**Name**	
Description of scheme:		**Organisation**	
		Role	Promoter/Official

Impacts		**Summary of key impacts**	**Assessment**			
			Quantitative	**Qualitative**	**Monetary £(NPV)**	**Distributional 7-pt scale/ vulnerable grp**
Economy	Business users & transport providers	Journey Time Benefits are the main source of monetised impacts for this option. Business users account for approximately 30% of journey time benefits	**Value of journey time changes(£)**: £13.3m **Net journey time changes (£)** 0 to 2min: £3.07m; 2 to 5min: £8.72m; > 5min: £1.54m	Beneficial	£13.58m	N/A
	Reliability impact on Business users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.	Estimating the value of reliability savings as around 10% of travel time savings would indicate a reliability benefit of £1.3m for Business users.	Beneficial	-	
	Regeneration	There is no development dependant on the scheme	Not Calculated		-	
	Wider Impacts	The scheme is consided to bring positive wider impacts in addition to transport user benefits as the scheme is likely to enable development with and around Norwich.	Not Calculated	Beneficial	-	
Environmental	Noise	***NB. This assessment did not use the WebTAG worksheet and DMRB gudiance. It is based on qualitative methodology set out by WSP in a Technical Memorandum, 2019.*** Route option A has been reviewed to qualitatively comment on areas that are likely to be susceptible to noise and/or vibration impacts. The closest properties on Sandy Lane are approximately 120 metres away from the proposed carriageway edge. The proposed works in this area include stopping up of existing roads, new junctions and accesses, and installation of pedestrian crossing bridges. The amount and proximity of construction works in this area is likely to lead to an adverse impact at the closest properties. Further north the route passes close to Woodforde Farm, as it crosses Breck Road. The proposed method of crossing is a road bridge, and the construction works involved with this may result in significant levels of construction noise and vibration at this receptor due to its proximity. Operational noise may also be an issue, again due to the proximity of the receptor to the route. The closest villages are Lenwade and Great Witchingham, which lie along the A1067 immediately either side of the existing junction with the B1533 and the proposed junction with Option A. The proposed works at this junction include the creation of a roundabout, and adverse impacts may occur at the closest properties during the construction phase due to the proximity of works. Any operational impacts will depend on the difference in vehicle movements as a result of the proposed route in comparison to those currently using the A1067 and B1533.	n/a	Route Option A adversely impacts more properties and benefits fewer properties than the other route options in the short-term. However, the changes in noise that result from Route Option A are almost all less than ±1dB, which would be classed as negligible changes.	n/a	
	Air Quality	Overall there is a net improvement in air quality and a decrease in regional NOx emissions. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080.	Assessment Score 2025 PM2.5: 17.71 NO2: 73.54 Assessment Score 2040 PM2.5: 23.53 NO2: 78.08 Emissions 2025 NOx: -8 tonnes Emissions 2040 NOx: -4 tonnes Properties Improved: 1500 Neutral: 0 Worsening: 2235	N/A	NPV of change in PM10 emissions: £2,220,433 NPV of change in NOx emissions: £1,382,970 (2019 prices) Total NPV of change in air quality: £3,603,402	N/A
	Greenhouse gases	The appraisal reflects a net decrease in vehicle kilometres travelled over the modelled road network. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080. There is no account of CO2 emissions from power generating sources for electric vehicles.	Change in non-traded carbon over 60y (CO2e): -196,560 Change in traded carbon over 60y (CO2e): 0	N/A	NPV: £8,622,885	
	Landscape	There would be no substantial change to the landscape character due to the proposed route substantially being a realignment and straightening of an existing road which is reflective of the existing landscape pattern. The road would run mainly at grade, with small sections of embankment and it's influence would be broadly similar as a single lane, however will be a more substantial road, particularly where it crosses the landscape between Sandy Lane and Wood Lane.	n/a	Slight Adverse	n/a	
	Townscape	Not applicable to the proposed Option A.	n/a	n/a	n/a	
	Historic Environment	The scheme would have a major direct impact on nationally significant historic environmental assets such that they are lost or their integrity is severely damaged.	There is one Grade II listed building, that will be physically affected by the scheme. There are 20 Listed Building assets which could have a setting impact, one Grade II* and 19 Grade II listed buildings, and two Scheduled Monuments.	Large Adverse, due to impacts on Built Heritage	n/a	
	Biodiversity	This option directly impacts the least ecological features however because bats are of high conservation importance and the route is lcoated close to a known maternity roost the impact of the route is very large adverse.	n/a	Very Large Adverse	n/a	
	Water Environment	Impacts to the River Wensum are negligible as there is minimal change to the existing infrastructure at this watercourse. Potential impacts during construction can be mitigated to negligible effect. Culverting the ordinary watercourses can cause slight adverse impacts to conveyance of flow and material and biodiversity. Construction of new embankments in the flood plain will cause minor adverse impact to flood risk. Compensatory storage is likely to be required in this scheme design. Impact to groundwater is considered negligible due to suitable drainage mitigation.	n/a	Minor Adverse	n/a	
Social	Commuting and Other users	Journey Time Benefits are the main source of monetised impacts for this option. Commuting and other users account for approximately 70% of journey time benefits	**Value of journey time changes(£)**: £24.73m **Net journey time changes (£)** 0 to 2min: £9.68m; 2 to 5min: £14.31; > 5min: £0.73	Beneficial	£25.77	N/A
	Reliability impact on Commuting and Other users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.		Beneficial	-	
	Physical activity	This option does not include measures aimed specifically at walking and cycling, however Walking and Cycling will be considered moving forward potentially through design of the route options and or potentially through the proposed additional non road options carried through from the initial sifting to be considered as part of a package of measures. The reduction in traffic on the local roads due to the scheme is likely to create a better environment for walkers and cyclist, therefore the scheme is likely to generate additional walking and cycling trips. At this current stage the size of the increase is unknown, therefore the impact is assumed as neutral to slight beneficial.		Neutral/slight Beneficial	-	
	Journey quality	The impact on traveller care will be neutral - beneficial. All elements will be designed to current industry standards therefore this may be an improvement to traveller environment over the existing local roads that are currently being used. The impact on travellers' views will be neutral as the majority of works will run through countryside. The impact on traveller stress will be beneficial as the scheme will reduce congestion and delay, which will improve route certainty and therefore reduce traveller stress. Overall the impact on journey quality is assumed as beneficial.		Beneficial	-	
	Accidents	The proposed options will encourage a reassignment of traffic away from existing lower standard routes to the new higher standard highway links proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.		Beneficial	-	N/A
	Security	No significant security risk will be introduced by the proposed scheme. The security impact is assumed to be neutral.		Neutral	-	N/A
	Access to services	At this stage the scheme focuses on highway improvements with no change in the routes served by the public transport system or the transport costs, although this may change in the future. The accessibility impact is currently assumed as neutral.		Neutral	-	N/A
	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs for users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs. The affordability impact is assumed as Neutral.		Neutral	-	N/A
	Severance	The scheme is likely to sever existing public rights of way along the new road corridor. However, the reduction in traffic along the existing local roads should reduce severance on the towns and villages. Where routes are severed it is considered that crossing facilities will be provided in line with or in close proximity to existing routes, or if required alternative routes will be provided, which should mitigate the impact of the new road. The severance impact is classed as neutral to slight beneficial.		Neutral/slight Beneficial	-	N/A
	Option and non-use values	At this stage the scheme does not directly provide for new public transport services. The option values impact is assumed as neutral.		Neutral	-	
Public Account	Cost to Broad Transport Budget	It it currently envisaged that the scheme will be fully public funded		-	£54.35m	
	Indirect Tax Revenues	The proposed option would results in changes in fuel use with affects indirect tax revenues.		-	£1.11m	

Appraisal Summary Table | **Date produced:** 5th June 2019 | **Contact:**

Name of scheme:	Norwich Western Link Option B West
Description of scheme:	
Name	
Organisation	
Role	Promoter/Official

	Impacts	Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Journey Time Benefits are the main source of monetised impacts for this option. Business users account for approximately 30% of journey time benefits	Value of journey time changes(£): £91.4m Net journey time changes (£): 0 to 2min: £34.1m; 2 to 5min: £22.7m; > 5min: £34.6m	Beneficial	£91.6m	
	Reliability impact on Business users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.	Estimating the value of reliability savings as around 10% of travel time savings would indicate a reliability benefit of £9,1m for Business users.	Beneficial	-	
	Regeneration	There is no development dependant on the scheme	Not Calculated		-	
	Wider Impacts	The scheme is consided to bring positive wider impacts in addition to transport user benefits as the scheme is likely to enable development with and around Norwich.	Not Calculated	Beneficial	-	
Environmental	Noise	***NB. This assessment did not use the WebTAG worksheet and DMRB guidance. It is based on qualitative methodology set out by WSP in a Technical Memorandum, 2019.*** The route passes immediately to the east of a small number of properties around the junction of Weston Green Road, approximately 45 metres from the proposed carriageway. Due to the proximity of these properties, there would be a greater chance of adverse noise impacts during the operational phases. This part of the route also includes a road bridge, which is likely to result in significant levels of construction noise and vibration at the properties. Close to the junction with the A1067, there are a number of properties to the north-east, on The Street. There are also properties to the west of this junction in Morton on the Hill, and to the east in the village of Attlebridge. The proposed works at this junction include the creation of a roundabout, a widened bridge crossing over the River Wensum, and an upgrade to the A1067. Adverse impacts may occur at the closest properties during the construction phase due to the proximity of works. Operational impacts may occur at the closest properties, although the level of impact will depend on the amount of traffic using the route, and any changes to traffic flow on the A1067 around the junction with the proposed route.	n/a	Slightly larger changes when compared to Option A, however overall they would still be classed as negligible in magnitude.	n/a	
	Air Quality	Overall there is a net worsening in air quality and a decrease in regional NOx emissions. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080.	Assessment Score 2025 PM2.5: -35.14 NO2: -153.39 Assessment Score 2040 PM2.5: -47.55 NO2: -95.85 Emissions 2025 NOx: - 25 tonnes Emissions 2040 NOx: + 4 tonnes Properties Improved: 10214 Neutral: 0 Worsening: 5339	N/A	NPV of change in PM10 emissions: £397,228 NPV of change in NOx emissions: £332,649 (2019 prices) Total NPV of change in air quality: £729,877	N/A
	Greenhouse gases	The appraisal reflects a net decrease in vehicle kilometres travelled over the modelled road network. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080. There is no account of CO2 emissions from power generating sources for electric vehicles.	Change in non-traded carbon over 60y (CO2e): 14,966 Change in traded carbon over 60y (CO2e): 0	N/A	NPV: -£1,358,528	
	Landscape	There would be perceptible impact on the landscape character by the proposed scheme. There would be subdivision of existing fields, that would in part replace historic field pattern eroded by recent enlargement, however there would be further subdivision of smaller fields in the north, or total loss which would alter the pattern. The road which is dualled would reduce tranquillity locally, particularly where it is on embankment to the north. The loss of small sections of hedgerows and woodlands would alter the landcover locally.	n/a	Moderate Adverse	n/a	
	Townscape	Not applicable to the proposed Option B western variant.				
	Historic Environment	The scheme would have a major direct impact on nationally significant historic environmental assets such that they are lost or their integrity is severely damaged.	There is one Grade II listed building, that will be physically affected by the scheme. There are nine designated heritage assets that could have a setting impact, one Grade I, one Grade II* and seven Grade II listed buildings.	Large adverse, due to impact on Built heritage	n/a	
	Biodiversity	This option has the potential to cause impacts to the River Wensum SAC and could also impact a known maternity colony of barbastelle bats and therefore the impact of the route is very large adverse.	n/a	Very large adverse	n/a	
	Water Environment	Changes to the existing bridge are likely to have a minor adverse effect on the River Wensum and adjacent riparian habitat in the short term, but with negligible long term effect. Potential impacts during construction can be mitigated to negligible effect. Culverting the ordinary watercourses can cause slight adverse impacts to conveyance of flow and material and biodiversity. Construction of new embankments in the flood plain will cause a minor adverse impact to flood risk. Compensatory storage and hydraulic modelling is likely to be required in this scheme design. Impact to groundwater is considered negligible due to suitable drainage mitigation.	n/a	Minor Adverse	n/a	
Social	Commuting and Other users	Journey Time Benefits are the main source of monetised impacts for this option. Commuting and other users account for approximately 70% of journey time benefits	Value of journey time changes(£): £220.3m Net journey time changes (£): 0 to 2min: £82.6m; 2 to 5min: £65.2m; > 5min: £72.4m	Beneficial	£213.4m	
	Reliability impact on Commuting and Other users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.		Beneficial		
	Physical activity	This option does not include measures aimed specifically at walking and cycling, however Walking and Cycling will be considered moving forward potentially through design of the route options and or potentially through the proposed additional non road options carried through from the initial sifting to be considered as part of a package of measures. The reduction in traffic on the local roads due to the scheme is likely to create a better environment for walkers and cyclist, therefore the scheme is likely to generate additional walking and cycling trips. At this current stage the size of the increase is unknown, therefore the impact is assumed as neutral to slight beneficial.		Neutral/slight Beneficial		
	Journey quality	The impact on traveller care will be neutral - beneficial. All elements will be designed to current industry standards therefore this may be an improvement to traveller environment over the existing local roads that are currently being used. The impact on travellers' views will be neutral as the majority of works will run through countryside. The impact on traveller stress will be beneficial as the scheme will reduce congestion and delay, which will improve route certainty and therefore reduce traveller stress. Overall the impact on journey quality is assumed as beneficial.		Beneficial		
	Accidents	The proposed options will encourage a reassignment of traffic away from existing lower standard routes to the new higher standard highway links proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.		Beneficial		
	Security	No significant security risk will be introduced by the proposed scheme. The security impact is assumed to be neutral.		Neutral		
	Access to services	At this stage the scheme focuses on highway improvements with no change in the routes served by the public transport system or the transport costs, although this may change in the future. The accessibility impact is currently assumed as neutral.		Neutral		
	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs for users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs. The affordability impact is assumed as Neutral		Neutral		
	Severance	The scheme is likely to sever existing public rights of way along the new road corridor. However, the reduction in traffic along the existing local roads should reduce severance on the towns and villages. Where routes are severed it is considered that crossing facilities will be provided in line with or in close proximity to existing routes, or if required alternative routes will be provided, which should mitigate the impact of the new road. The severance impact is classed as neutral to slight beneficial.		Neutral/slight Beneficial		
	Option and non-use values	At this stage the scheme does not directly provide for new public transport services. The option values impact is assumed as neutral.		Neutral		
Public Account	Cost to Broad Transport Budget	It it currently envisaged that the scheme will be fully public funded		-	£119.6m	
	Indirect Tax Revenues	The proposed option would results in changes in fuel use with affects indirect tax revenues.		-	-£1.14m	

Appraisal Summary Table

Date produced:	5th June 2019	Contact:	
Name of scheme:	Norwich Western Link Option B East	Name	
Description of scheme:		Organisation	
		Role	Promoter/Official

	Impacts	Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Journey Time Benefits are the main source of monetised impacts for this option. Business users account for approximately 30% of journey time benefits	Value of journey time changes(£): £96.4m Net journey time changes (£): 0 to 2min £36.6m; 2 to 5min £20.7m; > 5min £39.1m	Beneficial	£97.6m	
Economy	Reliability impact on Business users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.	Estimating the value of reliability savings as around 10% of travel time savings would indicate a reliability benefit of £9.6m for Business users.	Beneficial	-	
Economy	Regeneration	There is no development dependant on the scheme	Not Calculated		-	
Economy	Wider Impacts	The scheme is consided to bring positive wider impacts in addition to transport user benefits as the scheme is likely to enable development with and around Norwich.	Not Calculated	Beneficial	-	
Environmental	Noise	***NB. This assessment did not use the WebTAG worksheet and DMRB gudiance. It is based on qualitative methodology set out by WSP in a Technical Memorandum, 2019.*** The route passes immediately to the east of a small number of properties around the junction of Weston Green Road, approximately 45 metres from the proposed carriageway. Due to the proximity of these properties, there would be a greater chance of adverse noise impacts during the operational phases. This part of the route also includes a road bridge, which is likely to result in significant levels of construction noise and vibration at the properties. The route also passes within 280 metres of Morton Hall, and within 85 metres of Ivy Cottages, close to the A1067.The proposed works in this area include a viaduct crossing over the River Wensum and the construction of a roundabout to form a junction with the A1067. Due to the proximity and nature of these works, there is an increased risk of adverse impacts due to construction noise and vibration. Operational noise may also be an issue at Ivy Cottages close to the A1067, due to their proximity to the proposed route and its roundabout with the A1067.	n/a	Very similar to the outcomes for Route Option B West. All of the changes would be classed as negligible in magnitude.	n/a	
Environmental	Air Quality	Overall there is a net worsening in air quality and an increase in regional NOx emissions. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080.	Assessment Score 2025 PM2.5: -17.74 NO2: -68.39 Assessment Score 2040 PM2.5: -1.19 NO2: -20.22 Emissions 2025 NOx: - 25 tonnes Emissions 2040 NOx: + 6 tonnes Properties Improved: 8246 Neutral: 0 Worsening: 5338	N/A	NPV of change in PM10 emissions: -£403,887 NPV of change in NOx emissions: -£143,254 (2019 prices) Total NPV of change in air quality: -£547,141	N/A
Environmental	Greenhouse gases	The appraisal reflects a net increase in vehicle kilometres travelled over the modelled road network. Uncertainties include: no forecast of traffic growth beyond 2041, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080. There is no account of CO2 emissions from power generating sources for electric vehicles.	Change in non-traded carbon over 60y (CO2e): 93,585 Change in traded carbon over 60y (CO2e): 0	N/A	NPV: -£4,900,284	
Environmental	Landscape	The majority of the landscape would have minor changes, particularly in the south, however in the north their would be substantial change due to the introduction of the viaduct over the River Wensum and roundabout. The road would be dualled and a large proportion to the north and south being on embankment, reducing the perception of tranquillity. The scheme would be visible from a number of farmsteads throughout the landscape. In the north the viaduct would have an adverse influence on the wider landscape.	n/a	Moderate Adverse	n/a	
Environmental	Townscape	Not applicable to the proposed Option B eastern variant.				
Environmental	Historic Environment	The scheme would be intrusive in the setting (context), and will adversely affect the appreciation and understanding of the characteristic historic environmental resource. The scheme would be a major direct impact on regionally or locally significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised, but adequate mitigation can be specified.	There are no designated heritage assets that will be physically affected by the scheme. There are nine designated heritage assets that could have a setting impact, one Grade I, one Grade II* and seven Grade II listed buildings.	Moderate Adverse	n/a	
Environmental	Biodiversity	This option has the potential to cause impacts to a known maternity colony of barbastelle bats and therefore the impact of the route is very large adverse.	n/a	Very Large Adverse	n/a	
Environmental	Water Environment	Construction of a new viaduct over the River Wensum and flood plain is likely to have a minor adverse effect on the riparian habitat, water quality and conveyance during construction phase. Some potential impacts during construction can be mitigated to negligible effect. Culverting the ordinary watercourses can cause slight adverse impacts to conveyance of flow and material and biodiversity. Construction of bridge piers in the flood plain will cause a moderate adverse impact to flood risk. Compensatory storage and hydraulic modelling is likely to be required in this scheme design. Impact to groundwater is considered negligible due to suitable drainage mitigation.	n/a	Moderate Adverse	n/a	
Social	Commuting and Other users	Journey Time Benefits are the main source of monetised impacts for this option. Commuting and other users account for approximately 70% of journey time benefits	Value of journey time changes(£): £232.6m Net journey time changes (£): 0 to 2min £88.8m; 2 to 5min £62.7m; > 5min £81.1m	Beneficial	£226.6m	
Social	Reliability impact on Commuting and Other users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.		Beneficial		
Social	Physical activity	This option does not include measures aimed specifically at walking and cycling, however Walking and Cycling will be considered moving forward potentially through design of the route options and or potentially through the proposed additional non road options carried through from the initial sifting to be considered as part of a package of measures. The reduction in traffic on the local roads due to the scheme is likely to create a better environment for walkers and cyclist, therefore the scheme is likely to generate additional walking and cycling trips. At this current stage the size of the increase is unknown, therefore the impact is assumed as neutral to slight beneficial.		Neutral/slight Beneficial		
Social	Journey quality	The impact on traveller care will be neutral - beneficial. All elements will be designed to current industry standards therefore this may be an improvement to traveller environment over the existing local roads that are currently being used. The impact on travellers' views will be neutral as the majority of works will run through countryside. The impact on traveller stress will be beneficial as the scheme will reduce congestion and delay, which will improve route certainty and therefore reduce traveller stress. Overall the impact on journey quality is assumed as beneficial.		Beneficial		
Social	Accidents	The proposed options will encourage a reassignment of traffic away from existing lower standard routes to the new higher standard highway links proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.		Beneficial		
Social	Security	No significant security risk will be introduced by the proposed scheme. The security impact is assumed to be neutral.		Neutral		
Social	Access to services	At this stage the scheme focuses on highway improvements with no change in the routes served by the public transport system or the transport costs, although this may change in the future. The accessibility impact is currently assumed as neutral.		Neutral		
Social	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs for users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs. The affordability impact is assumed as Neutral.		Neutral		
Social	Severance	The scheme is likely to sever existing public rights of way along the new road corridor. However, the reduction in traffic along the existing local roads should reduce severance on the towns and villages. Where routes are severed it is considered that crossing facilities will be provided in line with or in close proximity to existing routes, or if required alternative routes will be provided, which should mitigate the impact of the new road. The severance impact is classed as neutral to slight beneficial.		Neutral/slight Beneficial		
Social	Option and non-use values	At this stage the scheme does not directly provide for new public transport services. The option values impact is assumed as neutral.		Neutral		
Public Account	Cost to Broad Transport Budget	It it currently envisaged that the scheme will be fully public funded		-	£147.8m	
Public Account	Indirect Tax Revenues	The proposed option would results in changes in fuel use with affects indirect tax revenues.		-	-£0.52m	

Appraisal Summary Table

Date produced:	5th June 2019
Name of scheme:	Norwich Western Link Option C
Description of scheme:	

Contact:	
Name	
Organisation	
Role	Promoter/Official

	Impacts	Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Journey Time Benefits are the main source of monetised impacts for this option. Business users account for approximately 30% of journey time benefits	Value of journey time changes(£): £102.5m Net journey time changes (£): 0 to 2min: £40.0m; 2 to 5min: £15.9m; > 5min: £46.7m	Beneficial	£107.50	
	Reliability impact on Business users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.	Estimating the value of reliability savings as around 10% of travel time savings would indicate a reliability benefit of £10.2m for Business users.	Beneficial	-	
	Regeneration	There is no development dependant on the scheme	Not Calculated		-	
	Wider Impacts	The scheme is consided to bring positive wider impacts in addition to transport user benefits as the scheme is likely to enable development with and around Norwich.	Not Calculated	Beneficial	-	
Environmental	Noise	***NB. This assessment did not use the WebTAG worksheet and DMRB gudiance. It is based on qualitative methodology set out by WSP in a Technical Memorandum, 2019.*** From the proposed junction with the A47 it heads north-east, following the same alignment as Routes B and B1 and running roughly parallel with Wood Lane. After crossing Breck Road it continues north-east, turning more easterly after crossing Ringland Lane before turning northward again and joining with the A1067. The route only passes close to a small number of properties, notably Low Farm and Old Hall Farm, Old Hall Farm Cottages and Woodstock close to the junction with the A1067. The works in this area include a viaduct crossing over the River Wensum, a drainage basin, and the construction of a roundabout to form a junction with the A1067. Due to the proximity and nature of these works, there is an increased risk of adverse impacts due to construction noise and vibration. The proximity of the route also means that there may be adverse impacts due to operational noise. Route Option C passes close to the fewest sensitive properties and is therefore considered the least likely to generate adverse effects.	n/a	Similar to those of Route Options B western and eastern variants, but overall they would be classed as minor impacts, both adverse and beneficial, rather than negligible.	n/a	
	Air Quality	Overall there is a net worsening in air quality and an increase in regional NOx emissions. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080.	Assessment Score 2025 PM2.5: -43.74 NO2: -4.47 Assessment Score 2040 PM2.5: -46.54 NO2: -104.53 Emissions 2025 NOx: - 20 tonnes Emissions 2040 NOx: + 5 tonnes Properties Improved: 8795 Neutral: 0 Worsening: 5729	N/A	NPV of change in PM10 emissions: -£269,001 NPV of change in NOx emissions: -£183,076 (2019 prices) Total NPV of change in air quality: -£452,077	N/A
	Greenhouse gases	The appraisal reflects a net increase in vehicle kilometres travelled over the modelled road network. Uncertainties include: no forecast of traffic growth beyond 2041, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080. There is no account of CO2 emissions from power generating sources for electric vehicles.	Change in non-traded carbon over 60y (CO2e): 79,525 Change in traded carbon over 60y (CO2e): 0	N/A	NPV: -£4,149,699	
	Landscape	There would be subdivision of fields, disrupting field patterns locally. There would be sections of embankment and cutting through the landscape which would affect the pattern locally and the viaduct would have a wider impact. The viaduct across the R. Wensum would introduce a new feature into this landscape and would have a substantia adversel impact on tranquillity in the north, the road would alter tranquillity locally along the length, limited due it largely being at grade or in cutting. The alignment which is dualled and which is larger in scale than the existing roads through this landscape. There would be some loss of woodland and arable farmland altering land cover locally.	n/a	Moderate Adverse	n/a	
	Townscape	Not applicable to the proposed Option C.				
	Historic Environment	The scheme would be intrusive in the setting (context), and will adversely affect the appreciation and understanding of the characteristic historic environmental resource. The scheme would be a major direct impact on regionally or locally significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised, but adequate mitigation can be specified.	There are no designated heritage assets that will be physically affected by the scheme. There are two Grade II listed buildings that could have a setting impact.	Moderate Adverse	n/a	
	Biodiversity	This route has the potential to cause impacts to gathering (pre-maternity) roosts of barbastelle bats. Given the recorded roosts are gathering roosts and are further away from the main maternity roost area (around Morton) the impact is Large (rather than very large) Adverse.	n/a	Large Adverse	n/a	
	Water Environment	Construction of a new viaduct over the River Wensum and flood plain is likely to have a minor adverse effect on the riparian habitat, water quality and conveyance during construction phase. Some potential impacts during construction can be mitigated to negligible effect. Culverting the ordinary watercourses can cause slight adverse impacts to conveyance of flow and material and biodiversity. Construction of bridge piers in the flood plain will cause a moderate adverse impact to flood risk. Compensatory storage and hydraulic modelling is likely to be required in this scheme design. Impact to groundwater is considered negligible due to suitable drainage mitigation.	n/a	Moderate Adverse	n/a	
Social	Commuting and Other users	Journey Time Benefits are the main source of monetised impacts for this option. Commuting and other users account for approximately 70% of journey time benefits	Value of journey time changes(£): £249.2m Net journey time changes (£): 0 to 2min: £100.2m; 2 to 5min: £47.5m; > 5min: £101.5m		£249.5m	
	Reliability impact on Commuting and Other users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.		Beneficial		
	Physical activity	This option does not include measures aimed specifically at walking and cycling, however Walking and Cycling will be considered moving forward potentially through design of the route options and or potentially through the proposed additional non road options carried through from the initial sifting to be considered as part of a package of measures. The reduction in traffic on the local roads due to the scheme is likely to create a better environment for walkers and cyclist, therefore the scheme is likely to generate additional walking and cycling trips. At this current stage the size of the increase is unknown, therefore the impact is assumed as neutral to slight beneficial.		Neutral/slight Beneficial		
	Journey quality	The impact on traveller care will be neutral - beneficial. All elements will be designed to current industry standards therefore this may be an improvement to traveller environment over the existing local roads that are currently being used. The impact on travellers' views will be neutral as the majority of works will run through countryside. The impact on traveller stress will be beneficial as the scheme will reduce congestion and delay, which will improve route certainty and therefore reduce traveller stress. Overall the impact on journey quality is assumed as beneficial.		Beneficial		
	Accidents	The proposed options will encourage a reassignment of traffic away from existing lower standard routes to the new higher standard highway links proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.		Beneficial		
	Security	No significant security risk will be introduced by the proposed scheme. The security impact is assumed to be neutral.		Neutral		
	Access to services	At this stage the scheme focuses on highway improvements with no change in the routes served by the public transport system or the transport costs, although this may change in the future. The accessibility impact is currently assumed as neutral.		Neutral		
	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs for users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs. The affordability impact is assumed as Neutral.		Neutral		
	Severance	The scheme is likely to sever existing public rights of way along the new road corridor. However, the reduction in traffic along the existing local roads should reduce severance on the towns and villages. Where routes are severed it is considered that crossing facilities will be provided in line with or in close proximity to existing routes, or if required alternative routes will be provided, which should mitigate the impact of the new road. The severance impact is classed as neutral to slight beneficial.		Neutral/slight Beneficial		
	Option and non-use values	At this stage the scheme does not directly provide for new public transport services. The option values impact is assumed as neutral.		Neutral		
Public Account	Cost to Broad Transport Budget	It it currently envisaged that the scheme will be fully public funded		-	£142.9m	
	Indirect Tax Revenues	The proposed option would results in changes in fuel use with affects indirect tax revenues.		-	£2.65m	

Appraisal Summary Table

Date produced:	5th June 2019
Contact:	
Name	
Organisation	
Role	Promoter/Official
Name of scheme:	Norwich Western Link Option D West
Description of scheme:	

	Impacts	Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Journey Time Benefits are the main source of monetised impacts for this option. Business users account for approximately 30% of journey time benefits	Value of journey time changes(£): £90.9m Net journey time changes (£): 0 to 2min: £33.1m; 2 to 5min: £29.8m; > 5min: £28.1m	Beneficial	£92.5m	
Economy	Reliability impact on Business users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.	Estimating the value of reliability savings as around 10% of travel time savings would indicate a reliability benefit of £9.1m for Business users.	Beneficial	-	
Economy	Regeneration	There is no development dependant on the scheme	Not Calculated		-	
Economy	Wider Impacts	The scheme is consided to bring positive wider impacts in addition to transport user benefits as the scheme is likely to enable development with and around Norwich.	Not Calculated	Beneficial	-	
Environmental	Noise	***NB. This assessment did not use the WebTAG worksheet and DMRB guidance. It is based on qualitative methodology set out by WSP in a Technical Memorandum, 2019.*** For properties close to the junction with the A1067, including Low Farm, Old Hall Farm, Old Hall Farm Cottages and Woodstock, the works in this area include a viaduct crossing over the River Wensum, a drainage basin, and the construction of a roundabout to form a junction with the A1067. Due to the proximity and nature of these works, there is an increased risk of adverse impacts due to construction noise and vibration. The proximity of the route also means that there may be adverse impacts due to operational noise. For properties close to the junction with the A47, the works in this area include a viaduct crossing over the River Tud and a drainage basin. Due to the proximity and nature of these works, there is an increased risk of adverse impacts due to construction noise and vibration. The proximity of the route also means that there may be adverse impacts due to operational noise.	n/a	Similar to those from Route Option B western and eastern variants and Route Option C and would be classed as negligible in magnitude.	n/a	
Environmental	Air Quality	Overall there is a net improvement in air quality and an increase in regional NOx emissions. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080.	Assessment Score 2025 PM2.5: -25.27 NO2: 11.36 Assessment Score 2040 PM2.5: -70.66 NO2: -285.48 Emissions 2025 NOx: - 19 tonnes Emissions 2040 NOx: + 9 tonnes Properties Improved: 10112 Neutral: 129 Worsening: 7178	N/A	NPV of change in PM10 emissions: -£1,971,176 NPV of change in NOx emissions: -£1,057,187 (2019 prices) Total NPV of change in air quality: -£3,028,364	N/A
Environmental	Greenhouse gases	The appraisal reflects a net increase in vehicle kilometres travelled over the modelled road network. Uncertainties include: no forecast of traffic growth beyond 2041, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080. There is no account of CO2 emissions from power generating sources for electric vehicles.	Change in non-traded carbon over 60y (CO2e): 223,239 Change in traded carbon over 60y (CO2e): 0	N/A	NPV: -£10,575,555	
Environmental	Landscape	There would be subdivision of fields, disrupting field patterns locally. The road is on viaduct in the north, then running in sections of cutting and on embankment through the central part and onto embankment and a viaduct over the River Tud in the south, where on viaduct it would have a substantial impact on tranquillity and introduce a new element into this landscape which would have a wider effect. The alignment which is dualled is larger in scale than the existing roads in the surrounding landscape. There would be some loss of woodland and arable farmland altering land cover locally.	n/a	Moderate Adverse	n/a	
Environmental	Townscape	Not applicable to the proposed Option D West.				
Environmental	Historic Environment	The scheme would be intrusive in the setting (context), and will adversely affect the appreciation and understanding of the characteristic historic environmental resource. The scheme would be a major direct impact on regionally or locally significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised, but adequate mitigation can be specified.	There are no designated heritage assets that will be physically affected by the scheme. There are five designated heritage assets that could have a setting impact, one Grade I, one Grade II* and three Grade II listed buildings.	Moderate Adverse	n/a	
Environmental	Biodiversity	This route has the potential to cause impacts to gathering (pre-maternity) roosts of barbastelle bats. Given the recorded roosts are gathering roosts and are further away from the main maternity roost area (around Morton) the impact is Large (rather than very large) Adverse.	n/a	Large Adverse	n/a	
Environmental	Water Environment	Construction of new viaducts over the River Wensum and River Tud and their associated flood plains is likely to have a minor adverse effect on the riparian habitat, water quality and conveyance during construction phase. Some potential impacts during construction can be mitigated to negligible effect. Construction of bridge piers in the flood plain will cause a moderate adverse impact to flood risk. Compensatory storage and hydraulic modelling is likely to be required in this scheme design. Impact to groundwater is considered negligible due to suitable drainage mitigation.	n/a	Moderate Adverse	n/a	
Social	Commuting and Other users	Journey Time Benefits are the main source of monetised impacts for this option. Commuting and other users account for approximately 70% of journey time benefits	Value of journey time changes(£): £229.4M Net journey time changes (£): 0 to 2min: £88.9m; 2 to 5min: £83.5m; > 5min: £57.1m	Beneficial	£225.4m	
Social	Reliability impact on Commuting and Other users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.		Beneficial		
Social	Physical activity	This option does not include measures aimed specifically at walking and cycling, however Walking and Cycling will be considered moving forward potentially through design of the route options and or potentially through the proposed additional non road options carried through from the initial sifting to be considered as part of a package of measures. The reduction in traffic on the local roads due to the scheme is likely to create a better environment for walkers and cyclist, therefore the scheme is likely to generate additional walking and cycling trips. At this current stage the size of the increase is unknown, therefore the impact is assumed as neutral to slight beneficial.		Neutral/slight Beneficial		
Social	Journey quality	The impact on traveller care will be neutral - beneficial. All elements will be designed to current industry standards therefore this may be an improvement to traveller environment over the existing local roads that are currently being used. The impact on travellers' views will be neutral as the majority of works will run through countryside. The impact on traveller stress will be beneficial as the scheme will reduce congestion and delay, which will improve route certainty and therefore reduce traveller stress. Overall the impact on journey quality is assumed as beneficial.		Beneficial		
Social	Accidents	The proposed options will encourage a reassignment of traffic away from existing lower standard routes to the new higher standard highway links proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.		Beneficial		
Social	Security	No significant security risk will be introduced by the proposed scheme. The security impact is assumed to be neutral.		Neutral		
Social	Access to services	At this stage the scheme focuses on highway improvements with no change in the routes served by the public transport system or the transport costs, although this may change in the future. The accessibility impact is currently assumed as neutral.		Neutral		
Social	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs for users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs. The affordability impact is assumed as Neutral.		Neutral		
Social	Severance	The scheme is likely to sever existing public rights of way along the new road corridor. However, the reduction in traffic along the existing local roads should reduce severance on the towns and villages. Where routes are severed it is considered that crossing facilities will be provided in line with or in close proximity to existing routes, or if required alternative routes will be provided, which should mitigate the impact of the new road. The severance impact is classed as neutral to slight beneficial.		Neutral/slight Beneficial		
Social	Option and non-use values	At this stage the scheme does not directly provide for new public transport services. The option values impact is assumed as neutral.		Neutral		
Public Account	Cost to Broad Transport Budget	It it currently envisaged that the scheme will be fully public funded		-	£166.6m	
Public Account	Indirect Tax Revenues	The proposed option would results in changes in fuel use with affects indirect tax revenues.		-	£0.31m	

Appraisal Summary Table		Date produced:	5th June 2019	Contact:	
Name of scheme:	Norwich Western Link Option D East			Name	
Description of scheme:				Organisation	
				Role	Promoter/Official

	Impacts	Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Journey Time Benefits are the main source of monetised impacts for this option. Business users account for approximately 30% of journey time benefits	Value of journey time changes(£): £90.9m Net journey time changes (£) 0 to 2min: £33.1m 2 to 5min: £29.8m > 5min: £28.1m	Beneficial	£92.5m	
Economy	Reliability impact on Business users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.	Estimating the value of reliability savings as around 10% of travel time savings would indicate a reliability benefit of £9.1m for Business users.	Beneficial	-	
Economy	Regeneration	There is no development dependant on the scheme	Not Calculated		-	
Economy	Wider Impacts	The scheme is consided to bring positive wider impacts in addition to transport user benefits as the scheme is likely to enable development with and around Norwich.	Not Calculated	Beneficial	-	
Environmental	Noise	***NB. This assessment did not use the WebTAG worksheet and DMRB guidance. It is based on qualitative methodology set out by WSP in a Technical Memorandum, 2019.*** For properties close to the junction with the A1067, including Low Farm, Old Hall Farm, Old Hall Farm Cottages and Woodstock, the works in this area include a viaduct crossing over the River Wensum, a drainage basin, and the construction of a roundabout to form a junction with the A1067. Due to the proximity and nature of these works, there is an increased risk of adverse impacts due to construction noise and vibration. The proximity of the route also means that there may be adverse impacts due to operational noise. For properties close to the junction with the A47, the works in this area include a viaduct crossing over the River Tud and a drainage basin. Due to the proximity and nature of these works, there is an increased risk of adverse impacts due to construction noise and vibration. The proximity of the route also means that there may be adverse impacts due to operational noise.	n/a	Similar to those from Route Option B western and eastern variants and Route Option C and would be classed as negligible in magnitude.	n/a	
Environmental	Air Quality	Overall there is a net improvement in air quality and an increase in regional NOx emissions. Uncertainties include: no forecast of traffic growth beyond 2040, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080.	Assessment Score 2025 PM2.5: -51.69 NO2: -194.71 Assessment Score 2040 PM2.5: -68.10 NO2: -263.38 Emissions 2025 NOx: - 19 tonnes Emissions 2040 NOx: + 9 tonnes Properties Improved: 10112 Neutral: 129 Worsening: 7196	N/A	NPV of change in PM10 emissions: -£1,971,176 NPV of change in NOx emissions: -£1,057,187 (2019 prices) Total NPV of change in air quality: -£3,028,364	
Environmental	Greenhouse gases	The appraisal reflects a net increase in vehicle kilometres travelled over the modelled road network. Uncertainties include: no forecast of traffic growth beyond 2041, beyond this no change has been assumed; no forecast emission factors after 2030. From 2030 it has been assumed that 2030 emission factors apply up to 2080. There is no account of CO2 emissions from power generating sources for electric vehicles.	Change in non-traded carbon over 60y (CO2e): 223,239 Change in traded carbon over 60y (CO2e): 0	N/A	NPV: -£10,575,555	
Environmental	Landscape	There would be subdivision of fields, disrupting field patterns locally. The road is on viaduct in the north, then running in sections of cutting and on embankment through the central part and onto embankment and a viaduct over the River Tud in the south, where on viaduct it would have a substantial impact on tranquillity and introduce a new element into this landscape which would have a wider effect. The alignment which is dualled is larger than the existing roads in the surrounding Landscape. There would be some loss of woodland and arable farmland altering land cover locally.	n/a	Moderate Adverse	n/a	
Environmental	Townscape	Not applicable to the proposed Option D East.				
Environmental	Historic Environment	The scheme would be intrusive in the setting (context), and will adversely affect the appreciation and understanding of the characteristic historic environmental resource. The scheme would be a major direct impact on regionally or locally significant historic environment non-designated assets, resulting in loss of features such that their integrity is substantially compromised, but adequate mitigation can be specified.	There are no designated heritage assets that will be physically affected by the scheme. There are five designated heritage assets that could have a setting impact, one Grade I, one Grade II* and three Grade II listed buildings.	Moderate Adverse	n/a	
Environmental	Biodiversity	This route has the potential to cause impacts to gathering (pre-maternity) roosts of barbastelle bats. Given the recorded roosts are gathering roosts and are further away from the main maternity roost area (around Morton) the impact is Large (rather than very large) Adverse.	n/a	Large Adverse	n/a	
Environmental	Water Environment	Construction of new viaducts over the River Wensum and River Tud and their associated flood plains is likely to have a minor adverse effect on the riparian habitat, water quality and conveyance during construction phase. Some potential impacts during construction can be mitigated to negligible effect. Construction of bridge piers in the flood plain will cause a moderate adverse impact to flood risk. Compensatory storage and hydraulic modelling is likely to be required in this scheme design. Impact to groundwater is considered negligible due to suitable drainage mitigation.	n/a	Moderate Adverse	n/a	
Social	Commuting and Other users	Journey Time Benefits are the main source of monetised impacts for this option. Commuting and other users account for approximately 70% of journey time benefits	Value of journey time changes(£): £229.4M Net journey time changes (£) 0 to 2min: £88.9m 2 to 5min: £83.5m > 5min: £57.1m	Beneficial	£225.4m	
Social	Reliability impact on Commuting and Other users	Providing a higher class standard of road than currently exists should lead to improved journey time reliability along this route.		Beneficial		
Social	Physical activity	This option does not include measures aimed specifically at walking and cycling, however Walking and Cycling will be considered moving forward potentially through design of the route options and or potentially through the proposed additional non road options carried through from the initial sifting to be considered as part of a package of measures. The reduction in traffic on the local roads due to the scheme is likely to create a better environment for walkers and cyclist, therefore the scheme is likely to generate additional walking and cycling trips. At this current stage the size of the increase is unknown, therefore the impact is assumed as neutral to slight beneficial.		Neutral/slight Beneficial		
Social	Journey quality	The impact on traveller care will be neutral - beneficial. All elements will be designed to current industry standards therefore this may be an improvement to traveller environment over the existing local roads that are currently being used. The impact on travellers' views will be neutral as the majority of works will run through countryside. The impact on traveller stress will be beneficial as the scheme will reduce congestion and delay, which will improve route certainty and therefore reduce traveller stress. Overall the impact on journey quality is assumed as beneficial.		Beneficial		
Social	Accidents	The proposed options will encourage a reassignment of traffic away from existing lower standard routes to the new higher standard highway links proposed between the A47 and A1067. It is expected that this will produce an overall reduction in accidents in the study area and deliver a beneficial outcome.		Beneficial		
Social	Security	No significant security risk will be introduced by the proposed scheme. The security impact is assumed to be neutral.		Neutral		
Social	Access to services	At this stage the scheme focuses on highway improvements with no change in the routes served by the public transport system or the transport costs, although this may change in the future. The accessibility impact is currently assumed as neutral.		Neutral		
Social	Affordability	The scheme has not been designed to address the affordability of the transport system, there will be no change in fares/travel costs for users apart from those already identified through TUBA via Car Fuel and Non-Fuel operating costs. The affordability impact is assumed as Neutral.		Neutral		
Social	Severance	The scheme is likely to sever existing public rights of way along the new road corridor. However, the reduction in traffic along the existing local roads should reduce severance on the towns and villages. Where routes are severed it is considered that crossing facilities will be provided in line with or in close proximity to existing routes, or if required alternative routes will be provided, which should mitigate the impact of the new road. The severance impact is classed as neutral to slight beneficial.		Neutral/slight Beneficial		
Social	Option and non-use values	At this stage the scheme does not directly provide for new public transport services. The option values impact is assumed as neutral.		Neutral		
Public Account	Cost to Broad Transport Budget	It it currently envisaged that the scheme will be fully public funded		-	£155.3m	
Public Account	Indirect Tax Revenues	The proposed option would results in changes in fuel use with affects indirect tax revenues.		-	£0.31m	

Appendix F

CONSULTATION FINDINGS AND REPORTS

Norfolk County Council

Norwich Western Link: Options Consultation Report

June 2019

Table of contents

Executive summary

Overview

Norfolk County Council is developing proposals for a Norwich Western Link to connect the western end of Broadland Northway (formerly the Northern Distributor Road) to the A47. The aim of the project is to support sustainable and economic growth, improving air quality in local communities, promoting an improved environment and improving strategic connectivity with the strategic road network.

Norfolk County Council carried out a public consultation on potential route options for the Norwich Western Link between 26 November 2018 and 18 January 2019.

The purpose of the consultation was to provide information on the options proposals, obtain feedback on each option and help identify a preferred route for the Norwich Western Link.

The consultation

A total of 1,931 responses to the consultation were received providing a broad range of views on the proposals. Key headlines from the consultation responses are:

- Option D was the most popular solution and Option C was the second most popular.
- Option D was generally considered to be the most viable option due to the shortness of the route and links to major roads such as the A47. However, Option C was perceived by several respondents to have fewer environmental impacts.
- Option A was the least popular solution, with particular concern that it is too far away from Norwich to act effectively as a link road.
- Options B WEST (also referred to as B1) and B EAST (also referred to as B2) have varying degrees of support, but have been highlighted as being too far away to act as an effective link road.
- There are concerns for the environment across all options, particularly with regards to impacts on woodlands and wildlife.
- There is support for in wider transport improvements, including improvements to public transport and walking / cycling facilities to be included in the scheme.

Next steps

An Option Selection Report will be published, detailing how consultation responses, amongst a variety of engineering and environmental aspects have been considered, and recommending the proposed option to take forward for further development and design. The proposed option will be consulted on in more detail prior to any planning application being submitted.

1. About the proposals

1.1 Introduction

1.1.1 Creating a Norwich Western Link to connect the western end of Broadland Northway (formerly the Northern Distributor Road) to the A47 is one of Norfolk County Council's top infrastructure priorities. Between 26 November 2018 and 18 January 2019, the Council consulted on road options for a Norwich Western Link, to help identify a preferred route.

1.1.2 In total, 1,931 responses to the consultation were received. This report summarises the consultation feedback received, highlighting both key themes and issues surrounding the Norwich Western Link proposals, as well as public sentiment towards preferred options.

1.2 Project overview

1.2.1 The Council is aware that there are significant problems with traffic congestion, rat-running and slow journey times in the area to the west of Norwich, and these are expected to worsen as the number of people living and working in the county increases. Creating a Norwich Western Link is one of Norfolk County Council's top infrastructure priorities.

1.2.2 In summer 2018, the initial consultation for a Norwich Western Link took place. More than 1,700 consultation responses were received which demonstrated very strong support for creating a link between Broadland Northway (formerly known as the Northern Distributor Road) and the A47, with the majority of those responding suggesting a new road as their preferred solution.

1.2.3 Since this initial consultation, further work has been undertaken to shortlist four road options for a Norwich Western Link. Between Monday 26 November 2018 and Friday 18 January 2019, the Council held a consultation on these proposals with the objective of identifying a preferred option.

1.3 The proposals

1.3.1 The consultation sought views on four options (A-D) for the Norwich Western Link. Figure 1 below sets out the four route options.

1.3.2 **Option A** - A 7.2mile single carriageway upgrade to the B1535 and A1067, linking to the A47 at the Wood Lane junction north of Honingham. This option would significantly realign the current B Road, smoothing it out to make it a higher standard route. The route would join the A1067 via a new junction at Lenwade and make use of the existing bridge across the River Wensum at Attlebridge. It is predicted this route would carry around 10,000 vehicles a day by 2040. The estimated cost is £60m.

1.3.3 **Option B** - A new dual carriageway route and dual carriageway upgrade of the A1067, with the new route to the east of Weston Longville and linking to the A47 at Wood Lane. At the northern end of this route, two alternatives are given for how it could join the A1067. **Option B West** would be via a new junction near Attlebridge which would include widening the existing River Wensum bridge at Attlebridge - this route would total 5.1 miles in length. **Option B East** would see a new 660 metre viaduct crossing of the Wensum created, joining the A1067 further to the east and would total 4.7 miles in length.

1.3.4 It is predicted this route would carry around 30,000 vehicles a day by 2040. The cost of the route using the existing bridge is estimated at £129m, while the viaduct alternative is estimated to cost £155m.

1.3.5 **Option C** - A new dual carriageway route and dual carriageway upgrade of the A1067, linking to the A47 at Wood Lane and totalling 3.9 miles. A short section of the A1067 would be dualled before a new junction would take the route between Weston Longville and Ringland, crossing the River Wensum on a 720 metre-long viaduct. It is predicted this route would carry around 32,000 vehicles a day by 2040. The estimated cost is £153m.

1.3.6 **Option D** - A new dual carriageway route and dual carriageway upgrade of the A1067. The route is similar to Option C at its northern end, however it then runs to the west of Ringland and links to the A47 further east. A short section of the A1067 would be dualled before a new junction would take the route between Weston Longville and Ringland, crossing the River Wensum on a 660metre-long viaduct, then turning more to the south and crossing the River Tud on a second 120 metre viaduct, before it meets the A47.

1.3.7 Two alternatives for how Option D could join the A47 were presented, but were not the subject of this consultation. This is due to Highways England's plans to dual the section of the A47 between North Tuddenham and Easton. The Council has accounted for the possibility of the junction being located near Blind Lane and Taverham Road or closer to the current Easton roundabout junction, and is currently further considering the junction options. The location of the junction makes a small difference to the overall length of the route - 3.8miles if the route connects near Blind Lane and Taverham Road and 3.7miles if it connects near the current Easton roundabout.

1.3.8 It is predicted this route would carry around 31,000 vehicles a day by 2040. The estimated cost is £161m (this remains the same for both alternatives for how the route could join the A47).

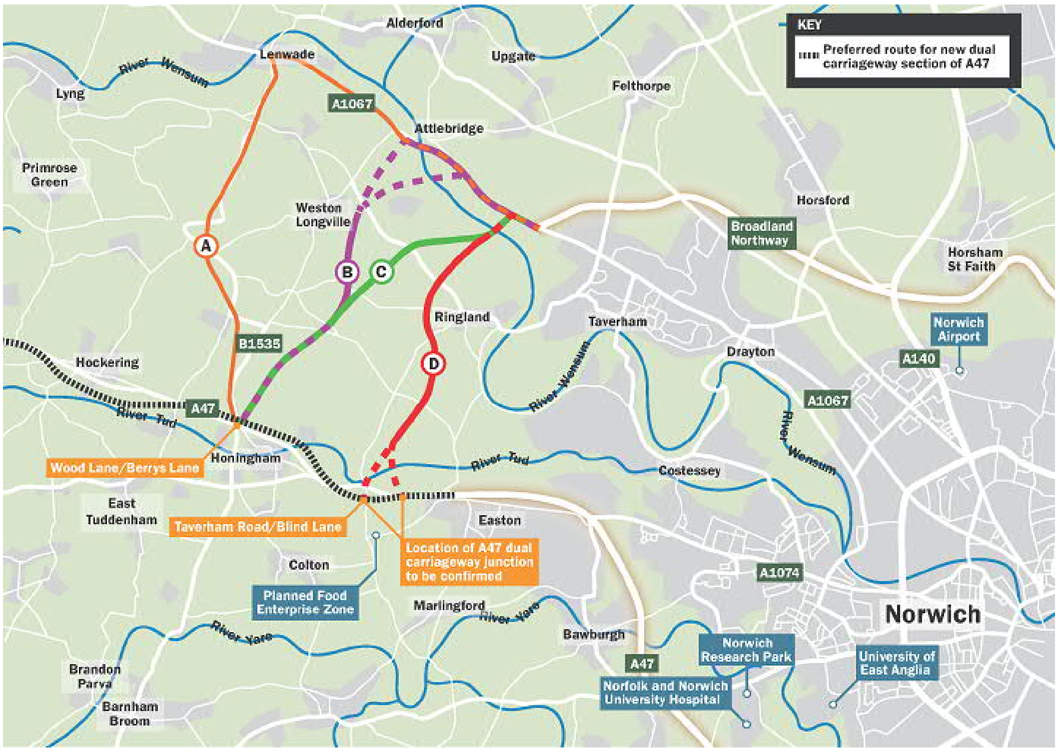


Figure 1: Norwich Western Link Shortlisted Options

1.3.9 Additional feedback was sought on potential complementary measures such as walking, cycling and public transport improvements that could be delivered as part of the NWL solution.

1.4 Key potential benefits of the project

1.4.1 The development of this link seeks to connect the Broadland Northway from the A1067 to the A47 west of Norwich. The strategic benefits of the Norwich Western Link include:

- Supporting sustainable growth
- Improving the quality of life for local communities
- Supporting economic growth
- Promoting an improved environment
- Improving strategic connectivity with the national road network

1.5 Potential effects

1.5.1 Some of the proposed route alignments involve the need to install a viaduct over the River Wensum and River Tud. With the River Wensum being a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI), this creates a potential environmental challenge, and subsequently environmental and ecological research has taken place to support this. Furthermore, it is recognised that overall the area surrounding the proposed route options is largely rural, including areas of ancient woodland, County Wildlife Sites, and roadside nature reserves.

1.5.2 Highways England plans to dual a section of the A47 between North Tuddenham and Easton with a planned construction date of 2021. Norwich Western Link would need to align with Highways England's own proposals to enable the best outcome for both schemes.

1.5.3 Potential effects vary with each proposed option and these include environmental issues, the potential for increased traffic in certain areas, the close proximity of route options to listed buildings and potential impacts on sites of archaeological interest. Mitigation measures are being considered for each of these issues as part of the project proposals.

2. Overview of the consultation

2.1 Purpose and objectives of the consultation

2.1.1 Norfolk County Council carried out a public consultation on four road options for the Norwich Western Link between 26 November 2018 and 18 January 2019. The purpose of the consultation was to provide information on the options proposals, asking for views on them to help identify a preferred option

2.1.2 The objectives for the consultation were as follows:

- Understand the degree of public support for each of the four options.
- Understand how each option may rank against one another.
- Gauge support for each option from statutory and non-statutory organisations.
- Gain knowledge of potential scheme risks and local effects of each of the proposed options which may influence design or cost.
- Inform the development of the Strategic Outline Business Case, in particular seeking to identify additional potential social and economic scheme benefits and opportunities which may arise as a result of each option and any aspects requiring mitigation which may influence the scheme cost.
- Identify other potential complementary measures which could be delivered as part of the scheme.

2.2 Who Norfolk County Council consulted

2.2.1 The consultation sought views from the public and stakeholders, including previous respondents to the initial consultation, local communities and businesses.

2.2.2 Key stakeholders that were consulted, included:

- Local authorities, businesses and organisations within the Norwich Western Link local area;
- Relevant public sector bodies;
- Environmental groups;
- Walking and cycling groups; and
- Organisations who have previously expressed an interest in the project.

2.2.3 Work to identify any land interests affected by any of the proposed options was undertaken. As such, those identified were sent a letter containing tailored information prior to the start of the consultation period informing them of the latest proposals and the opportunity to provide comment.

2.3 What Norfolk County Council consulted on

2.3.1 Consultees were asked to provide their views on the four options, and to advise any options they preferred based on the information provided and the potential benefits and impacts of each option. People could also state a preference for ‘none of them – do nothing’ or ‘none of them but something should be done’.

2.3.2 Respondents were asked to highlight any particular interests or concerns in relation to each of the options put forward, as well as comparative views on the different options.

2.3.3 The questionnaire also asked respondents what other transport improvements they felt could complement the Norwich Western Link proposals.

2.3.4 A copy of the consultation questionnaire can be found in Annex B. Further information about the questions and analysis of responses is set out in Chapter 4 of this report.

2.4 Methods of responding

2.4.1 Consultees were invited to respond to the consultation by completing an online questionnaire, available via the consultation website.

2.4.2 Written responses were also accepted by writing to: Norwich Western Link, Infrastructure Delivery Team, Norfolk County Council, County Hall, Floor 2, Martineau Lane, Norwich, NR1 2DH, or emailing norwichwesternlink@norfolk.gov.uk. Individuals, groups and organisations responding in a professional capacity were encouraged to respond in this way.

2.4.3 People were also able to respond in person by attending a consultation event.

2.5 Consultation materials and publicity

2.5.1 The consultation was promoted using a range of different methods to encourage as many views as possible. The methods used are listed below.

Website

2.5.2 The online questionnaire was available via the County Council website.

2.5.3 As part of the consultation questionnaire, people were asked where they had seen information about the consultation - the website was cited in nearly 400 responses.

Consultation brochure

2.5.4 A consultation brochure provided information on the background for the proposals and details of the proposed options. The brochure also included the consultation questionnaire, which could be completed and left at an exhibition, or posted to Norfolk County Council.

2.5.5 As part of the consultation questionnaire, people were asked where they had seen information about the consultation - the brochure was cited in more than 300 responses.

Public consultation events

2.5.6 Public consultation events were held in locations which reflected the impact and interest of the scheme to local communities, business and stakeholders. The project team were available to answer questions and to talk to visitors about the proposals.

2.5.7 Public consultations were held at:

- Ringland Village Hall (Wednesday 28 November 2018)
- Drayton Village Hall (Monday 3 December 2018)
- The Forum, Norwich (Tuesday 4 December 2018)
- Hockering Village Hall (Wednesday 5 December 2018)
- Easton Village Hall (Monday 10 December 2018)
- Taverham Village Hall (Tuesday 11 December 2018)
- Hall for All, Weston Longville (Wednesday 12 December 2018)

- Salvation Army Church, Fakenham (Friday 14 December 2018)
- Aylsham Town Hall (Tuesday 8 January 2019)
- Diamond Jubilee Lodge, Hellesdon (Thursday 10 January 2019)
- Great Witchingham Village Hall (Friday 11 January 2019)
- The Costessey Centre (Monday 14 January 2019)
- Dereham Memorial Hall (Tuesday 15 January 2019)
- Honingham Village Hall (Wednesday 16 January 2019) – also attended by Highways England staff

2.5.8 Consultation events were also held at the Norfolk and Norwich University Hospital on 27 November and at Norwich Research Park on 9 January and promoted to staff in advance. Staff from the project team also attended a consultation event organised by Barnham Broom Parish Council on 5 January.

2.5.9 Exhibition boards provided information on the need for the Norwich Western Link, the project objectives, information on each of the proposed options, environmental considerations, traffic impacts for each of the options, and how people could respond to the consultation.

2.5.10 As part of the consultation questionnaire, people were asked where they had seen information about the consultation – attending a consultation event was cited in more than 250 responses.

2.6 Social media

2.6.1 The consultation was also publicised online using social media platforms. Facebook and Twitter were used as a channel to provide information on the consultation and encourage people to have their say. Both of these channels were also used by members of the public to provide comments.

2.6.2 As part of the consultation questionnaire, people were asked where they had seen information about the consultation - social media was cited in nearly 150 responses.

2.6.3 Annex F of this report provides a breakdown of the main comments raised on Facebook and Twitter with regards to the Norwich Western Link proposals.

2.7 Media and community newsletters

2.7.1 Information about the consultation and events was sent to local newspapers, radio stations, television news and community newsletters and magazines. This was focused around two main periods of activity - in the lead up to the launch of the consultation in November and in early January as a reminder that time was running out to take part. Substantial coverage of the consultation was secured as a result, including seven articles in the Eastern Daily Press before and during the consultation period.

2.7.2 As part of the consultation questionnaire, people were asked where they had seen information about the consultation - the media was cited in more than 300 responses.

2.8 Promotional materials

2.8.1 Posters, leaflets and business cards were created to promote the consultation. Posters were displayed in local libraries and at County Hall and electronic and hard copies were sent to consultation event venues. Leaflets and business cards were handed out at consultation events and were left at the venues. These promotional materials were also made available to county, district and parish councillors to help them spread the word about the consultation in their local area.

2.8.2 Pop-up banners were created for use at venues telling people that a Norwich Western Link consultation event was happening there on that day. These were erected at or near the entrance to the venue to increase awareness of the event and the consultation as a whole and make it easier for people to find the event.

2.9 Targeted promotion to key stakeholders

2.9.1 Emails and letters were sent in November to more than 2,000 stakeholders including MPs, councillors, local businesses and land interest who could be affected, with a reminder sent in January. Email updates were also sent regularly to people who had subscribed to news about the project – more than 900 subscribed to these updates through the options consultation, which, when combined with subscribers gathered through the initial consultation in summer 2018, took the total number of subscribers to more than 2,000.

2.9.2 Briefings about the consultation were held with key stakeholders in the run-up to and during the consultation period. These included:

- District councils
- MPs
- Local media
- Affected land interests
- Norfolk Chamber of Commerce
- Easton and Otley College

2.9.3 The Norwich Western Link Local Liaison Group, made up of representatives from 29 local parish councils, were kept informed about the consultation via a meeting before the consultation began on 6 November and during the consultation on 19 December. In addition, briefings were offered prior to each consultation event to each local parish council.

3. Consultation methodology and analysis

3.1 Number of responses

3.1.1 A total of 1,931 respondents provided feedback to the consultation. Responses were received either via the online questionnaire, or through letters and emails. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). Through the analysis of the 1,931 responses, over 12,000 comments regarding the proposals were identified.

3.1.2 The majority of responses were received via the online questionnaire, with 1,825 people providing a response in this manner. Some of these respondents only provided responses to the closed / quantitative questions (see Sections 3.2 and 3.3), and therefore did not provide any written comments. This report focuses only on those online questionnaire responses which included written comments, of which there are a total of 1,711.

3.1.3 In addition to the online questionnaires, 74 stakeholder organisations and 32 members of the public provided responses by letter or email. A list of the stakeholder organisations who responded can be found in **Annex A** of this report.

Table 1: Qualitative responses received to consultation

Response type	Number of qualitative responses
Questionnaire responses	1,711
Letters / emails from public	32
Letters / emails from stakeholder organisations	74
Total	**1817**

3.2 Questionnaire responses

3.2.1 The questionnaire consisted of:

- 14 closed questions (quantitative questions) whereby respondents were asked to select answers based on a selection of pre-determined responses;
- Eight open free-text questions (qualitative questions) whereby respondents could elaborate or provide further comment; and
- A series of demographic questions to help understand who has responded to the consultation.

3.3 Questionnaire – analysis of quantitative questions

3.3.1 The analysis of the quantitative questions was undertaken separately by Commonplace. A summary of this quantitative analysis is included in Chapter 4 of this report. The full report of this quantitative analysis is included in **Annex D** for reference, including headline figures and demographic analysis of respondents.

3.4 Questionnaire – analysis of qualitative questions

3.4.1 The consultation questionnaire asked eight open questions where respondents could provide comments on each option and any other aspects of the proposals. These qualitative responses were coded into themes and categories using a coding framework, helping to identify the most commonly raised issues.

3.4.2 A summary of the questions and the associated responses is set out in Chapter 5. The coding framework can be found in **Annex E**.

3.5 Analysis of letters and emails responses

3.5.1 Responses received by letter or email are considered as open / qualitative responses and have been analysed in the same manner. These responses are summarised separately in Chapters 6 and 7 as they do not directly relate to the questionnaire questions, and as such have been analysed separately.

4. Summary of questionnaire quantitative responses

4.1 The questions asked

4.1.1 Quantitative questions within the questionnaire covered preferences across the different proposed options, as well as querying which local issues respondents felt were most important to consider as part of the proposals. Respondents were also asked to clarify how effective they felt each option could be if taken forward as the Norwich Western Link.

4.1.2 The questionnaire asked respondents any options they would support, as well as which other transport improvement they felt could complement the Norwich Western Link proposals.

4.2 Responses to quantitative questions

4.2.1 The response to the quantitative questions shows that many respondents supported Option D, in comparison to the other options. Option C is the second most supported option. Option A received the least amount of support. Figure 2 provides the number of respondents who expressed support for each of the options, as well as those who noted support for none of them. Respondents were able to select more than one option for this question.

4.2.2 Figure 3 shows the level of effectiveness which respondents assigned to each of the options. Option D is considered to be the most effective, with nearly 75% of responses highlighting Option D as either ‘fairly effective’ or ‘very effective’. Option A is considered to be the least effective with nearly 75% of respondents highlighting this option as being ‘not very effective’. Nearly 50% of respondents considered Option C to be very effective, with less than 25% of respondents saying that this Option was ‘not very effective’.

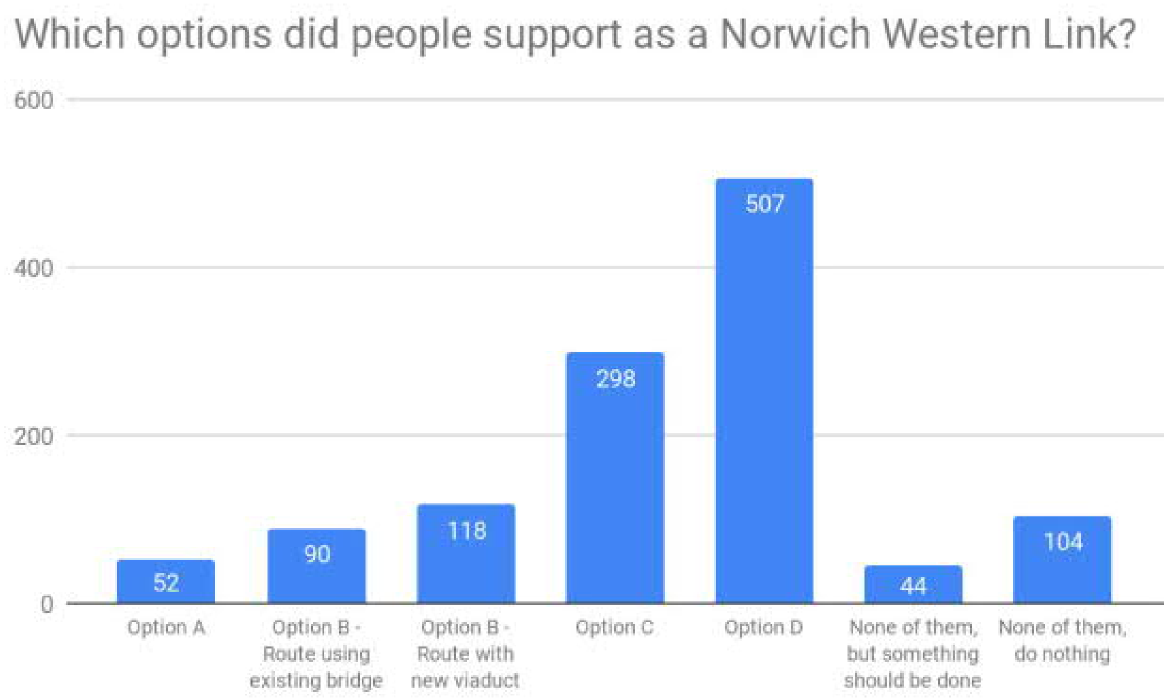


Figure 2: Level of support for the proposed options

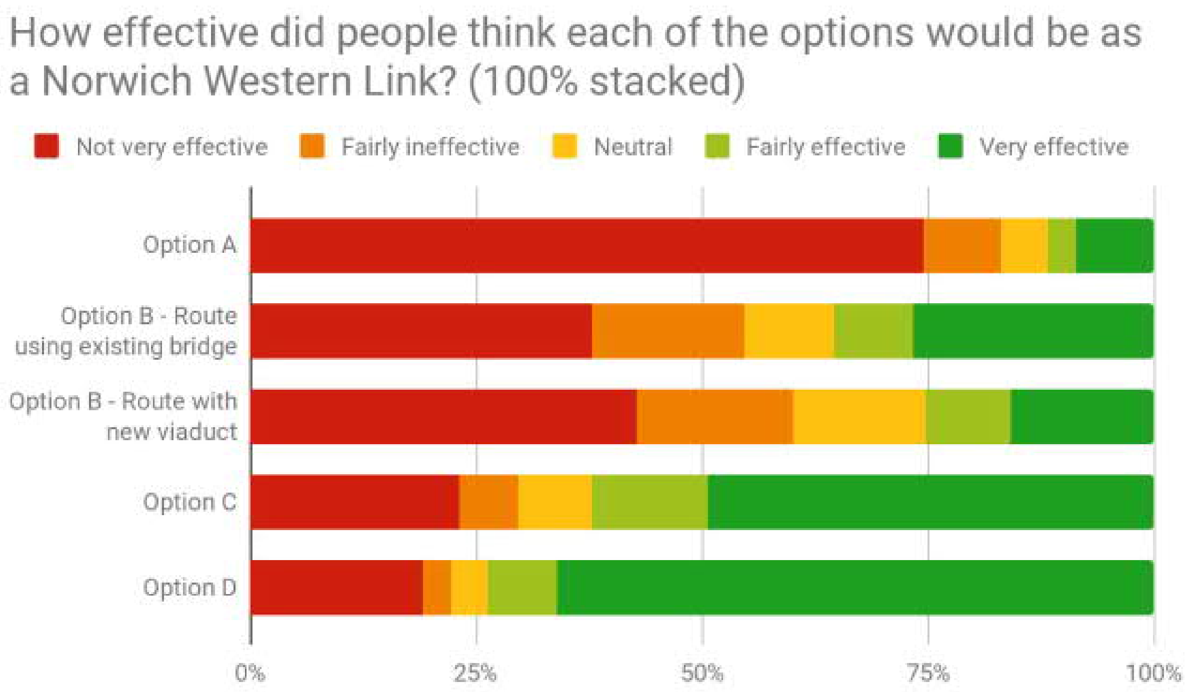


Figure 3: Effectiveness of Norwich Western Link options

4.2.3 A further detailed report of the responses from the quantitative questions is included in **Annex D** for reference.

5. Questionnaire qualitative responses

5.1 Introduction

5.1.1 This chapter summarises the responses received to the qualitative open questions asked as part of the consultation questionnaire, including the comments raised with regards to each of the options, potential transport improvements and any other issues respondents wanted to raise.

5.2 Questionnaire questions for Options A, B WEST, B EAST, C and D.

5.2.1 The first section of the consultation questionnaire asked respondents to provide their views on each of the different options. For each option, respondents were asked to answer three questions as set out in Box 1. Questions 1 and 2 are quantitative; a summary of these responses can be found in **Annex D**.

5.2.2 This chapter provides a summary of the issues raised as part of Question 3 for each of the options.

Question 1: In our initial consultation in summer 2018, we asked people to tell us about any issues they wanted us to consider when creating a Norwich Western Link. The top ten issues that were highlighted are listed below, please select any you think this option would help to tackle. You can select as many as you want.

Road safety / Shortening journey times / Better access to Norfolk and Norwich Hospital / Better journey reliability / Reducing rat-running / Reducing emissions from queuing vehicles / Reducing congestion / Improving emergency response times / Protecting the environment / Boosting local economy

Question 2: Based on all the information provided, how effective do you think this option would be as a Norwich Western Link (respondents were asked to mark a point on a line)

Question 3: Please tell us why you think this.

Box 1: Questions on Options A, B WEST, B EAST, C and D

5.3 Comments received for Option A

5.3.1 There were 619 respondents who provided a response to Question 3 for Option A. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 619 responses, we identified a total of 1,144 different comments regarding Option A.

5.3.2 Table 2 lists the top 10 most frequently raised comments, including the number of times this comment was raised throughout the responses to Question 3 (Option A). The table also shows the percentage breakdown in relation to the total number of comments raised for Question 3 (Option A), indicating how often this issue was noted by respondents in comparison to all other comments within this question.

Table 2: Question 3 (Option A) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Rat-running	Does not solve rat-running / traffic will not divert from villages	200	17.5%
General opposition	Opposed to scheme / scheme not needed	151	13.2%
Design	Single carriageway is not fit for purpose / road capacity is insufficient	117	10.2
Design	Route is too long / no journey time improvement	93	8.1%
Cost	Not cost effective	86	7.5%
Design	Route will not be used / too much of a diversion	76	6.6%
Environment	Concern over impact on environment	69	6%
Environment	Option has lowest environmental impacts	45	3.9%
Design	Route is not effective / not fit for purpose	38	3.3%
Cost	Low cost / cheapest option	36	3.1%

5.3.3 Table 2 shows that 200 comments (17.5%) were raised noting that Option A will not resolve rat-running and traffic will continue to go through local villages. Some respondents referred to particular concern over impacts on the local villages of Ringland, Weston Longville, Lyng and Taverham.

5.3.4 Several respondents also noted general opposition to the scheme (151 comments, 13.2%), noting that it will not be fit for purpose or that it is not needed. Some respondents also highlighted concerns regarding the designs, particularly that a single carriageway is not sufficient, that the option does not provide any improvements to journey times or that it is not cost effective.

5.3.5 Comments on Option A also highlighted concern over potential environmental impacts (69 comments, 6%), with reference to impacts on natural beauty, Wensum Valley emissions, noise/ air pollution. This compared to 45 comments (3.9%) highlighting that respondents felt that this option had the lowest environmental impact.

5.3.6 Figure 4 provides an outline of the main comments raised by respondents regarding Option A, categorised by theme. A full list of comments received to this question can be seen in **Annex E.**

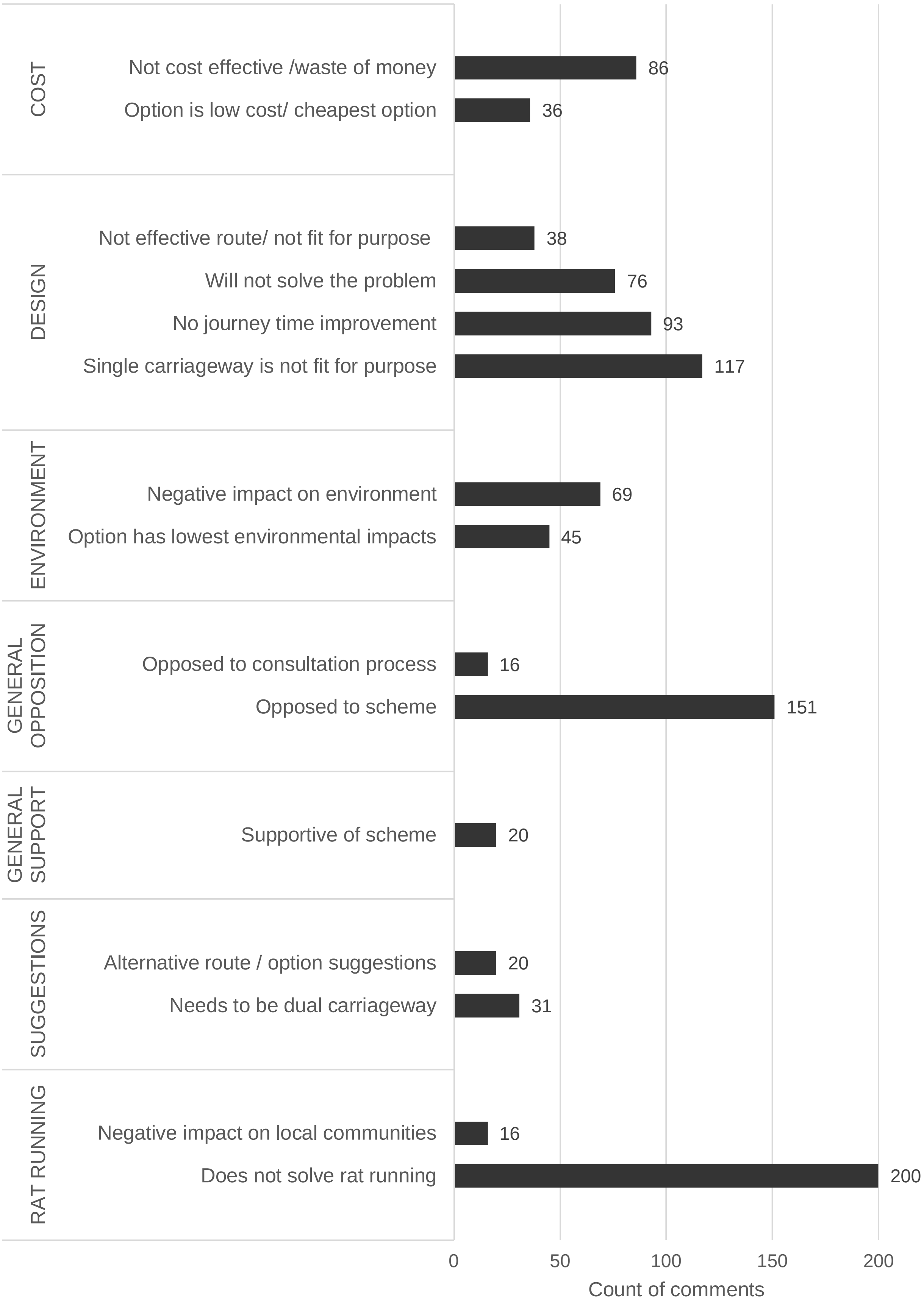


Figure 4: Comments received regarding Option A

5.4 Comments received for Option B WEST: Using existing bridge

5.4.1 There were 475 respondents who answered Question 3 for Option B WEST. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 475 responses, we identified a total of 1,138 different comments regarding Option B WEST. Table 3 lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option B WEST). The table also shows for each comment its percentage in relation to the total number of comments raised for Question 3 (Option B WEST).

Table 3: Question 3 (Option B WEST) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option is too far west	111	9.8%
General support	General support for Option B WEST	101	8.9%
Environment	Concern about environmental impacts	71	6.2%
Rat running	Traffic will still use local roads / rat run	68	6.0%
Environment	Option has less environmental impacts	61	5.4%
General opposition	Other options are better	51	4.5%
Cost	Option is most cost effective	43	3.8%
Connectivity	Concern over ineffective links	42	3.7%
General opposition	General opposition to this option	33	2.9%
General support	Positive comments regarding use of existing bridge	32	2.8%

5.4.2 Table 3 shows that several respondents noted that Option B WEST is too far to the west of Norwich (111 comments, 9.8% of comments raised for this question), impacting on the effectiveness of the link road and creating a longer route. There was also general support noted for this option, with 101 comments noting this as a preferred option. Several respondents also noted support for this option as it uses the existing bridge.

5.4.3 Concern was raised regarding continued traffic using local roads as rat runs, particularly as this option is considered too far away to be used effectively. Figure 5 provides an outline of the main comments raised by respondents regarding Option B WEST, categorised by theme. A full list of comments received to this question can be seen in **Annex E.**

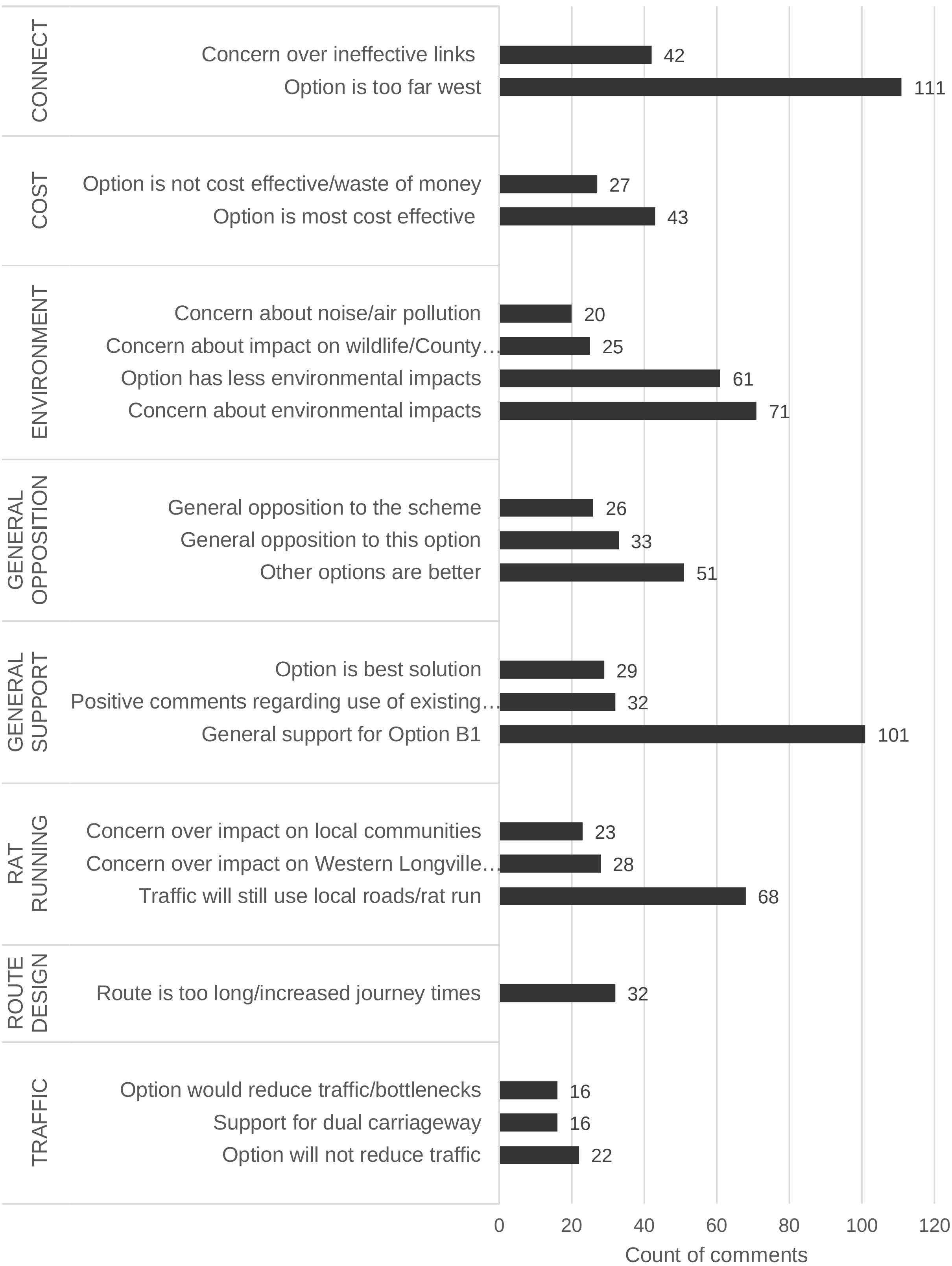


Figure 5: Comments received regarding Option B WEST

5.5 Comments received for Option B EAST: Using new viaduct

5.5.1 There were 294 respondents who answered Question 3 for Option B EAST. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 294 responses, we identified a total of 724 different comments regarding Option B EAST. Table 7 lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option B EAST). The table also shows for each comment its percentage in relation to the total number of comments raised.

Table 4: Question 3 (Option B EAST) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option is too far west	77	10.6%
Environment	Concern about environmental impacts	53	7.3%
Rat running	Traffic will still use local roads/rat run	40	5.5%
Cost	Option is not cost effective/waste of money	32	4.4%
Environment	Option has less environmental impacts	26	3.6%
General opposition	Opposed to new bridge/viaduct	25	3.5%
General opposition	General opposition	25	3.5%
General support	Support for new bridge/viaduct	24	3.3%
Rat running	Option has minimum impact on communities	24	3.3%
Connectivity	Concern over ineffective links	24	3.3%

5.5.2 As with Option B WEST, many respondents noted that Option B EAST is too far west of Norwich and therefore creates a longer, less effective route. 24 comments (3% of comments raised for this question) were raised noting that this option does not provide an effective link and so would not be used. Several respondents noted concern for the environmental impacts of this option (53 comments, 7.3%), with concern over ruining the countryside and damaging the environment.

5.5.3 Both opposition and support for the bridge / viaduct was highlighted. Concerns about the viaduct are rooted in cost, height and visual impact, as well as wider environmental impact over the Wensum Valley. Figure 6 below provides an outline of the main comments raised by respondents regarding Option B EAST, categorised by theme. A full list of comments received to this question can be seen in **Annex E.**

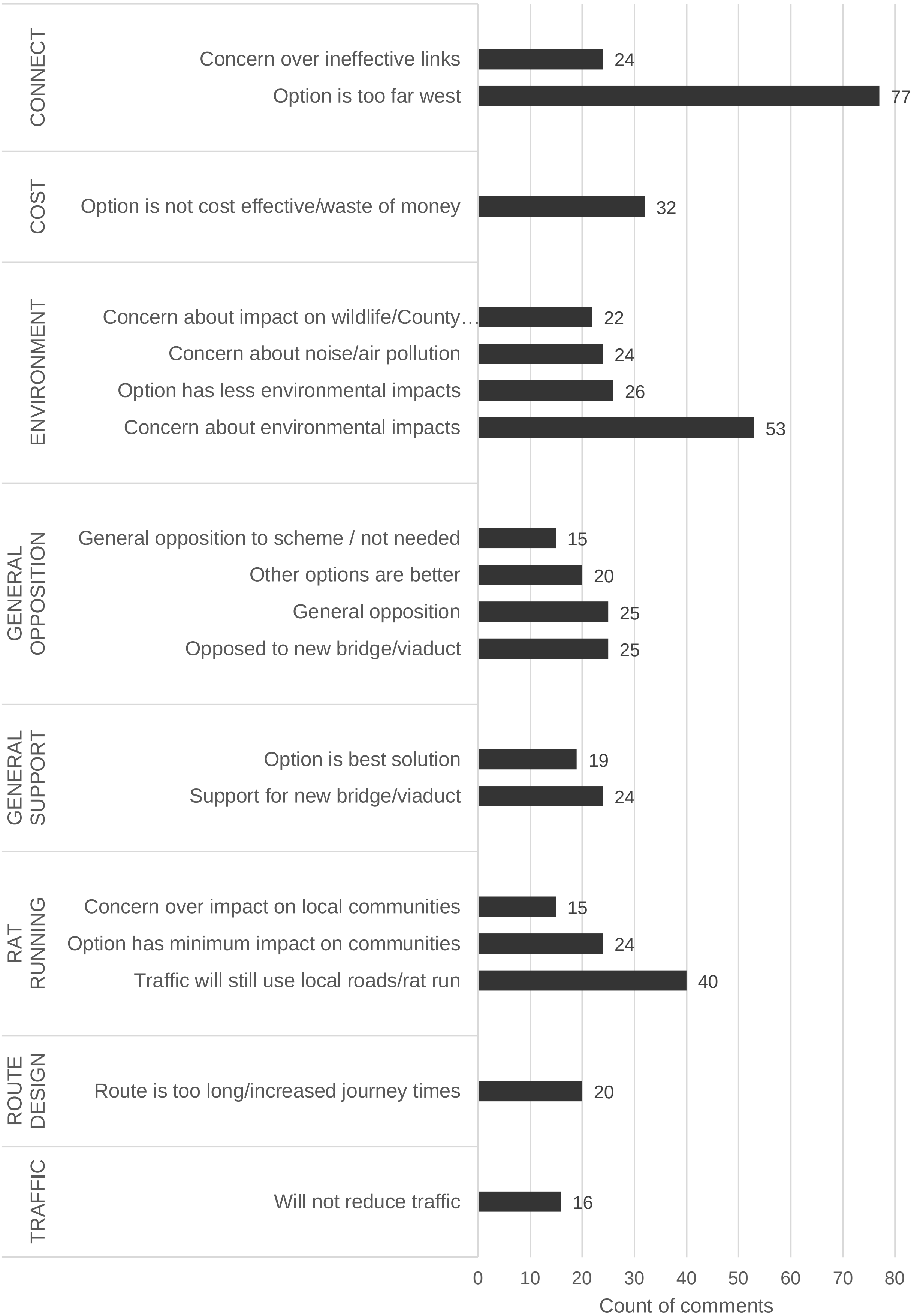


Figure 6: Comments received regarding Option B EAST

5.6 Comments received for Option C

5.6.1 There were 573 respondents who answered Question 3 for Option C. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 573 responses, we identified a total of 1,552 different comments regarding Option C. Table 5 lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option C). The table also shows for each comment its percentage in relation to the total number of comments raised.

Table 5: Question 3 (Option C) – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
General support	Option is the most viable / best solution	191	12.3%
Environment	Option has less environmental impacts	111	7.2%
Environment	Concern about environmental impacts	103	6.6%
Connectivity	Route is too far west / away from Norwich	69	4.4%
Cost	Option is most cost effective	68	4.4%
Traffic	Option is shortest / most direct route	65	4.2%
Rat running	Option will discourage rat running	62	4%
General support	General support for Option C	56	3.6%
Connectivity	Option provides good links to Broadland Northway (NDR)	56	3.6%
Traffic	Option would reduce traffic/bottlenecks	54	3.5%

5.6.2 191 comments were raised noting that Option C is the most viable option, with many respondents noting the shorter distance to travel compared to other options or often because it ‘ticks several boxes’. Although a number of respondents felt this option has the least environmental impact (111 comments), a similar number of comments were raised (103) regarding concern regarding the environmental impact of the option, particularly with regards to impact on woodland and wildlife.

5.6.3 Respondents have noted that, similarly to Options B WEST and B EAST, this option is too far west to be effective. Conversely, other comments note that this option provides good links to the Broadland Northway (often referred to in comments as the NDR).

5.6.4 Other frequently raised comments note that Option C is cost effective, that it is the most direct route of the options, that it would discourage rat running and reduce bottlenecks. Figure 7 below provides an outline of the main comments raised by respondents regarding Option C, categorised by theme. A full list of comments received to this question can be seen in **Annex E.**

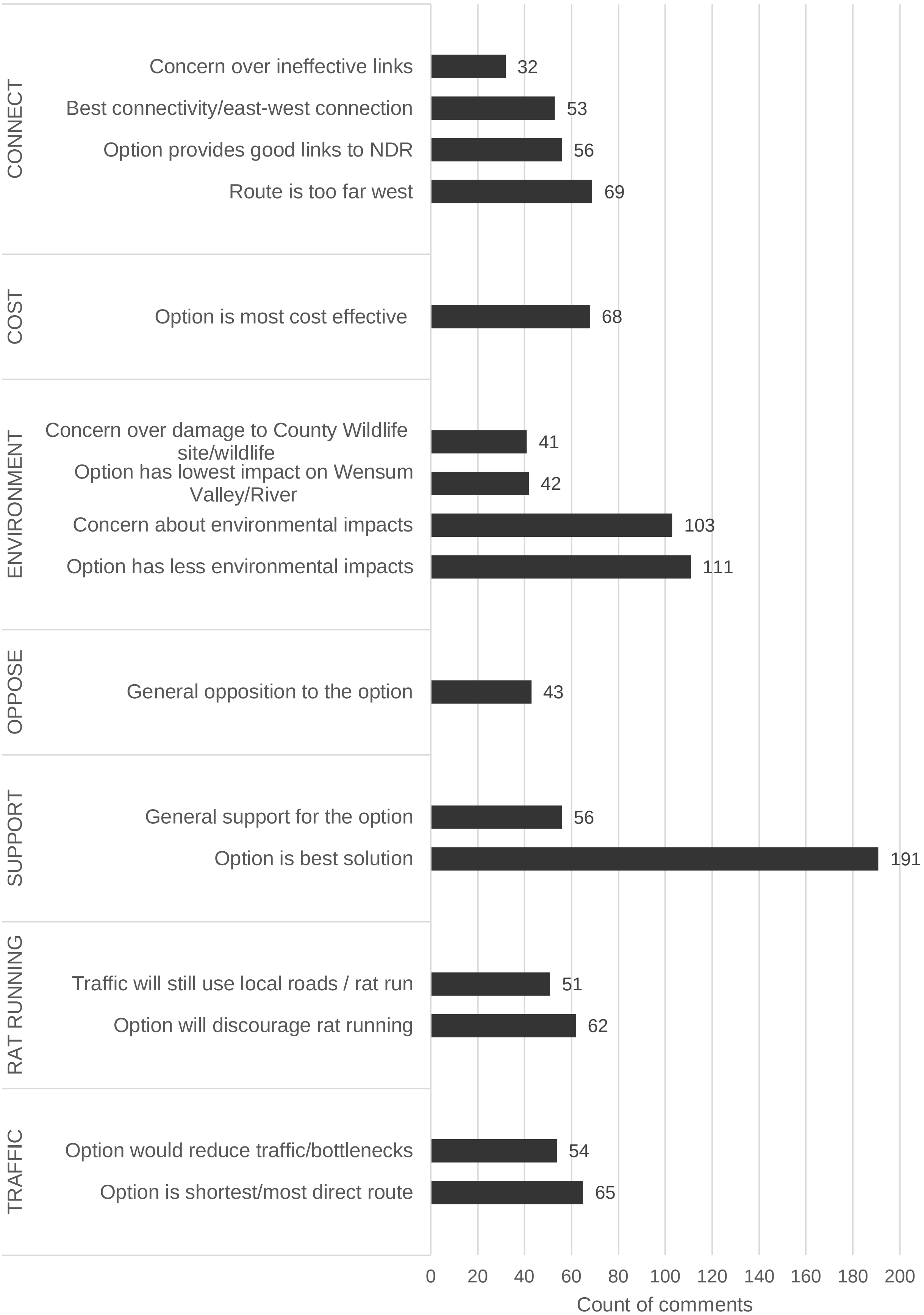


Figure 7: Comments received regarding Option C

5.7 Comments received for Option D

5.7.1 There were 983 respondents who answered Question 3 for Option D. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 983 responses, we identified a total of 2,837 different comments regarding Option D. Table 6 below lists the top 10 overall comments to this question, including the number of times this comment was raised throughout the responses to Question 3 (Option D).

Table 6: Option D – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
General support	Option is most viable / best solution	338	11.9%
Traffic	Option is shortest / most direct route	214	7.5%
Rat running	Option will discourage rat running	150	5.3%
Environment	Concern about environmental impacts	145	5.1%
Connectivity	Option is an effective link for A47 to north	141	5%
Connectivity	Option provides good links to Broadland Northway (NDR)	116	4.1%
Connectivity	Option provides good links to other major roads	111	3.9%
Cost	Option is not cost effective / waste of money	95	3.3%
Environment	Option has less environmental impacts then other options	90	3.2%
Traffic	Option would reduce traffic/bottlenecks	89	3.1%

5.7.2 Many respondents noted this option as being most viable or the most practical solution. 214 comments noted that this option is the shortest and most direct route, with respondents highlighting that this route is closest to link roads, such as the Southern Bypass or the Broadland Northway.

5.7.3 As with the other options, there is concern over the environmental impact of this option, with over 100 comments raised regarding concern over damage to the local area, to woodlands and to wildlife.

5.7.4 With regards to the two proposed alternative links to the A47 (either at Taverham Road or closer to Easton), 10 comments suggested a preference for a link closer to Easton, and two comments indicated a preference to a link at Taverham Road / Blind Lane. Figure 8 below provides an outline of the main comments raised by respondents regarding Option D, categorised by theme. A full list of comments to this question can be seen in **Annex E.**

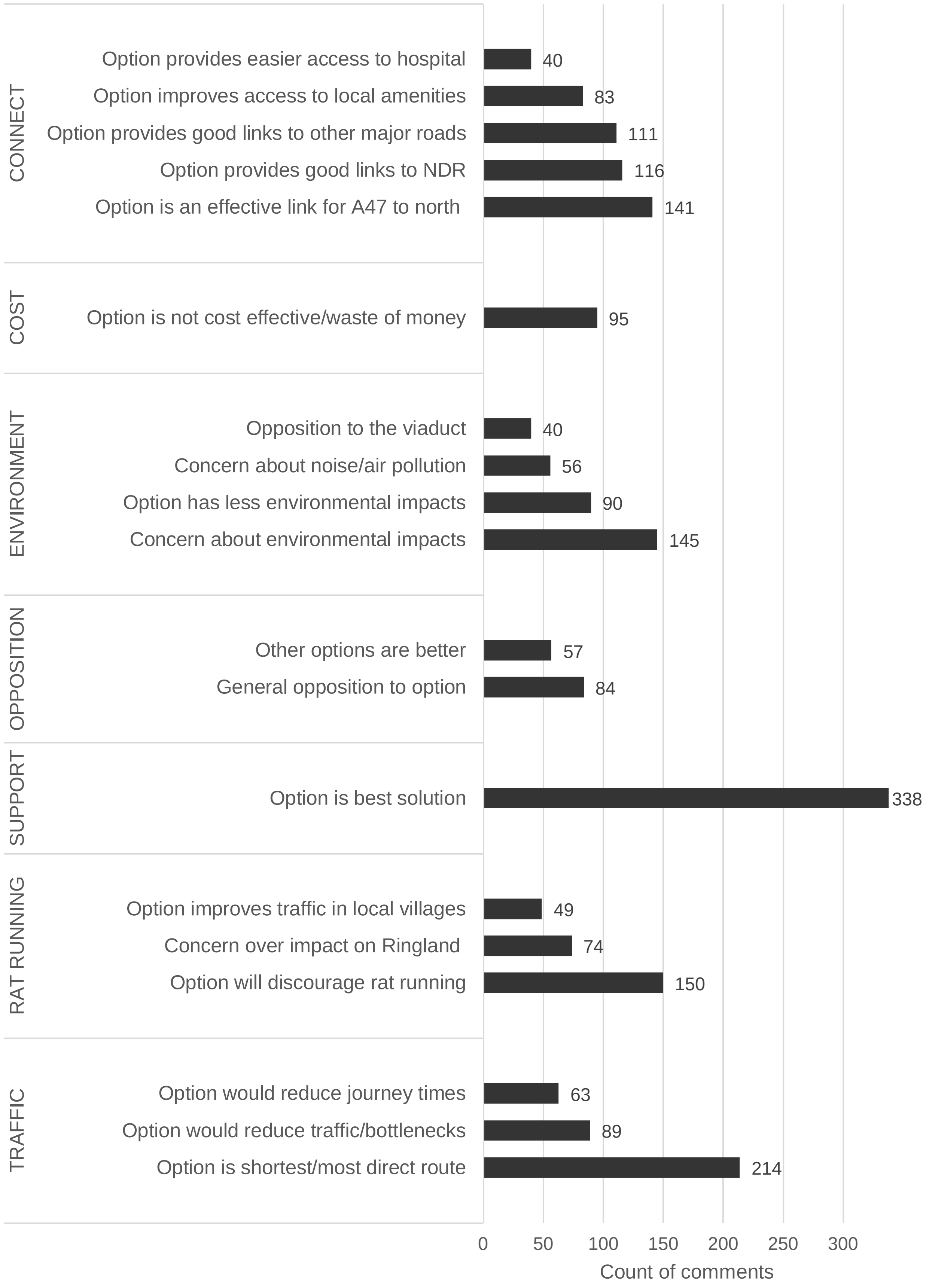


Figure 8: Comments received regarding Option D

5.8 Support and opposition for options

5.8.1 The next section of the consultation questionnaire asked respondents which option they would support as a Norwich Western Link, as well as the reasons for their choices. Box 2 below sets out the wording of this section of the questionnaire.

> **Question 3: Please select any of the options that you would support as a Norwich Western Link. If you think none of the options are suitable, please select the appropriate box below. You can select as many as you like.**
>
> *Option A, Option B - Existing bridge route, Option B – New viaduct route, Option C, Option D, None of them, but something should be done, None of them, do nothing*
>
> **Question 4: Please tell us why you chose these options. If your comment relates to a specific option, please tell us which option your comment refers to.**

Box 2: Support for options questions

5.8.2 For full analysis of the quantitative responses to this questionnaire section, please refer to **Annex D**. This chapter provides a summary of the key issues raised as part of the qualitative Question 4. There were 844 respondents who answered this question. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 844 responses, we identified a total of 3,270 different comments.

5.8.3 Analysis of the qualitative questions corroborates the findings set out in Annex D and Chapter 4 of this report, highlighting that Option D is most supported by respondents, whilst Option A received the least support and the most opposition. Option C is the second most supported option, with 295 comments indicating support for this option. Figure 9 outlines the number of comments which expressed support and opposition for each of the options.

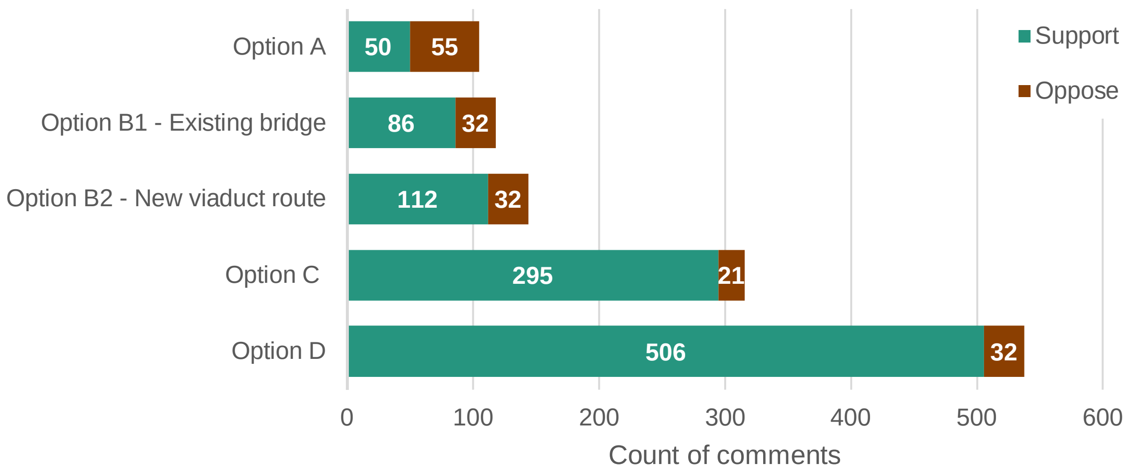


Figure 9: Options support and opposition

5.8.4 Several respondents also noted either general support or opposition to the scheme, not specific to any particular option. Figure 10 highlights the number of comments made around opposition or support for the scheme. Several comments were made suggesting that improvements are not required. Others noted that improvements are needed in the area but that these options are not the solution.

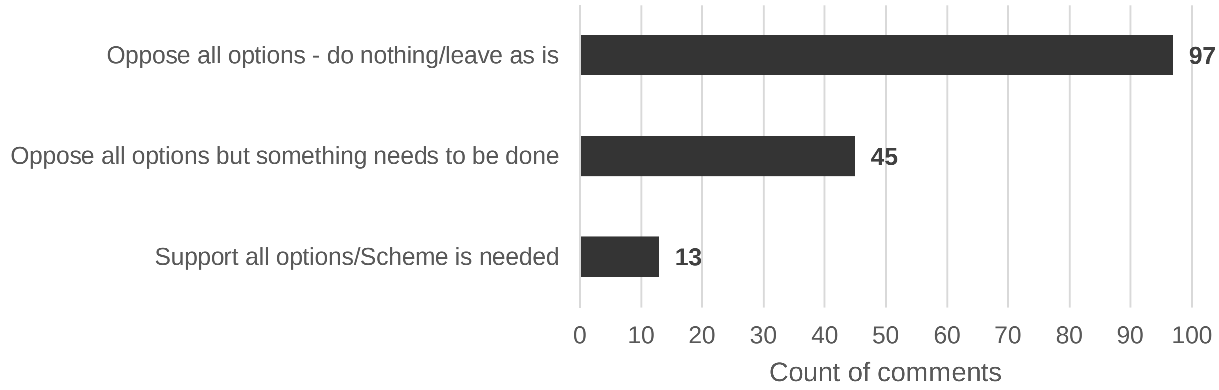


Figure 10: Options support and opposition

5.8.5 Of the comments received for this question, three key themes have emerged which mirror the comments raised for each of the separate options: connectivity, environment, and rat running. Figures 11 to 13 indicate the main comments raised as part of this question.

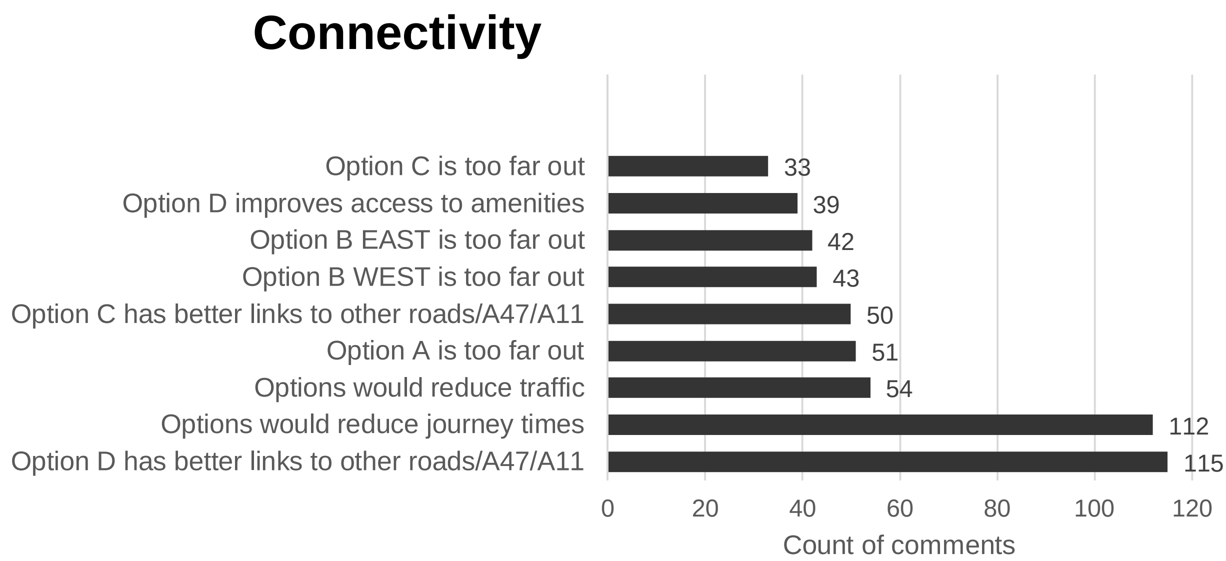


Figure 11: Options comparison - connectivity

5.8.6 With regards to road network connectivity, Option D is highlighted as having better connections with other roads such as the A47 or A11. Option C is also noted to have good connections. Options A, B WEST, B EAST and C are noted as being too far away from Norwich to be effective.

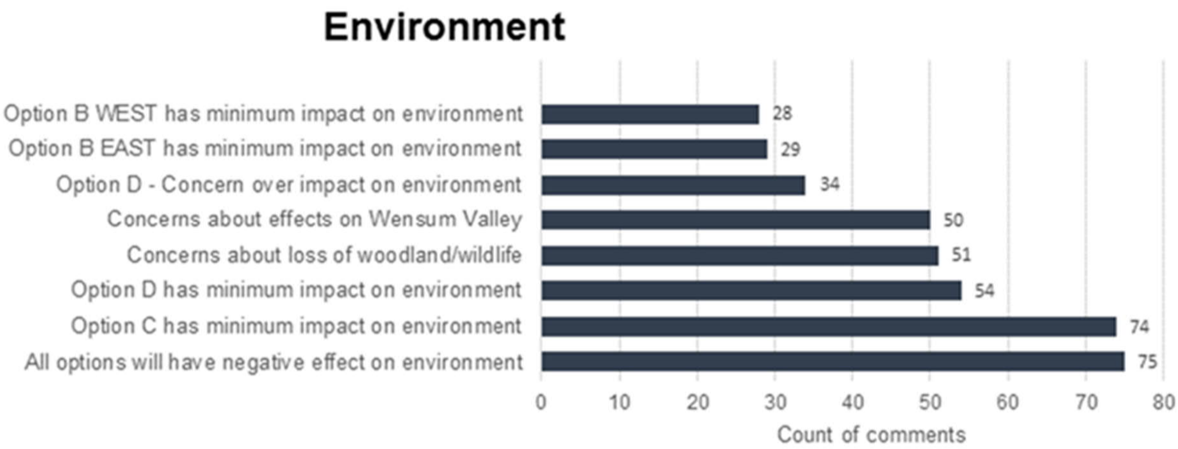


Figure 12: Options comparison – environment

5.8.7 With regards to environmental comments, all options are generally considered to have an environmental impact on the area. There is particular concern over the impact on woodland, wildlife, and the impacts on Wensum Valley. There are varying views on which option would have a minimum impact on the environment in comparison to the others; although the majority of comments in this respect state that Option C will have the least environmental impact (74 comments).

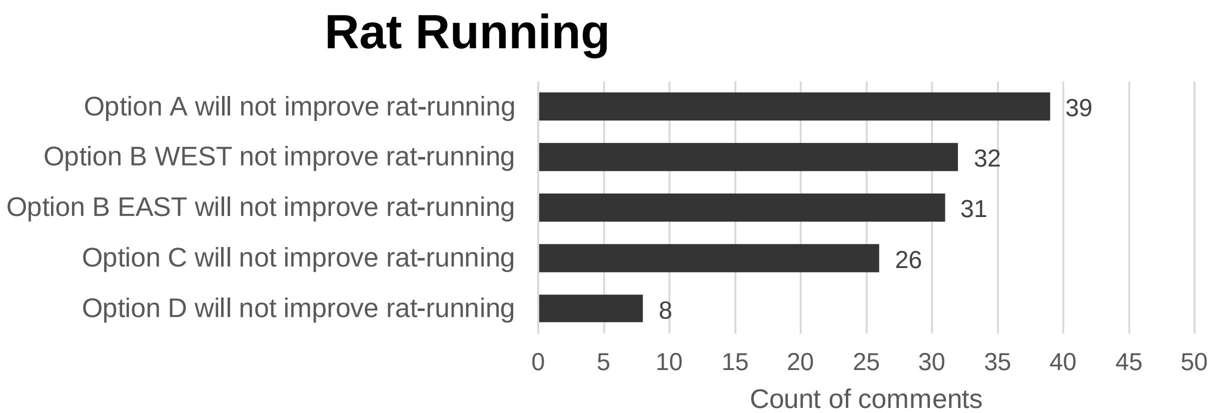


Figure 13: Options comparison – rat running

5.8.8 With regards to rat-running, all options have been highlighted by respondents as not improving the rat-running situation, this is particularly the case for Option A.

5.9 Comments received for other transport improvements

5.9.1 The next section of the consultation questionnaire asked respondents whether there were any other transport improvements they felt could complement the Norwich Western Link. Box 3 sets out the wording of these questions.

> **Question 5**: We are considering making other transport improvements which could complement the Norwich Western Link options. Which of the following measures do you think could be most effective in doing this? Please select as many improvements as you like.
>
> *Improving Bus services, traffic calming on existing roads, restricting traffic on existing roads, improving existing junctions, improving cycling routes, improving walking routes, introducing a lorry management strategy*
>
> **Question 6**: Please tell us why you think this

Box 3: Transport improvement questions

5.9.2 For the quantitative responses to Question 5 of this questionnaire section, please refer to **Annex D**. This chapter provides a summary of the key issues raised as part of the qualitative Question 6. A total of 724 comments were made for Question 6. Figure 14 provides an outline of the main comments raised. A full list of comments received to this question can be seen in **Annex E.**

5.9.3 Over 100 comments refer to the need for improved bus services. The need for improved facilities for cycling and walking are also highlighted by respondents. Roads and traffic improvements are suggested, including the avoidance of any new roundabouts as well as improved signage.

5.9.4 Traffic calming measures are commented upon in both a positive and negative context. Several respondents note the need to implement traffic calming measures, while others also note concern with these measures causing more congestion, noise and air pollution.

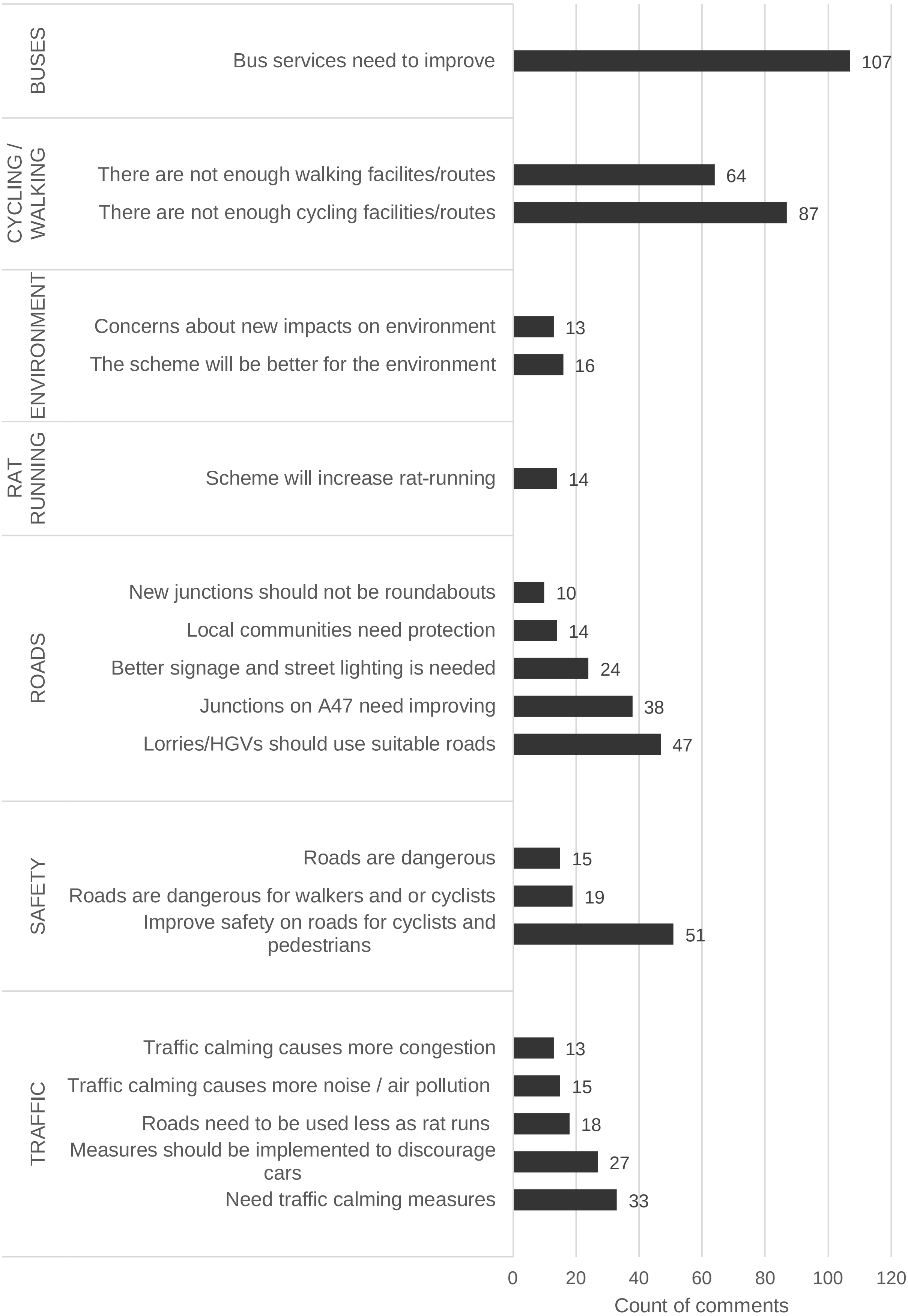


Figure 14: Comments received regarding other transport improvements

5.10 Any other comments

5.10.1 The final qualitative question in the questionnaire asked respondents if they have any further comments regarding the shortlisted options. 260 respondents provided a response to this question. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 260 responses, a total of 420 different comments were identified.

5.10.2 The comments raised in this section mirror the comments raised as part of responses to other questions in this questionnaire. A full list of comments received to this question can be seen in **Annex E.**

5.10.3 Table 7 outlines the most frequently raised comments in this section, highlighting those comments that were raised over 10 times by respondents. Many of the comments stated that the scheme is needed (40 comments, 9.5%), whilst 38 comments (9%) noted opposition to all options or that improvements are not required (38 comments, 9%). Several respondents (10 comments, 2.4%) noted that there is a need for improvements, but opposed all options put forward.

Table 7: Any other comments – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Support for Options	Support all options / Scheme is needed	40	9.5%
Oppose options	Oppose all options / do nothing / leave as is	38	9%
Support for Options	Support - Option D	31	7.4%
Suggestions	Other suggestions or alternatives	29	6.9%
Environment	All options will have negative effect on environment	27	6.4%
Suggestions	Alternative route suggestion given	21	5%
Cost	Too expensive / not cost effective	14	3.3%
Oppose options	Oppose - Option A	12	2.9%
Other negative comments	General comments (negative towards the scheme or the consultation)	12	2.9%
Cycling / walking	Need better improvements in pedestrian / cycle facilities	11	2.6%
Support for Options	Support - Option C	11	2.6%
Oppose options	Oppose - all options but something needs to be done	10	2.4%

5.10.4 Support for Option D is further expressed (31 comments, 7.4%), as well as opposition to Option A (12 comments, 2.9%) and support for Option C (11 comments, 2.6%).

5.10.5 Several comments also re-iterated concern over environmental impacts of all options.

5.10.6 Several respondents also provided alternatives or variations to the options proposed. This includes requests for single carriageway routes, amalgamations between different options (such as a route between B and C), and considering more direct or improved access to the A47 or the NDR. Other neutral comments included suggestions with regards to the scheme as a whole, including need for street lights, park and ride schemes, and national speed limit trials.

6. Summary of letters and emails from the public

6.1 Introduction

6.1.1 A total of 32 responses were received from members of the public by letter or email, as opposed to the questionnaire. Each response tended to include several different comments (for example, commenting on several aspects or concerns regarding the scheme). In analysing the 32 responses, a total of 176 different comments were identified. A full list of the qualitative consultation comments can be found in **Annex E**.

6.1.2 As with the qualitative questionnaire responses, these letters and emails were coded into broad themes and further categorised into groups of comments using a coding framework. The themes enable Norfolk County Council to identify the most commonly issues raised, as well as aspects of the scheme that people supported the most.

6.2 Support and opposition from letters or email from the public

6.2.1 Table 8 summarises the level of support and opposition mentioned through the public letters and emails. The table indicates the number of comments which referred to support or opposition for each option, including its percentage in relation to the total number of comments raised throughout the letter and emails received from the public.

6.2.2 There is most support for Option D, followed by Option C which has the second highest level of support. There is most opposition to Options A and B (both variants). Other comments note opposition to all options proposed but that improvements are required.

Table 8: Public letters and emails – Support and opposition

Theme	Comment	N° of times mentioned	% of comments
Support for options	Support - Option D	18	7.5%
	Support - Option C	7	2.9%
	Support - Option B WEST - Existing bridge	1	0.4%
	Support - Option B EAST - New viaduct route	1	0.4%
	Support - Option A	2	0.8%
Opposition to options	Oppose - Option A	8	3.3%
	Oppose - Option B WEST - Existing bridge	7	2.9%
	Oppose - Option B EAST - New viaduct route	7	2.9%
	Oppose - Option C	6	2.5%
	Oppose all options but something needs to be done	4	1.6%

6.3 Themes arising from letters and emails from the public

6.3.1 Table 9 provides a summary of the key comments and issues raised as part of the letters and email received from the public.

Table 9: Any other comments – Most frequently raised comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option D - Better links to other roads/A47/A11	5	2.8%
	Would reduce journey times	4	2.3%
	Option A - Option is too far out/not good links	4	2.3%
	Option C - Better links to other roads/A47/A11	3	1.7%
	Option D – Improves access to amenities/the town	2	1.1%
	Option C – Option is too far out/not good links	1	0.6%
	Option B EAST - Option is too far out/not good links	1	0.6%
	Option B WEST - Option is too far out/not good links	1	0.6%
Construction	Concern about construction disruption	1	0.6%
Cost	Provides economic benefits	2	1.1%
	Options are cost effective	2	1.1%
	Option A -Too expensive/not cost effective	2	1.1%
Environment	All options will have negative effects on the environment	7	4%
	Option C - Negative effect on the environment	5	2.8%
	Option B WEST - Negative effect on the environment	5	2.8%
	Option B EAST - Negative effect on the environment	5	2.8%
	Concerns about effects on Wensum Valley	4	2.3%

Theme	Comment	N° of times mentioned	% of comments
	Opposition to new viaduct / bridge	4	2.3%
	Option D - Negative effect on the environment	3	1.7%
	Option D - Minimum impact on the environment	2	1.1%
	Option C - Concern about loss of woodland/wildlife	2	1.1%
	Option A - Negative effect on the environment	1	0.6%
	General concern about loss of woodland/wildlife	1	0.6%
	Option A - Concerns about effects on woodland/wildlife	1	0.6%
	Option B WEST - Concerns about effects of woodland/wildlife	1	0.6%
	Option B EAST - Concerns about effects of woodland/wildlife	1	0.6%
Local communities	Option B WEST - Will impact on local communities	2	1.1%
	Option B EAST - Will impact on local communities	2	1.1%
	Option C - Will impact on local communities	1	0.6%
	Option D - Will impact on local communities	1	0.6%
Suggestions	Alternative route suggestion given	4	2.3%
	Create pedestrian/cycle routes and facilities	3	1.7%
	Improve bus services	2	1.1%
	Roundabouts need to be considered/re-designed	1	0.6%
Information	Not enough information presented	4	2.3%
	Proposals are out of date/old fashioned	2	1.1%

Theme	Comment	N° of times mentioned	% of comments
Rat running	Option A - Will not improve rat-running	1	0.6%
Traffic	Option D - Will reduce traffic	4	2.3%
	Option B WEST - Will not reduce traffic	2	1.1%
	Option B EAST - Will not reduce traffic	2	1.1%
	Option C - Will not reduce traffic	2	1.1%
	Option B WEST - Will reduce traffic	1	0.6%
	Option B EAST - Will reduce traffic	1	0.6%
	Option C - Will reduce traffic	1	0.6%

7. Summary of responses from stakeholder organisations

7.1 Introduction

7.1.1 This section summarises the responses from stakeholder organisations who responded to the consultation. In total, 74 responses from stakeholder organisations were received. Table 10 sets out the number of responses received by stakeholder group. A list of the stakeholders who provided a consultation response can be found in **Annex A.**

Table 10: Responses received to consultation

Stakeholder group	Number of responses
Local authorities	5
Elected representatives	8
Educational groups	1
Environmental (non-statutory)	8
Emergency services	1
Land interests	13
Local and wider business	8
NHS Trust	1
Parish councils	22
Statutory bodies	4
Walking / cycling groups	3
Total	**74**

7.2 Support and opposition from stakeholder organisations

7.2.1 Table 11 summarises the level of support and opposition mentioned in responses from stakeholder organisations. The table indicates the number of comments which referred to support or opposition for each option, including its percentage in relation to the total number of comments received from stakeholder organisations.

7.2.2 There is most support amongst stakeholder organisations for Option D, with some support noted for Option C. There is most opposition to Options A and B (both variants).

Table 11: Stakeholder organisations – support and opposition

Theme	Comment	N° of times mentioned	% of comments
General	Overall support for scheme	18	6.23%
	Oppose all options	6	2.08%
Support for options	Support - Option D	34	11.76%
	Support - Option C	17	5.88%
	Support - Option B WEST - Existing bridge	2	0.69%
	Support - Option A	1	0.35%
	Support - Option B (both)	2	0.69%
	Support - Option B EAST - New viaduct route	2	0.69%
Opposition to options	Oppose - Option A	11	3.81%
	Oppose - Option B (both)	10	3.46%
	Oppose - Option D	3	1.04%
	Oppose - Option C	4	1.38%
	Oppose - Option B WEST - Existing bridge	3	1.04%
	Oppose - Option B EAST - New viaduct route	2	0.69%

Themes arising from stakeholder organisation responses.

7.2.3 Figure 15 shows the most frequently raised comments made by stakeholder organisations, categorised by theme. A full list of the comments made by stakeholder organisations can be found in **Annex E**.

7.2.4 A majority of comments related to environmental concerns, with several stakeholders stating that Option C would have the least environmental impact. There was also general concern that all of the options would have a significant negative impact on the environment. Some stakeholders noted that Option D would have the least environmental impact.

7.2.5 Stakeholder organisations also raised several neutral comments and suggestions in relation to the scheme, for example putting the scheme in the context of local plans such as sub-regional Development Plan targets or the Economic Strategy for Norfolk and Suffolk.

7.2.6 Other comments raised by stakeholder organisations included concern over the impact of the scheme on rat-running, with particular concern over Option A. It was also raised frequently that both Options B WEST and B EAST would impact on local communities.

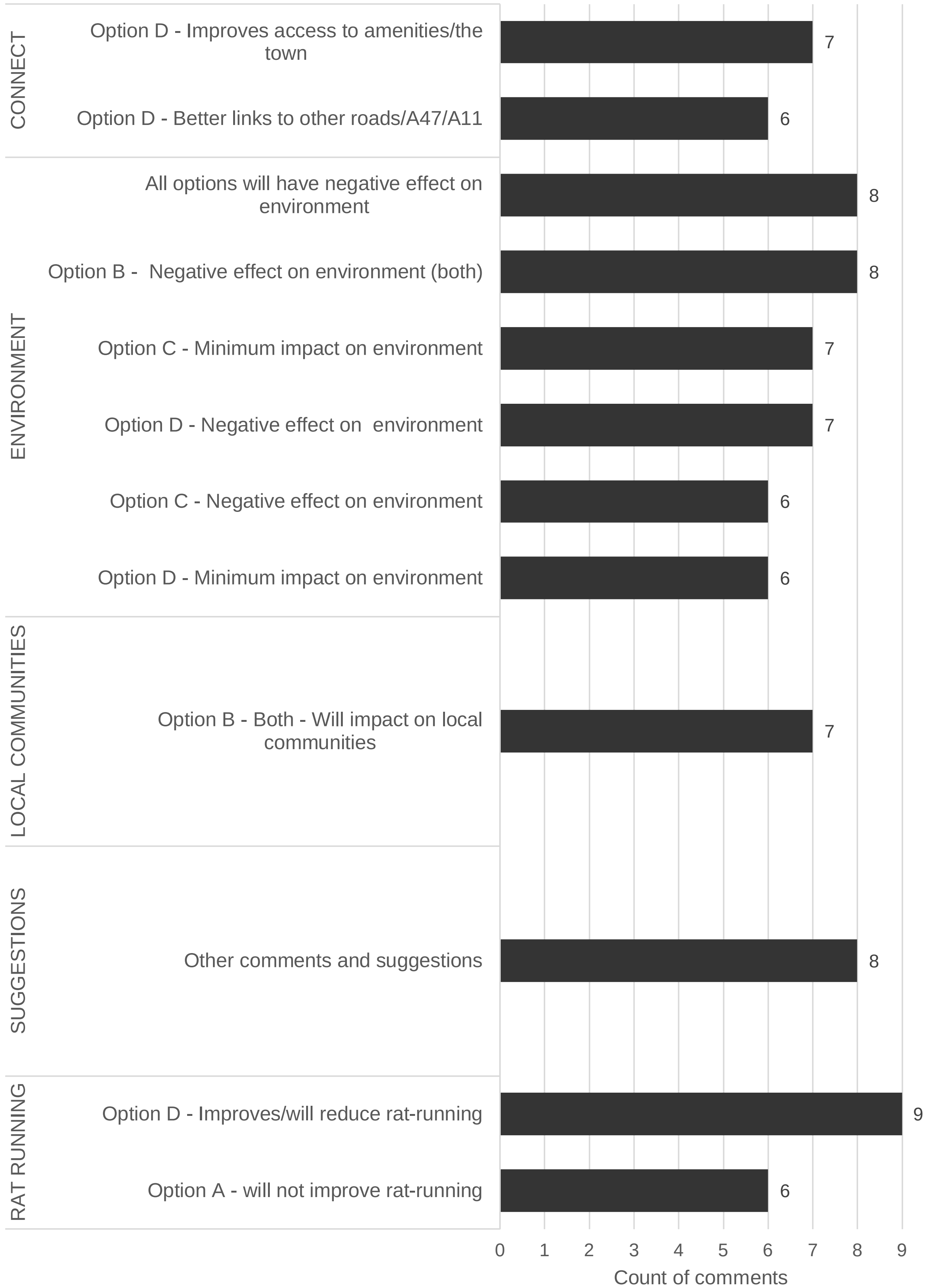


Figure 15: Frequently raised comments received from stakeholder organisations

7.2.7 The next section summarises the consultation responses received from stakeholder organisations.

7.3 Local Authorities

Broadland District Council (BDC)

7.3.1 BDC states that Options C and D are their preferred routes based on the following comments submitted by the Economic Success Panel and approved by Cabinet:

- Option A - It was strongly felt that a dual carriageway is needed. States that this option is too far out of Norwich and the junction with Broadland Northway to deliver maximum benefits.
- Option B - States this option is also too far out and would not provide effective links to amenities including universities and hospitals. Concerned about the possible impacts on nearby communities, Wensum Valley, Country Wildlife Sites and surrounding farmland. Favours a viaduct over use of the existing bridge due to a lesser impact on the environment.
- Option C – States this option provides the closest junction to Broadland Northway but further away from access to amenities and would connect to the A47 further away from the City. However, states that this option would have the least damaging environmental impacts. This option was considered to be the most resilient and avoids crossing the Bacton high pressure gas line. Recognises that it would help to reduce rat running but not as effectively as route D.
- Option D – States that this option provides the best connectivity, is the shortest route and closest junction to the Broadland Northway. Acknowledges that this route is likely to be costly but will deliver the most benefits. States environmental concerns need to be addressed. In regard to the variants the eastern option is favoured, but dependant on where Highways England put the Easton roundabout on the A47. Also states that this option may have a greater impact on heritage assets.

7.3.2 BDC also recognises the social and economic benefits of the Norwich Western Link scheme.

Breckland Council

7.3.1 Breckland Council supports the Norwich Western Link in principle.

7.3.2 Breckland Council favoured option D. This is because option D has the greatest potential benefits for transport for users who, in particular, live in communities in the north east of the district.

7.3.3 Breckland Council has also noted that the consultation does not provide detail on other mitigation measures and has asked Norfolk County Council to include a range of complementary transport measures, which include walking and cycling routes and implementation of traffic management. This is to maximise the use of non-car modes of transport but also to discourage rat running.

North Norfolk District Council

7.3.4 North Norfolk District Council supports for the proposals for a Norwich Western Link in principle but did not state a preferred option.

Norwich City Council

7.3.5 Norwich City Council supports the scheme in principle, however this support is subject to the delivery of a package of sustainable transport improvements as promoted through Transport for Norwich (TfN) and mitigation of the environmental impacts.

7.3.6 Norwich City Council noted that they are not supportive of Option A, the single carriageway option which they anticipate will provide the fewest benefits to Norwich city. The Council did not express a preference between the remaining three options B, C and D.

South Norfolk Council

7.3.7 South Norfolk Council supports the scheme in principle, with option D being the preferred route. The commitment to enhance options for walking, cycling and public transport, whichever route is chosen, is welcomed.

7.3.8 South Norfolk Council does not support Option A because it feels that the length of the proposed route would not fulfil the objectives of the scheme, would not reduce rat running and represented low value for money.

7.3.9 In relation to Options B and C, South Norfolk Council felt that these routes join the A47 further to the west and subsequently away from existing and emerging growth locations, with Option B seen as less attractive than Option C.

7.3.10 South Norfolk Council acknowledged that Option D runs closer to a number of Listed Buildings and that it also has to cross both the River Tud and the National Grid Gas Lines but stated it shows the most significant reductions in traffic on Ringland Lane and Taverham Lane, and therefore Option D is seen as the overall preferred route.

7.3.11 The Council would like further investigation into the benefits and constraints of Options C and D to establish which is the most appropriate to take forward.

7.4 Parish and Town Councils

Attlebridge Parish Council

7.4.1 Attlebridge Parish Council stated a preference for Option D.

7.4.2 It was felt that this would be the most practical route as it continues from the current termination of the Northern Distributor Road at the Fakenham Road roundabout. Since the Northern Distributor Road opened (a project fully supported by the Parish Council), the council stated it has experienced a reduction in traffic through the village but much more difficulty in entering or leaving the village at the A1067 junction, due to increased traffic from and to the NDR.

Barford & Wramplingham Parish Council

7.4.3 The preferred route option for Barford and Wramplingham Parish Council was Option D.

Diss Town Council

7.4.4 Diss Town Council stated a preference for Option D. This is because it provides a more direct link to the Norfolk and Norwich University Hospital at Colney for health provision for the residents of Diss and surrounding parishes. The Council advised that this is key for residents as weekend health service providers do not currently have a robust service.

Dereham Town Council

7.4.5 Dereham Town Council stated a preference for Options C and D as they joined closest to the North Norwich Distributor Road and the viaduct would provide better opportunities for wildlife to move between roads.

Drayton Parish Council

7.4.6 Drayton Parish Council stated its support of a full dual carriageway Norwich Western Link from the Postwick junction around the north of Norwich to join up with the A47 West of Norwich.

7.4.7 Drayton Parish Council does not support Options A and B as it does not believe rat running will be reduced through Drayton.

7.4.8 The Council noted the benefit of Option D’s proximity to the outskirts of Norwich. It also expressed its concern for the impacts on the environment and residents of Ringland for this option.

7.4.9 Drayton Parish Council noted that Option C does avoid having a viaduct crossing over the River Tud and has a less detrimental impact on woodlands, would avoid being within 500m of more than one listed building and avoids close proximity to Ringland.

7.4.10 Drayton Parish Council believes that the short additional distance and travel time from where options ‘C’ joins the A47 rather than option ‘D’ is acceptable as the detrimental impacts are less. Should option ‘C’ not be deliverable, Drayton Parish Council would support route ‘D’ providing measures are taken to lessen the impact on the residents of Ringland.

Fakenham Town Council

7.4.11 Fakenham Town Council expressed support for Option A. The reasons for this are the fact that it is the cheaper option and therefore more likely to be built, it is more convenient for their residents, it is less likely to further increase traffic on the A1607 and it is more environmentally friendly in that it does not cross the river or damage any important conservation areas.

Hockering Parish Council

7.4.12 Hockering Parish Council stated it does not support any of the options presented. The Parish Council felt that none of the routes have been adequately researched and none are satisfactory.

7.4.13 Hockering Parish Council expressed concern that there is a lack of detailed background information on junctions and crossings. The Parish Council noted that no alternative options are considered, such as alternative public transport options.

7.4.14 Hockering Parish Council noted particular concern for how the current HGV movements will be routed, and also expressed the need for HGVs to be banned along the B1535, apart from those accessing sites in the area. Hockering Parish Council also state that the routes used by those HGVs require to reduce the problem of damage to verges.

7.4.15 Hockering Parish Council noted concern about the impact on Ringland and its environment as well as the impact on the River Wensum.

Honingham Parish Council

7.4.16 Honingham Parish Council did not state support or give preference to any of the proposed four routes as it felt that further information and clarity was needed regarding exact alignment of the proposed routes, type of junctions, amount of land, which properties are subject to compulsory purchase, mitigation of impact (view, noise, light and other pollution; flood risk). It raised concerns about the level of change in the area and the impact this could have on the Parish. The Parish Council is seeking assurance and evidence of coordination between the Norwich Western Link and the other surrounding projects including the dualling of the A47, the Food Enterprise Park and proposals for the Greater Norwich Plan.

7.4.17 The Parish Council expressed concerns over the levels of traffic through Honingham and is disappointed that more isn't being done to resolve this. Honingham Parish Council notes their request for the existing A47 road to remain open once the dualling of the A47 is complete. They are concerned over options A, B and C, in particular on the potential for a new junction where Wood Lane and Berrys Lane meet the A47, stating that this could increase rat running onto local roads such as Berry Lane, which are unsuitable and being damaged by larger vehicles and current levels of traffic. They also noted that there should be joined up thinking between Norfolk County Council and the Highways Agency.

7.4.18 The Parish Council noted that Option A was the cheapest and would have the least environmental impact. Option B would have a lesser environmental impact in comparison to route D. Option C was of serious concern due to negative environmental impact, and Option D was most likely to reduce rat running but could have a large environmental impact.

7.4.19 The Parish Council wishes for the existing A47 road to remain open once the dualling of the A47 is complete, as it believes that it would significantly change the potential impact of routes A, B and C.

Little Melton Parish Council

7.4.20 Little Melton Parish Council noted support for Option D. They stated that this option would remove the most traffic from local roads and has the greatest potential to decrease traffic on the A140 ring road, Watton Road and Dereham Road. In addition, the Council stated that Option D provides the shortest journey for vehicles coming to and from the hospital, Norwich Research Park and the University of East Anglia, and that the other options will push large amounts of traffic to take shortcuts through Ringland.

Lyng Parish Council

7.4.21 Lyng Parish Council stated unanimous support for Option D.

Marlingford and Colton Parish Council

7.4.22 Marlingford and Colton Parish Council raised concerns about potential rat-running between the A47 and Wymondham particularly as the Food Hub progresses. The Council felt that options A and B are not suitable.

7.4.23 Overall, Marlingford and Colton Parish Council stated a preference for Options C and D, with a small majority favouring Option D. The Council noted concern that Option C has the potential to cause rat running through the parish, and that Option D, whilst having less potential to cause rat running on the basis of the closure of Blind Lane to traffic, has a higher environmental impact than Option C.

Morton on the Hill Parish Council

7.4.24 Morton on the Hill Parish Council unanimously agreed to oppose any option which has a junction with the A47 at Wood Lane, that is, Options A, B or C, and would like to see a junction with the newly dualled A47 adjacent to the proposed food hub west of Easton instead. Retaining existing network for local traffic will maximise the flow of traffic and eliminate the need for new side roads.

7.4.25 The Parish Council felt that Option A would not reduce traffic on the ring road and does not solve the strategic or local objectives.

7.4.26 It was felt that Option B was the least attractive option, particularly as it will have the greatest impact on those living and working in Morton on the Hill, and that Option B also did not meet the strategic and local objectives.

7.4.27 The concern with regards to Option C was that it would give traffic leaving the A47 three options; to use the existing route through Weston Longville, use the B1535 or to use the Western Link. Subsequently it was felt that this option would cause a 'funnel' effect for around 40,000 vehicles per day, and would not provide environmental protection. It was also felt that Option C would not meet the strategic and local objectives.

7.4.28 Option D was the preferred option because it is the shortest and would remove virtually all traffic rat running through local villages. Additionally, the Council felt that it provides access to the proposed Food Hub and that there is less visual and noise impact on the surrounding villages and countryside. Morton on the Hill requested the County Council to adopt a route that is closest to Norwich and continue to work with and consider the concerns of local stakeholders.

North Elmham Parish Council

7.4.29 North Elmham Parish Council stated unanimous support for Option D.

North Tuddenham Parish Council

7.4.30 North Tuddenham Parish Council stated support for Option C.

7.4.31 Options B and D were unfavoured, and Option A was seen as a possible back up option. However, North Tuddenham Parish Council felt that Option C involves less disturbance to those living in the vicinity, it is close to Broadland Northway, it has less environmental impact than Options B and D, is relatively close to Norwich and that Wood Lane is a better junction than the proposed Blind Lane option.

7.4.32 North Tuddenham Parish Council raised other concerns around escalating costs, damage to conservation areas, HGV access from Frans Green, rat running, the strategy for existing roads, the lack of public transport options and the need for clarity about links to planned Highways England A47 improvements.

Pulham St Mary Parish Council

7.4.33 Pulham St Mary Parish Council noted support for a new road link to the A47 and Broadland Northway, but felt that the preferred route should be decided by Norfolk County Council and local residents.

Ringland Parish Council

7.4.34 Ringland Parish Council noted support of the scheme. Their recommended route option is Option C because it will have a negative effect on the smallest number of households, remove the largest number of cars from local roads, will reduce overall noise and pollution levels considerably and it costs less than Option B and D, as well as being the most cost-effective solution.

7.4.35 In addition, Ringland Parish Council feels that this option offers good opportunities for low cost and highly effective noise mitigation measures where the road passes close to households.

7.4.36 The Council noted opposition to Option D as it would increase noise levels and would have the greatest environmental impact and a lower cost benefit ratio. It stated Option A would not deliver the required reduction in road use. Option B should be discounted as a result of the negative impact on Weston Longville.

Swannington with Alderford & Little Witchingham

7.4.37 Swannington with Alderford & Little Witchingham Parish Council expressed a preference for route Option D.

Tivetshall Parish Council

7.4.38 Tivetshall Parish Council expressed a preference for Option C.

Taverham Parish Council

7.4.39 Taverham Parish Council noted a preference for Option B (inner route). It stated that no parish councillor at the meeting was in favour of proposed route A. It was suggested that a widening of Fir Covert Road and Beech Avenue would negate the need for any of the proposed options. Councillors raised concerns for those living nearest to the proposed routes, about noise pollution on villages and questioned the need for the bridges to be as high as 12m.

Thetford Town Council

7.4.40 Thetford Town Council stated that it supported Option D as the preferred option because it is the closest option to be a ring road and is the easiest route for those travelling from the south of the county.

Weston Longville Parish Council

7.4.41 Weston Longville Parish Council requested that Norfolk County Council consider:

- That the northern junction for the Norwich Western Link should be as close as is feasible to the junction of the A1067 and the Broadland Northway, and that the southern junction should be adjacent to A47 Taverham Road / Blind Lane junction (the option closest to Easton).
- That the County Council work with local stakeholders (parish councils, land interest Land interests, businesses etc.) to reach a consensus on a route alignment between the two junctions.

7.4.42 The Parish Council stated that it does support the principle of a NWL, but does not support Options A, B or C which have a junction with the dualled A47 at Wood Lane, and felt that proposals for a Norwich Western Link must be seen together with the proposals for dualling the A47. It felt that retaining the existing road structure alongside the newly dualled A47 would reduce the risk of creating new rat runs, eliminate the need for new side roads, would reduce costs and offer an alternative option in case of disruption on the dualled A47. They felt that options A, B and C would funnel traffic through the parish and would subsequently have a large impact.

7.4.43 The Parish Council stated that people are likely to continue using existing rat runs with Option A. Options A and B would impact on the community cohesion. For Options B and C the road would cross open, high ground and the noise and visual impact would be significant and would also disturb minor road and footpath network

Wicklewood Parish Council

7.4.44 Wicklewood Parish Council did not have a preference of options. It raised concerns that all of the options have the potential to cause traffic from the south of the region to ‘rat run' through Wicklewood and surrounding villages to reach the new network and would subsequently request preventative weight restrictions on country roads.

7.5 Elected Representatives

Cllr Claudette Bannock, Broadland District Council

7.5.1 Cllr Bannock expressed a preference for Option D, with Option C as a second preference.

Cllr Dale, South Norfolk Council

7.5.2 Cllr Dale expressed that, as a resident of Hethersett, or as someone coming up the A11, it would be preferable to use the nearest northbound way through the west of Norwich. Cllr Dale also suggested that the further west the new route is aligned, the more likely she will use the northerly road off the Easton roundabout or for returning, Longwater Lane at Costessey.

Cllr Denise Carlo, Norwich City Council

7.5.3 Cllr Carlo wrote on behalf of the Norwich Green Party. She stated the party does not support any of the proposed route options because of the irreversible harm to the landscapes and ecology, the additional traffic generated and the resultant higher greenhouse gas. They suggested modest improvements to the B WEST135 and A1067 between Lenwade and NDR to provide an acceptable HGV route and take traffic from Weston Longville instead of option A, and noted strong opposition to Options B, C and D on the grounds of ecology and landscape, traffic concerns, underestimated cost and poor value for money, as well as concerns around climate change and air pollution.

7.5.4 They suggested that new developments, Food Enterprise Zone and a new settlement, have been proposed to boost the traffic case for a road option. They stated that a NWL would induce traffic significantly and increase air pollution, including greenhouse gas emissions and particulate pollution. Also, they considered that consultants have failed to provide a feasible alternative to a new road link, and did not model a significant package of sustainable transport measures to encourage a modal shift.

Cllr Margaret Dewsbury, South Norfolk Council

7.5.5 Cllr Dewsbury expressed her support for Option D, stating that although Option D is the most expensive of the roads, it is considered to be the shortest and most viable route for keeping traffic out of Norwich to relieve congestion on the inner ring road. Cllr Dewsbury noted that it would help take traffic from the roundabout at Easton through Lower Easton and Ringland Hills to Taverham.

7.5.6 Cllr Dewsbury stated the greatest concern regarding the Wood Lane junction is that traffic will cross the A47 to get to Wymondham/A11 travelling the narrow country lanes via Barnham Broom and Kimberley rather than turning left along the A47 via Longwater and Thickthorn. Cllr Dewsbury re-iterated that local people campaigned against a Wood Lane junction in July 2005 and once again Parish Councils on both sides of the A47 do not support a junction at Wood Lane.

7.5.7 Cllr Dewsbury noted that Option D would provide an effective link to the Food Hub and would help to minimise rat running via Barnham Broom and Kimberley. Cllr Dewsbury highlighted that residents are concerned that the currently proposed entrance at the rear of the site will encourage more rat running through narrow country lanes making them more dangerous for cyclists, walkers and motorists as it is difficult for larger vehicles to pass in some places and speed of traffic is also a concern.

Cllr Trevor Lewis

7.5.8 Cllr Trevor Lewis stated that whilst none of the options affected him directly, B, C or D would benefit him most. He felt that Option A is poor value for money and would provide little improvement. He stated that Options B, C and D were broadly similar in relation to value and traffic use. Cllr Lewis also noted that the consultation provided little information on the impact to existing settlements, and added that if Options A, B or C are selected, this must not result in delays to Highways England's intended A47 improvement works.

Cllr Tim East

7.5.9 Cllr Tim East favoured Option C.

Cllr Paul Chambers

7.5.10 Cllr Paul Chambers did not specify a preferred option, but felt that the road should link up with the A47 west of Norwich, effectively becoming an outer ring road around Norwich. He felt that this would bring huge benefits for business.

Clive Lewis MP

7.5.11 Clive Lewis MP noted that the scheme was contrary to climate change commitments, referencing articles on the subject of carbon emissions, studies on induced car travel and impacts to wildlife. Clive Lewis MP highlighted that district councils are only being given one option in relation to transport schemes (road schemes) and that there should be a focus on improving public transport systems. He suggested providing the right infrastructure for an efficient and cheap-for-user bus system and taking a more pro-active approach to the delivery of bus services.

7.5.12 Clive Lewis MP also stated that he has serious concerns about the consultation process, saying that it was flawed and based on inadequate and unclear data. He also noted that the costs for the Western Link seem to have been underestimated.

7.5.13 Clive Lewis MP stated the importance of encouraging people to use sustainable alternatives to transport such as public transport, car sharing schemes, cycling, and pedestrian facilities.

7.6 Statutory bodies

Environment Agency

7.6.1 The Environment Agency's principal concern is the impact of any new road on the River Wensum SSSI/SAC, which will need to be assessed in due course under the Conservation of Habitats and Species Regulations 2017 and the Wildlife and Countryside Act 1981. They state that a new road should only be permitted if it can be demonstrated that it does not adversely affect the integrity of the River Wensum SAC. The final proposal should result in no net loss, and where possible look to achieve a net gain in habitat quantity, quality, connectivity and integrity. Stringent pollution prevention measures are to be incorporated into the design of the road to prevent contamination of rivers, streams and other controlled waters.

7.6.2 The impacts of the proposed options on the River Wensum SSSI/SAC will need to be assessed under the Conservation of Habitats and Species Regulations 2017 and the Wildlife and Countryside Act 1981 (as amended). A new road should only be permitted if it can be demonstrated that, alone or in combination with other plans or projects, it does not adversely affect the integrity of the River Wensum SAC.

7.6.3 The EA welcome the inclusion of a specific project objective to not affect the integrity of the River Wensum SAC, but would suggest that this should be given increased prominence. A new route could provide many benefits as stated, but not harming the environment is a statutory responsibility and should therefore be given appropriate weighting.

7.6.4 The EA also highlight that *'The River Tud is identified as a chalk river (Priority Habitat) in the WWF-UK 2014 report 'The State of England's Chalk Streams'. It retains many classic chalk river characteristics, including relict gravels and associated flora, fauna and water quality. It will be important that any road proposals affecting the River Tud are designed so that they adequately protect the ecology and ecological functioning of the River Tud valley'.*

7.6.5 The Environment Agency also highlighted the need for schemes to have an appropriate Water Framework Directive assessment and Flood Risk Assessment. The Environment Agency would prefer an option which uses existing infrastructure. However, In the event that a road option is chosen that requires a new river crossing, as previously highlighted and as referenced in the consultation material, the EA would prefer the construction of a viaduct which minimizes the environmental impacts on the river and floodplain.

7.6.6 The Environment Agency commented as follows in relation to specific options:

- Option A will have the least potential impact on flood risk of the four options.
- Option B EAST includes a new viaduct bridge crossing downstream of Attlebridge over the river Wensum and Option C and D both include a bridge crossing upstream of Taverham. The viaducts for all three options would be raised on piers and so likely be raised above the floodplain reducing its impact on flood risk.
- Options A and B WEST avoid new crossings of both the rivers Wensum and Tud
- Option D requires two river crossings. In line with the comments above, routes that minimise the number of new crossings are likely to be considered preferable in this respect.

Highways England

7.6.7 Highways England did not have a view on a preferred link option, but stated that, in developing junction options and route choice, consideration will need to be given to ensuring there is no significant delay to through traffic.

7.6.8 Highways England noted that, in the event the NWL is taken forward, and depending on NWL route corridor selection, it will be important to ensure that there is synergy between the HE proposed dualling scheme and the A47 between North Tuddenham and Easton scheme with a coordinated approach on the junction design.

Historic England

7.6.9 As the Government's adviser on the historic environment, Historic England is keen to ensure that the protection of heritage assets is fully considered and accorded proper weight in accordance with legislation and the National Planning Policy Framework at all stages and levels of the process. Historic England have identified and listed the designated heritage assets that are likely to be affected by the road proposal but have not considered archaeological issues in detail and, non-designated (heritage) assets and referred to other sources for these.

7.6.10 From the information available to date, and from a high-level desk-based assessment only of designated heritage assets, Option C would appear to have least impact on the historic environment and therefore, is their preferred route at this stage.

7.6.11 Option A would have the least impact on assets of high grade (grade I and II* assets). The western-most alternative Option B would probably have the greatest effect on designated heritage assets.

7.6.12 It should be understood that an expressed preference for an option at this stage should not be taken as support for that a route, or even for the road at all.

Natural England

7.6.13 Natural England noted concern with the conservation of management of the natural environment. Their response recognised the adverse potential environmental impacts (to varying extents) of all four of the Norwich Link Road options. Natural England also stated that they support and echo the comments made by the Environment Agency in relation to this consultation with respect to the River Wensum SSSI and SAC.

7.6.14 Where impacts cannot be avoided, mitigation measures are needed together with compensatory measures for any impacts that cannot be mitigated. They encourage to look beyond the immediate road corridor area in implementing these measures, so that there are long term environmental benefits on a landscape scale, achieving net gain in terms of the quality and extent of habitat created, managed, enhanced and connected.

7.6.15 In their view, Option A would have the least direct environmental impact on the River Wensum Site of Special Interest (SSSI) & Special Area of Conservation (SAC) and when compared to the other routes would result in a lower degree of fragmentation to the woodland.

7.6.16 Both variations of Option B are considered to have both pros and cons. In terms of reducing noise and visual landscape impacts, widening the existing Attlebridge bridge crossing would be better than the other proposed option of a new viaduct crossing the river and the Wensum valley, though a new dual carriageway bridge would result in greater shading of the river channel beneath. A new viaduct is likely to mean there would be less impact on the river corridor and floodplain as structures to support the new road and bridge crossing would be set further back from the river and so not impede natural river processes over time.

7.6.17 Regarding Option C, the northern end of the proposed route on the A1067 crosses the River Wensum and flood zones 2 and 3, although it avoids the County Wildlife Sites (CWS) adjacent to the western side of the River Wensum. It severs various parcels of woodland along the route, passes close to a block of ancient woodland and through a CWS before joining the A47.

7.6.18 Option D requires two new river crossings, one over the Wensum and the second over the Tud. It avoids any CWS sites and direct impacts on ancient woodland. However, due to potential environmental impacts, it would be better to minimise the number of new river crossings.

7.7 Environmental (non-statutory)

Campaign to Protect Rural England (CPRE), Norfolk

7.7.1 CPRE Norfolk is highly concerned about the substantial harmful impacts to countryside, environment, wildlife and ecology which are likely to be caused by any of the proposed options for the Norwich Western Link road (NWL.) CPRE Norfolk opposed the construction of the Northern Distributor Road (NDR) for Norwich, on the basis that there were other less damaging options, and noted that the extension beyond the A140 was not justified, warning that it would lead to ‘rat-running’ in the Wensum valley.

7.7.2 CPRE did not agree with the priorities outlined by Norfolk County Council and stated that serious mitigation measures are needed both for the environment and the directly affected communities should the project progress. CPRE was disappointed to see that options located closer to Norwich have not been included for public consultation.

7.7.3 CPRE raised concerns about the consultation materials, specifically around the lack of detail to assess the environmental impacts and mitigations.

7.7.4 CPRE was not convinced by any of the four options and are critical of the prioritisation of the new road proposals rather than other transport solutions.

Friends of the Tud Valley

7.7.5 Friends of the Tud Valley in Costessey noted support for the completion of the Northern Distributor Road. Friends of the Tud Valley noted that it is in favour of Option C and believes that this route will cause the least environmental damage to the River Valleys and also will avoid crossing the Tud Valley.

Norfolk Wildlife Trust

7.7.6 Norfolk Wildlife Trust states that none of the routes avoid significant damage to multiple County Wildlife Sites (CWS) and Ancient Woodlands. Without further evidence that the losses to important wildlife sites, degradation of nearby habitats and landscape severance can be avoided or successfully mitigated, and that the route can be delivered with a net gain for wildlife - in line with national planning policy -, they currently regard all the options as unacceptable. They explain in general terms what measures would need to be included.

Royal Norfolk Agricultural Association

7.7.7 The Royal Norfolk Agricultural Association (RNAA) welcomed the proposals to build the Norwich Western Link and deliver the associated benefits for road users.

7.7.8 Of the four options, RNAA noted support for Option C and if pressed would support Option D, but does express concern for the impact of the route on the community of Ringland. They discounted Options A and B on the grounds of (excessive) route length, environmental and community impact and value for money.

7.7.9 RNAA selected route C as it follows directly from Broadland Northway junction with the A1067, has the advantage of a long lead-in for traffic approaching the Easton/Longwater junctions, allow traffic from the west to take a northerly route around Norwich, bypassing the pinch points at Easton/Longwater and Thickthorn, minimizes the impact on the environment (mitigation measures are required) and appears to offer the least impact on local communities.

The Wensum Valley Alliance and Norwich & Norfolk Friends of the Earth

7.7.10 The Wensum Valley Alliance and Norwich & Norfolk Friends of the Earth strongly disagreed with the proposals in principle. In their view, the proposals are deeply flawed and question the accuracy of the transport data and cost, feel that such a project is contrary to our climate change commitments, lead to increased air pollution, cuts through wildlife sites, lacks detailed information on mitigation measures and overlooked public transport options.

Toadwatch

7.7.11 Toadwatch noted support for Option D on the basis that this route will remove traffic from toad crossings at Ringland and Costessey. This project could create toad ponds and toad hibernacula under the viaducts that will cross the river valleys.

Woodland Trust

7.7.12 The Woodland Trust strongly objected to three of the four road options (Options A, C and D) on the grounds of direct environmental impacts to two areas of ancient woodland and a veteran tree. Primrose Grove and Jennis Wood are designated as Plantation on Ancient Woodland Sites (PAWS) on Natural England's Ancient Woodland Inventory.

7.7.13 The Woodland Trust stated Option A is within close proximity to a veteran tree, identified by Norfolk County Council. The Trust would like confirmation as to whether the tree roots are likely to be impacted by this route.

7.7.14 Option C is within close proximity to the ancient woodlands and will increase disturbance to both Primrose Wood and Jennis Wood.

7.7.15 Option D will result in direct loss to Primrose Grove as well as detrimental impact to Jennis Wood. The Woodland Trust strongly oppose the loss of this habitat and therefore discount this as a viable option.

7.7.16 The organisation did suggest that Options C and D could be re-designed to include a buffer zone of at least 30 metres between the road and the ancient woodland, which is line with Natural England's standing advice.

7.8 Local and wider businesses

Norfolk Chamber of Commerce

7.8.1 Norfolk Chamber of Commerce (NCoC) welcomed the Norwich Western Link. NCoC believes Option C is the most appropriate route option that will benefit the majority of Norfolk Chamber's members.

7.8.2 NCoC stated Option A will not benefit business and commuter traffic and the route will impact on three County Wildlife Sites and pass within 500m of 15 listed buildings.

7.8.3 Option B, whilst being shorter than Option A, involves either widening the existing River Wensum Bridge or building a new viaduct, both of which will impact on the Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). Also, this route is low value for money and the overall benefit to business users would be limited.

7.8.4 Option D is the shortest route option and high value for money. However, the high impact and that it crosses two rivers does raise concern for the Norfolk Chamber of Commerce. It is made clear that this option does not reflect the most effective use of resources and therefore is not comparable to Option C.

CBRE Ltd, on behalf of Wensum Valley Hotel, Golf and Country Club

7.8.5 CBRE is supportive of the need for a Norwich Western Link Road, but expressed concerns in relation to the route options and their impacts on the Wensum Valley Hotel and Golf Club and the Wensum Valley itself.

7.8.6 CBRE raised concerns about the lack of information regarding the impacts of the four options on noise pollution.

7.8.7 Option A is discounted due to the route's inability to fulfil the objectives of the scheme and is likely to lead to more traffic on local roads and does not offer value for money.

Both Options C and D could have a devastating impact on the business.

7.8.8 CBRE preferred Option B with a preference for the variation that incorporates the existing bridge. The reason for this is that the impacts on the Wensum Valley Hotel and Golf Club (WVHGC) are lower for this variation of Option B, than the other option to utilise a new viaduct.

7.8.9 Although Options B, C and D all offer “high” value for money, Option B still remains the most favourable option, which offers the best balance between impact on WVHGC and meeting the Council’s objectives.

7.8.10 CBRE did note that most consultation respondents are not aware that the closure of Easton Roundabout will stop the rat run through Ringland. Also, they suggest revisiting the connection of route B to Blind Lane roundabout.

Brown & Co and Transport Planning Associates on behalf of Clarion Housing Group

7.8.11 Clarion Housing Group strongly supported the concept of the Norwich Western Link, with a preference for Option D, which is viewed as the most cost-effective way of achieving the benefits of the link.

7.8.12 The Group acknowledged that if the ecological issues are so significant they cannot be dealt with, then Option C would be its second preference.

7.8.13 Option A and B are both routes too far removed from the edge of Norwich to provide the benefits described. Clarion Housing Group also provided a technical note from highways consultants Transport Planning Associates as part of its response.

Intu Chapelfield

7.8.14 Intu Chapelfield recognised the need for the Norwich Western Link to help address the existing issues of rat running and traffic congestion in the areas west of Norwich.

7.8.15 Intu Chapelfield supported Option C as this route is regarded as highly cost effective and achieves minimal environmental impact for the NWL scheme.

7.8.16 As part of the scheme, this business is expecting to see concerted efforts to encourage people to use more sustainable forms of transport.

7.8.17 Intu Chapelfield sought more information on the potential traffic impacts during construction and the potential overlap with Highways England’s scheme to dual the A47. They noted there should be a high level of engagement with local communities and businesses when planning construction.

Konectbus

7.8.18 Konectbus noted support for the scheme to provide a Norwich Western Link and requested the new road is built as close to the Longwater junction as possible. It stated the success of this link would be the perception that it forms a circle around North West of Norwich without the extra drive for buses away from the city first.

7.8.19 Konectbus did highlight the need for access roads which are fit for purpose to accommodate both the bus service and housing development in the area.

7.8.20 A further suggestion from Konectbus was that a link road would be a more user friendly cross-country route between the A47 Dereham bypass at North Tuddenham and the A1067 at Lenwade. This would not only give an alternative link to the NDR but would also take traffic off the A47 heading eastbound from King’s Lynn towards Great Yarmouth, which is a busy HGV route.

New Anglia LEP

7.8.21 New Anglia LEP have expressed their support for the Norwich Western Link and have a strong preference for route Option D. They believe this option will best serve the agri-food sector around Norwich, one of the pillar sectors in our developing Local Industrial Strategy. However, they also can see merit in option C. They recognise the importance of appropriate environmental mitigation for either route.

7.8.22 They noted connecting Broadland Northway to the A47 west of Norwich will help deliver the Economic Strategy for Norfolk and Suffolk. The Norwich Western Link was identified as a priority in their Integrated Transport Strategy and will encourage investment into the Norfolk and Suffolk Economic Strategy. Further to this, the scheme will support the Strategy's ambitions by reducing city centre congestion, improve transport links and journey reliability to economic opportunities in the north and east of the city.

7.8.23 New Anglia LEP also noted Norwich Western Link has the opportunity to add benefits that will be realised by Highways England's A47 improvements and improve connectivity to the centres of global excellence in food and health and Norwich Research Park, the Food Enterprise Zone at Easton and the Cambridge Norwich Tech Corridor.

Barton Willmore LLP on behalf of Norwich Airport Limited

7.8.24 Norwich Airport Limited noted full support for the proposal to build a western link which will bring significant economic benefits to the region as well as improving the Airport's connectivity and accessibility in the Greater Norwich Area and beyond, and thereby help facilitate its economic growth objective.

7.8.25 The organisation is aware of the environmental and technical challenges that options for this Norwich Western Link road could create, but stated the final route chosen should provide the maximum highway capacity and efficiency for the long term, accounting for the growth ambitions of the Airport, its associated businesses and the wider emerging sub-regional Development Plan targets.

7.8.26 It should provide a comprehensive network of cycle and pedestrian routes and links to allow people the choice to travel by sustainable modes.

7.8.27 Norwich Airport Limited stated that the new road should be prioritised for construction by 2022.

James Gray Haulage Contractor

7.8.28 The response sent on behalf of James Gray Haulage Contractor indicated a preference for Option D. The reasons for this were reduced rat running, boosting the local economy and reduced congestion. It was also felt that Option D is not an intrusion to the local village.

7.9 NHS Trust

Norfolk and Norwich University Hospitals (NNUH), NHS Foundation Trust

7.9.1 The NHS Foundation Trust is supportive of the development of the road infrastructure linking the Northern Distributor Road (NDR) from the A1067 to the A47 west of Norwich as it will significantly improve the access to the hospital to meet the increasing demand for ambulance services and increase in outpatients over the recent years.

7.10 Emergency services

Norfolk Constabulary

7.10.1 Norfolk Constabulary's preferred route is Option C.

7.10.2 It stated the option has the highest vehicle count of all 4 options, therefore is deemed to be the most effective in reducing city traffic. In addition, this route is the second shortest which will result in less car emissions per vehicle journey. Despite the route being the second most expensive to the tax payer it does provide a more viable route to join to the A47 compared to Option D.

7.11 Walking and cycling groups

Norwich Cycling Campaign

7.11.1 Norwich Cycling Campaign noted that all options cut through existing routes used by cyclists. The group stated the Council should follow the guidelines set out by Highways England, specifically for "Cycle Traffic and the Strategic Road Network" and footway and cycleway designs should comply with the "Design Manual for Roads and Bridges".

7.11.2 Concern was expressed with regards to the new road and the severance for existing routes used by pedestrians and cyclists. The group respects that a new road could reduce traffic capacity on key parts of radial routes and the ring road northwest of the city, however Norwich Cycling Campaign notes that this should not happen at the expense of pollution, health and other environmental related impacts.

7.11.3 They requested that the detail design of the preferred route seeks to mitigate any potential severance so that effects on pedestrians, cyclists and public transport are minimised and if possible routes and access is enhanced. They find it essential that a programme of improvements to transport on foot, by cycle and public transport, and opportunities for removing traffic capacity on key parts of radial routes and the ring road northwest of the city are delivered concurrently with the development of the scheme.

Norfolk Local Access Forum

7.11.4 Norfolk Local Access Forum had no view on the principle of establishing the Norwich Western Link, but were concerned that should a new road be built, the route should avoid cutting existing rights of way or other well used routes, and should not divide communities or deny them from accessing their local transport network.

7.11.5 In addition, where a bridge or underpass cannot be provided, safe crossing places should be incorporated into the route with minimal disruption and inconvenience caused to all path users. The group asserted that the maintenance of the peaceful environment that currently exists in the Wensum Valley should not be jeopardised at the expense of such a scheme.

Ramblers' Association

7.11.6 The Ramblers' Association raised a number of specific concerns for each of the four option routes, including:

- Option A - This option is deemed expensive pro rata for the number of prospective users and may affect Weston Longville Footpath 7 and 8 and would cut a track called Ley's Lane which may not yet be shown on the Definitive Map. The group does suggest that if this route is adopted, a roadside footway is to exist between ends of the two footpaths and that Ley's Lane's cut arms remain open.

- Option B - Of the two variations, the northwest Option B appears to be the least damaging to the environment. They request that the track running northeast from opposite the Pump Farm junction of u57217 and C167 remain connected to these roads, that the public path Honingham RB 1 is protected, and that the road design at Attlebridge Hall makes safe provision for people crossing between Attlebridge Footpath 5 and Attlebridge RB4.
- They think that Options C and D are the most damaging to the environment and people's enjoyment of the area. Both routes cut across Ringland Footpath 1. The near continuous traffic noise would affect the peace of walks on both Ringland Footpath 1 and 2.
- Option C would cut through the quiet walking and riding track on Blackbreck Lane (u57323).
- Option D would cut through a quiet walking and riding track called Sandy Lane (u57321).

7.12 Land interests

NWL-OC-LO-001

7.12.1 The land interest objected to Options B and C due to the impact upon the estate, including disruption to their business, impact on flora and fauna/ ecology/ woodland, land drainage, topography and soil structure and archaeology.

7.12.2 The land interest stated Option D appears to the most viable route that is closest to the end of the existing Northern Distributor Road (NDR) and would improve traffic flow and reduce congestion.

NWL-OC-LO-002

7.12.3 The land interest declared that they have concerns over several route options, but particularly route option D. They felt that the options presented ignore earlier representations and will severely impact the estates as well as having a detrimental environmental impact.

7.12.4 They felt that insufficient information has been provided to allow consultees to make an objective decision. They provided in-depth analysis and research into the impacts of each route option, but summarised that only route option A or B could be selected, subject to modifications, as they state that they are least harmful to the Special Area of Conservation.

NWL-OC-LO-003

7.12.5 The response is from two longstanding tenants on land affected by the scheme, who raised concern for the future of their farm. They favoured Option D as it has minimal environmental and financial effects. If one of the routes which does cut through land is selected, Option C is the preferred option rather than B.

7.12.6 The main concern of the proposed routes is the potential for Options B and C to intersect through the land that these tenants occupy. A number of specific concerns have been cited in their response relating to their land.

NWL-OC-LO-004

7.12.7 The land interest acknowledged the need for provision of a Norwich Western Link to connect the A47 to the western end of Broadland Northway which will in theory help to ease traffic congestion problems and improve connectivity between these two routes. That being said, the four route proposals have caused this business a great deal of concern.

7.12.8 Option A would have no positive impact on the current traffic journey time issues. They also state their uncertainty surrounding the alternative route which drivers will need to take (further up the A47) should Route B or C be adopted.

7.12.9 With Option C the main concern is that it is further for vehicles to travel to join the A47 as well as the close proximity to property and business which will be impacted by noise pollution and the disruption that the construction and greater use of the road will bring.

7.12.10 Option D puts the running and reputation of their business at huge risk. This business is concerned about the direct impacts that the route decision will cause on them.

NWL-OC-LO-005

7.12.11 This land interest favoured Option D as it does not affect any of the properties that link to Fakenham Road and would have less impact on residential properties overall. A second preference is Option C.

7.12.12 They expressed concern over Option B because it would cut across their land and subsequently from Attlebridge. They also said that Option B would increase noise and light pollution, and specifically the viaduct option as having a direct impact in terms of noise pollution.

NWL-OC-LO-006

7.12.13 This land interest specified a preference for route B and believes that route D would be the worst choice for Ringland residents and for themselves. The land interest stated that routes C and D both affect their property but that route B was the preferred option as it requires no viaduct bridge which they felt would cost less money and would be less damaging for the environment.

NWL-OC-LO-007

7.12.14 This land interest stated a preference for route option D as it is closer to Norwich. They noted that Options B and C would make it difficult to farm their land as this would require crossing the proposed Norwich Western Link Road.

NWL-OC-LO-008

7.12.15 A joint response was sent from two land interests at the same residence. They felt that Hockering Parish Council should support the more easterly routes, namely Options C and D. They also stated that the villages of Weston Longville and Ringland should present a unified preference for Option D.

7.12.16 They said that Option A crosses their property and will subsequently have a detrimental effect, and adding that it would cause 20,000 vehicles using alternative routes on a daily basis. They did however say that they are in full agreement that a proper connecting road needs to be constructed between the A1067 and the A47.

NWL-OC-LO-009

7.12.17 Two land interests provided a joint response, stating a preference for option D. Their reasons were because it is the shortest route for future traffic joining the A47 from the NDR. In addition, they stated that this was the most economical route referencing fewer emissions from traffic, they also stated that this route provided better junctions by linking closer to the Food Hub and Longwater area. Lastly, they felt that this route had less environmental impact than options B and C. They stated that options B and C would significantly impact all residents of Weston Green and Weston Longville.

NWL-OC-LO-010

7.12.18 This land interest stated a preference for Option D.

NWL-OC-LO-011

7.12.19 This land interest's preference was for Option D. They stated that this option has far less impact on the countryside as a result of being a shorter route.

7.12.20 They expressed concern over Options B and C on the basis that these routes would have an adverse impact on their farm. They stated that these routes would devalue their property as well as increasing the levels of air and noise pollution. These routes would also result in a loss of farmland.

NWL-OC-LO-012

7.12.21 This land interest expressed a preference for Option D because it links two major roads by the most direct route and would discourage rat-running.

7.12.22 They noted that Option A is too far west and, while useful for HGVs, this option would not reduce rat-running from commuter traffic. They stated that Options B and C join the A47 a lot further away from the city.

7.12.23 They expressed concern over the environmental impact of Options B, C and D and would like some form of access to remain between the villages. They also said that they would like to use public transport, however noted that there is no current service through Weston and no footpath to the A1067.

NWL-OC-LO-013

7.12.24 This land interest stated a preference for Option D because it would improve access to Norwich Airport and local businesses, utilises mostly unused land and the site would create a natural barrier to limit noise.

7.12.25 They expressed concern over Option A, saying that traffic volumes would increase, it is too far west, would devalue their property and would have a detrimental impact on the environment.

7.13 Educational groups

Easton and Otley College

7.13.1 Easton and Otley College noted support for Option D as their preferred route for the Norwich Western Link, with their second choice as Option C.

7.13.2 Their reasoning is that route D offers the shortest route and is likely to allow the avoiding of use of the A47 for journeys from north of Norwich to the College campus.

7.13.3 The College stated Option C is the second shortest route and lowest estimated cost for a dual carriage way connection, but it does not however offer the potential to connect directly to the College without using the A47.

7.13.4 The College felt Option A would create more bottlenecks.

8. Conclusion

8.1 Consultation outcomes

8.1.1 A total of 1,931 responses were received to the Norwich Western Link options consultation, providing a broad range of views and comments on the proposals which have been summarised in this report.

8.1.2 The consultation feedback indicates a broader preference for Option D, with consultees highlighting this as a viable route due to it being so direct, as well as providing good links to other major roads such as the A47 and the Broadland Northway. However, it is acknowledged by many that this is more expensive than other options and is considered to potentially affect more environmental constraints than some of the other options.

8.1.3 Option C was generally found to be the second most supported option by consultees, noting that it is a cost-effective solution and provides one of the most viable and direct routes, with lower environmental effects perceived than in relation to other options.

8.1.4 Options B WEST (with the existing bridge) and B EAST (with the new viaduct route) received a mix of support and opposition. Most concerns in relation to Options B WEST and B EAST were in relation to the location deemed to be too far west to be an effective route, and that it therefore does not provide a suitable link. Several respondents noted that these options would have less environmental impacts; this is particularly the case for Option B WEST. Outputs from the questionnaire analysis demonstrated that there was marginally more support for Option B EAST.

8.1.5 Consultation responses suggest that Option A is the least preferred option. Consultees have noted that this option does not solve current traffic / congestion issues as this route is longer and further away from Norwich to be as effective as other options. There are also concerns regarding the capacity of single carriageway proposals.

8.1.6 Concern over environmental impacts have arisen for all options, with particular concern over potential impacts on wildlife, woodland, and the River Wensum SAC. However, the Environment Agency and Natural England did not oppose any of the options and expressed a preference for minimising the number of river crossings and accepted the principle of a new viaduct in the event that a new crossing was required, subject to adequate mitigation and biodiversity enhancement.

8.1.7 There is interest in the potential to integrate other transport improvements which could complement the Norwich Western Link. Consultees noted the need for improved bus services, as well as cycling and walking facilities.

8.2 Next steps

8.2.1 The feedback from this consultation will help Norfolk County Council to better understand the issues encountered in this area and potential mitigation requirements. It will assist in developing the options further and selecting a preferred option.

8.2.2 The Option Selection Report (OSR) details how consultation responses have been considered, amongst a wide range of factors including engineering constraints, cost, environmental effects and traffic modelling. The OSR seeks to recommend a preferred option which if approved the Council will take forward for further development and design. The preferred option design will be consulted on prior to the submission of a planning application, with further opportunities for members of the public, affected land interests and stakeholders to have their say on the detail of the final scheme design.

Annex A – List of stakeholders who responded

Stakeholder group	Organisation
Educational groups	Easton & Otley College
Elected representatives	Cllr Margaret Dewsbury
	Cllr Dale
	Clr Claudette Bannock
	Cllr Denise Carlo
	Cllr Trevor Lewis
	Cllr Tim East
	Clive Lewis MP
	Cllr Paul Chambers
Emergency services	Norfolk Constabulary
Environmental (non-statutory)	CPRE Norfolk
	Royal Norfolk Agricultural Association
	Friends of the Tud Valley
	Woodland Trust
	Toadwatch
	Norfolk Wildlife Trust
	The Wensum Valley Alliance
	Norwich & Norfolk Friends of the Earth
Land interests ***(names removed for confidentiality)***	NWL-OC-LO-001
	NWL-OC-LO-002
	NWL-OC-LO-003
	NWL-OC-LO-004
	NWL-OC-LO-005
	NWL-OC-LO-006

Stakeholder group	Organisation
	NWL-OC-LO-007
	NWL-OC-LO-008
	NWL-OC-LO-009
	NWL-OC-LO-010
	NWL-OC-LO-011
	NWL-OC-LO-012
	NWL-OC-LO-013
Local and wider businesses	James Gray Haulage Contractor
	New Anglia LEP – Chris Starkie
	Norfolk Chamber of commerce
	Norwich Airport Ltd
	Konectbus
	Clarion Housing Group, Transport Planning Associates
	Intu Chapelfield
	Wensum Valley Hotel Golf and Country Club (CBRE)
Local authorities	Broadland District Council
	North Norfolk District Council
	Norwich City Council
	South Norfolk Council
	Breckland Council
NHS Trust	NNUH NHS Foundation Trust
Parish councils	Weston Longville Parish Council
	Drayton Parish Council
	Honingham Parish Council
	Fakenham Town Council
	Thetford Town Council

Stakeholder group	Organisation
	Dereham Town Council
	Diss Town Council
	Little Melton Parish Council
	Wicklewood Parish Council
	Morton on the Hill Parish Council
	Taverham Parish Council
	Hockering Parish Council
	Ringland Parish Council
	Lyng Parish Council
	North Elmham Parish Council
	Pulham St Mary Parish Council
	North Tuddenham Parish Council
	Barford & Wramplingham Parish Council
	Marlingford and Colton Parish Council
	Tivetshall Parish Clerk
	Attlebridge Parish Council
	Swannington with Alderford & Little Witchingham
Statutory bodies	Natural England
	Highways England
	Environment Agency
	Historic England
Walking / cycling groups	Ramblers Association
	Norfolk Local Access Forum
	Norwich Cycling Campaign

Annex B – Consultation Questionnaire

Norwich Western Link Options - have your say

Option A

1. In our initial consultation in summer 2018, we asked people to tell us about any issues they wanted us to consider when creating a Norwich Western Link. The top ten issues that were highlighted are listed below, please select any you think this option would help to tackle. You can select as many as you want.

- ❏ Road safety
- ❏ Shortening journey times
- ❏ Better access to Norfolk & Norwich Hospital
- ❏ Better journey reliability
- ❏ Reducing rat-running
- ❏ Reducing emissions from queuing vehicles
- ❏ Reducing congestion
- ❏ Improving emergency response times
- ❏ Protecting the environment
- ❏ Boosting the local economy

2. Based on all the information provided, how effective do you think this option would be as a Norwich Western Link? (mark point on line below)

Not very effective ——— Very effective

3. Please tell us why you think this

Option B - Route with existing bridge

1. In our initial consultation in summer 2018, we asked people to tell us about any issues they wanted us to consider when creating a Norwich Western Link. The top ten issues that were highlighted are listed below, please select any you think this option would help to tackle. You can select as many as you want.

- ❏ Road safety
- ❏ Shortening journey times
- ❏ Better access to Norfolk & Norwich Hospital
- ❏ Better journey reliability
- ❏ Reducing rat-running
- ❏ Reducing emissions from queuing vehicles
- ❏ Reducing congestion
- ❏ Improving emergency response times
- ❏ Protecting the environment
- ❏ Boosting the local economy

2. Based on all the information provided, how effective do you think this option would be as a Norwich Western Link? (mark point on line below)

Not very effective — Very effective

3. Please tell us why you think this

Option B - Route with new viaduct

1. In our initial consultation in summer 2018, we asked people to tell us about any issues they wanted us to consider when creating a Norwich Western Link. The top ten issues that were highlighted are listed below, please select any you think this option would help to tackle. You can select as many as you want.

- ❏ Road safety
- ❏ Shortening journey times
- ❏ Better access to Norfolk & Norwich Hospital
- ❏ Better journey reliability
- ❏ Reducing rat-running
- ❏ Reducing emissions from queuing vehicles
- ❏ Reducing congestion
- ❏ Improving emergency response times
- ❏ Protecting the environment
- ❏ Boosting the local economy

2. Based on all the information provided, how effective do you think this option would be as a Norwich Western Link? (mark point on line below)

Not very effective — Very effective

3. Please tell us why you think this

Option C

1. In our initial consultation in summer 2018, we asked people to tell us about any issues they wanted us to consider when creating a Norwich Western Link. The top ten issues that were highlighted are listed below, please select any you think this option would help to tackle. You can select as many as you want.

- ❏ Road safety
- ❏ Shortening journey times
- ❏ Better access to Norfolk & Norwich Hospital
- ❏ Better journey reliability
- ❏ Reducing rat-running
- ❏ Reducing emissions from queuing vehicles
- ❏ Reducing congestion
- ❏ Improving emergency response times
- ❏ Protecting the environment
- ❏ Boosting the local economy

2. Based on all the information provided, how effective do you think this option would be as a Norwich Western Link? (mark point on line below)

Not very effective — Very effective

3. Please tell us why you think this

Option D

1. In our initial consultation in summer 2018, we asked people to tell us about any issues they wanted us to consider when creating a Norwich Western Link. The top ten issues that were highlighted are listed below, please select any you think this option would help to tackle. You can select as many as you want.

- ❏ Road safety
- ❏ Shortening journey times
- ❏ Better access to Norfolk & Norwich Hospital
- ❏ Better journey reliability
- ❏ Reducing rat-running
- ❏ Reducing emissions from queuing vehicles
- ❏ Reducing congestion
- ❏ Improving emergency response times
- ❏ Protecting the environment
- ❏ Boosting the local economy

2. Based on all the information provided, how effective do you think this option would be as a Norwich Western Link? (mark point on line below)

Not very effective — Very effective

3. Please tell us why you think this

Options Comparison

1. Which of the following statements best describe the information you have seen. Please select all that apply.

- ❏ I've read the information on this website
- ❏ I've visited the Norwich Western Link website
- ❏ I've read information in the media
- ❏ I've read information on social media
- ❏ I've attended a consultation event
- ❏ I've read the consultation brochure

2. To what extent do you agree or disagree that there is a need for a new or improved road linking the western end of Broadland Northway (previously known as the NDR) to the A47?

Disagree Agree

3. Please select any of the options that you would support as a Norwich Western Link. If you think none of the options are suitable, please select the appropriate box below. You can select as many options as you like.

- ❏ Option A
- ❏ Option B - Existing bridge route
- ❏ Option B - New viaduct route
- ❏ Option C
- ❏ Option D
- ❏ None of them, but something should be done
- ❏ None of them, do nothing

4. Please tell us why you chose these options. If your comment relates to a specific option, please tell us which option your comment refers to.

5. We are considering making other transport improvements which could complement the Norwich Western Link options. Which of the following measures do you think could be most effective in doing this? Please select as many improvements as you like.

- ❏ Improving bus services
- ❏ Traffic calming on existing roads
- ❏ Restricting traffic on existing roads
- ❏ Improving existing junctions
- ❏ Improving cycling routes
- ❏ Improving walking routes
- ❏ Introducing a lorry management strategy

6. Please tell us why you think this

7. If there is anything else you want to tell us about our shortlisted options, please write this below.

About you

What's your postcode?

What is your connection to the area?

- ❏ I live here
- ❏ I work here
- ❏ I study here
- ❏ Visiting
- ❏ I transport goods here
- ❏ I own a business here

What is your age group?

- ❏ 15 or under
- ❏ 16-24
- ❏ 25-34
- ❏ 35-44
- ❏ 45-54
- ❏ 55-64
- ❏ 65-74
- ❏ 75-84
- ❏ 85 or over

What is your gender?

- ❏ Male
- ❏ Female
- ❏ Other

If other, please state:

What is your ethnicity?

- ❏ White
- ❏ Mixed/multiple
- ❏ Asian/Asian British
- ❏ Black/African/Caribbean/Black British
- ❏ Other

If other, please state:

What is your employment status?

- ❏ Working full-time
- ❏ Working part-time
- ❏ Zero-hour contract
- ❏ Apprenticeship /training
- ❏ Student
- ❏ Retired
- ❏ Unemployed
- ❏ Self-employed

How do you usually travel around this area?

- ❏ Car (driver)
- ❏ Car (passenger)
- ❏ Bicycle
- ❏ Train
- ❏ Bus
- ❏ Motorbike/moped
- ❏ Taxi
- ❏ On foot
- ❏ Mobility scooter/wheelchair
- ❏ Goods vehicle (driver)

Do you have or use any of the following?

- ❑ Car
- ❑ Car hire
- ❑ Cycle
- ❑ Cycle hire
- ❑ Car club/car sharing membership
- ❑ Van
- ❑ Driving licence

Do you have a disability?

- ❑ Yes - visual impairment
- ❑ Yes - hearing impairment
- ❑ Yes - restricted mobility
- ❑ Yes - mental health
- ❑ Yes - other
- ❑ No

What is your email address?

Occasionally the project team may respond to a comment directly. If they respond to yours, would you like to be notified?

- ❑ Yes
- ❑ No

Would you like to receive news and updates about this project?

- ❑ Yes
- ❑ No

Would you like to be informed about future opportunities to have your say?

- ❑ Yes
- ❑ No

Your comment will be made public, including online at https://nwloptions.commonplace.is/.

Please don't mention any personal details. By commenting you agree to Commonplace's terms of use, which you can find at https://www.commonplace.is/terms.

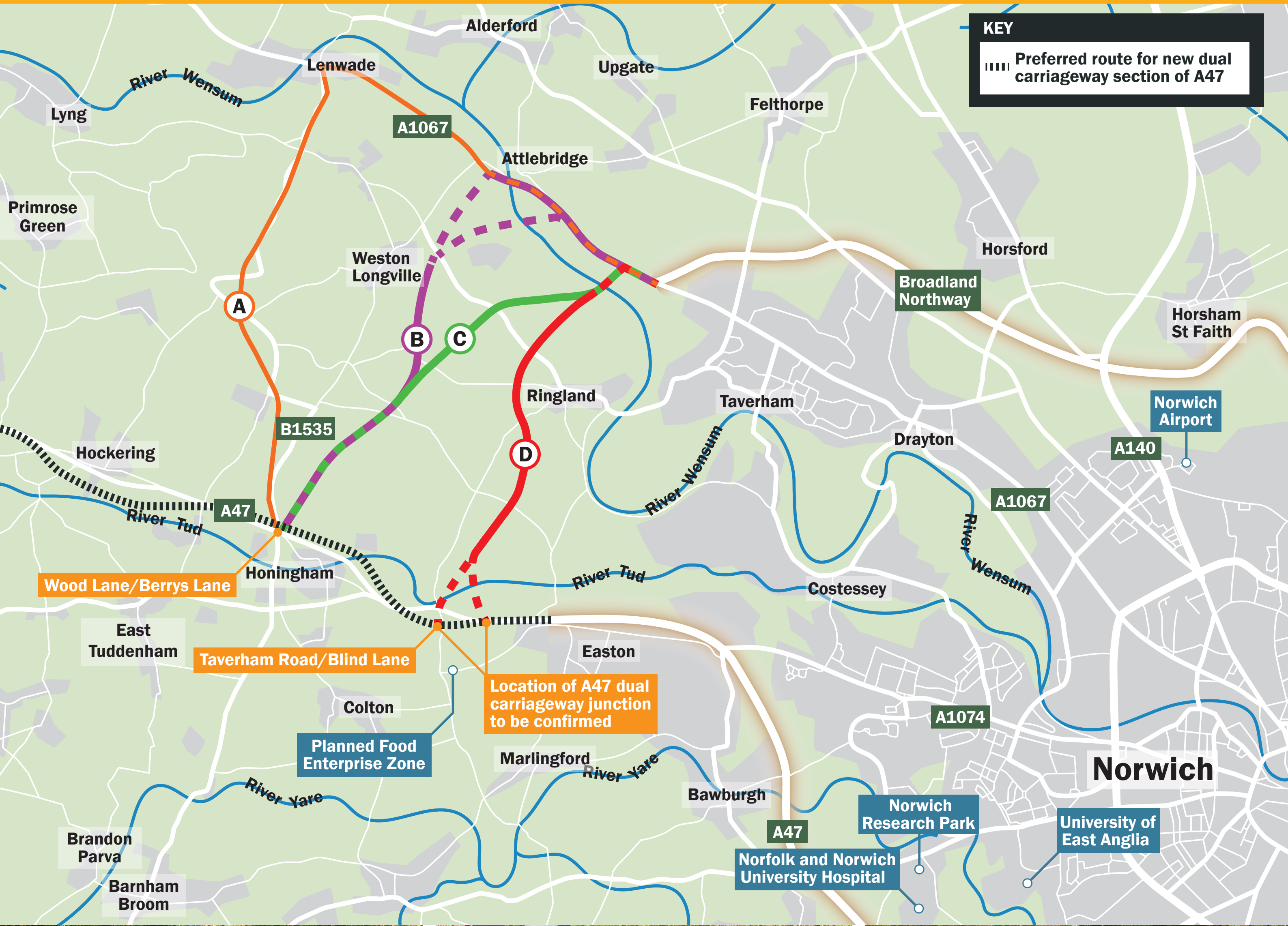
If you supply your email address you will be notified when your comment has been added. Your personal information will not be shown and will be stored securely.

A public engagement powered by **Commonplace**

Annex C – Copy of consultation brochure

Norwich Western Link

Options Consultation



26 November 2018 – 18 January 2019

www.norfolk.gov.uk/nwl

Norfolk County Council

IN TRAN communication for all

If you need this report in large print, audio, Braille, alternative format or in a different language please email norwichwesternlink@norfolk.gov.uk or telephone 0344 8008020 and we will do our best to help.

Contents

Why are we doing this consultation?

Creating a Norwich Western Link to connect the western end of Broadland Northway (formerly the Northern Distributor Road) to the A47 is one of Norfolk County Council's top infrastructure priorities.

We're aware that there are significant problems with traffic congestion, rat-running and slow journey times in the area to the west of Norwich, and these are only likely to get worse as the number of people living and working in the county increases.

In summer 2018, we carried out our first Norwich Western Link consultation. We received more than 1,700 responses to this consultation which showed there is very strong support for creating a link between Broadland Northway and the A47, with the majority of those responding suggesting a new road as their preferred solution.

Following months of work, we have now shortlisted four road options that we think could be effective as a Norwich Western Link. Between Monday 26 November 2018 and Friday 18 January 2019, we're asking for your views on them to help us identify a preferred option.

We want you to feel able to make an informed response to the consultation, so we have provided detailed information on each of the options. Please look through all the information provided here before giving us your views – you can do so online via **www.norfolk.gov.uk/nwl** or in person at one of our consultation events.

We're looking forward to hearing what you think and every response will be considered. Thanks in advance for taking the time to give us your opinions and insight.

Why do we need a Norwich Western Link?

Broadland Northway (formerly the Northern Distributor Road) fully opened to traffic in spring 2018 and has already shortened many people's journey times and changed the way they travel.

However, even before construction on Broadland Northway started, there were calls to fill in what many people saw as the 'missing link' between where the new dual carriageway road ends at the A1067 Fakenham Road and the A47. There were concerns that existing transport problems in communities and on roads to the west of Norwich were only going to increase.

In the last few years, we have made changes to some roads in this area following discussions with local people, including introducing traffic restrictions and traffic calming and improving some junctions. However, it's clear there is still a wider problem that needs to be tackled.

Why now?

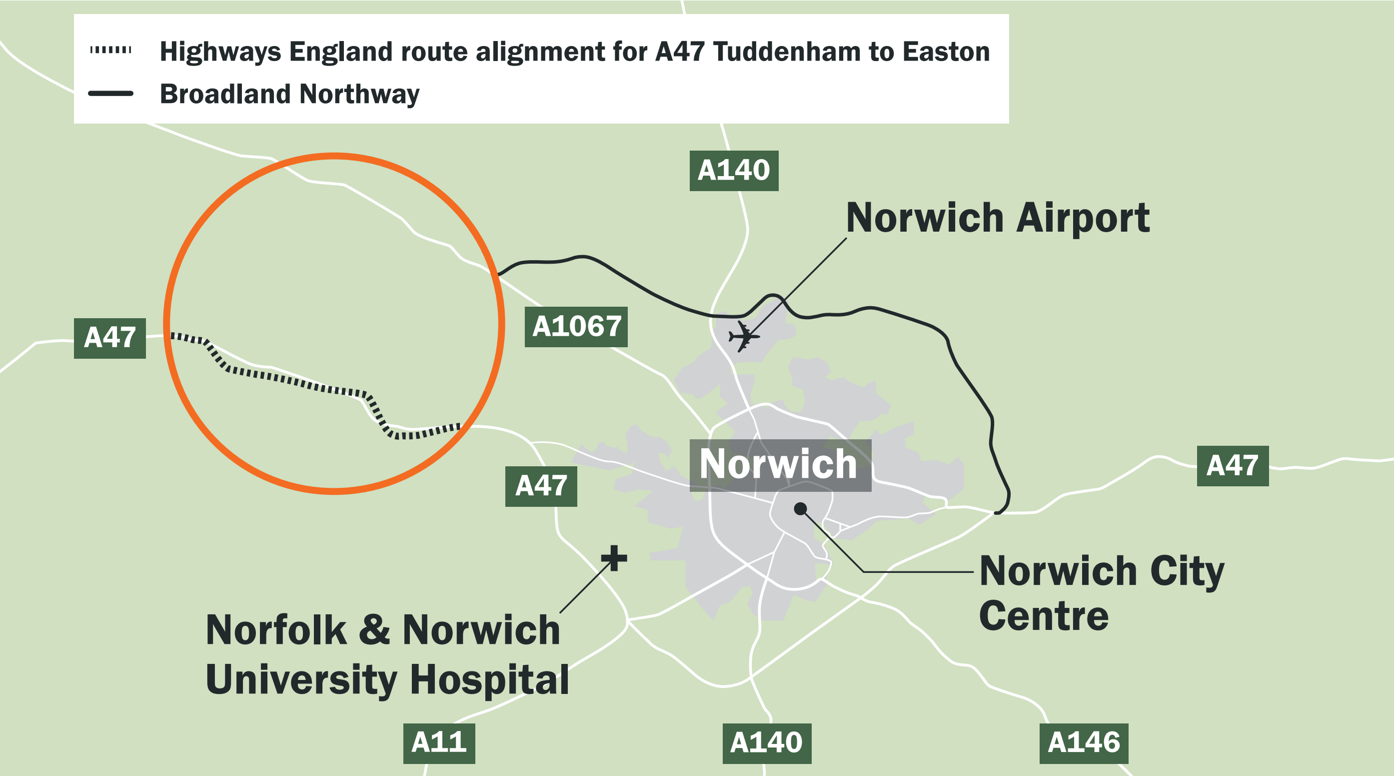
In summer 2018, we carried out traffic surveys on roads to the west of Norwich and compared these with similar surveys done in 2015. These surveys suggest the level of traffic is generally higher than was previously recorded in 2015.

Traffic modelling – which uses data to predict future traffic levels – also suggests pressure on these roads is likely to increase as more jobs and homes are created in and around Norwich.

Linking to the A47 west of Norwich was considered when Broadland Northway was originally proposed. At the time, the section between the A1067 Fakenham Road and A47 was omitted from the scheme due to the challenges posed by the potential need for this section of road to cross the River Wensum, which is a Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI).

We know we will need to be extremely mindful of these environmental and ecological sensitivities at every stage of our work to create a Norwich Western Link so that we minimise any adverse impacts and, wherever possible, enhance the environment in this area. We've done lots of work and research into this and we're confident this is possible.

With transport problems such as traffic congestion and rat-running increasing in this area, and set to increase further, there is a greater need to create a Norwich Western Link now than ever before.



What a Norwich Western Link should achieve

We want to find the best possible option for a Norwich Western Link and this means we want it to achieve a number of different things.

So we have developed objectives which will guide our work. These comprise strategic objectives, which will ensure the project is aligned with local and national policy on planning and transport, and local objectives, which have been created with the help of local residents.

Strategic Objectives

- Support sustainable growth
- Improve the quality of life for local communities
- Support economic growth
- Promote an improved environment
- Improve strategic connectivity with the national road network

Local Objectives

- Reduce congestion and delay, and improve journey time reliability, on routes in the area to the west of Norwich
- Improve network resilience and efficiency of the strategic and local transport network
- Reduce the number of heavy goods vehicles using minor roads
- Make the transport network safer for all users (including non-motorised users)
- Encourage a shift to more sustainable modes of transport, such as public transport, walking and cycling
- Provide traffic relief (and reduce noise and emissions) within residential areas
- Enable improved accessibility to existing and new housing and employment sites
- Improve emergency response times
- Improve access to green space
- Not affect the ecological integrity of the Wensum Valley Special Area of Conservation
- Contribute to the improved health and well-being of local residents
- Improve connectivity and access to Norwich International Airport, Norwich Research Park and Norfolk & Norwich University Hospital

We are working to the following timetable, some of which is subject to all the necessary statutory processes for a project of this kind being completed.

- **Summer 2018 Initial consultation**
- **Winter 2018/19 Options consultation**
- **Spring 2019 Preferred route announcement**
- **Autumn 2021 Planning process complete**
- **Late 2022 Start of construction**

How we shortlisted our four options

We started with an initial long list of 82 options which included:

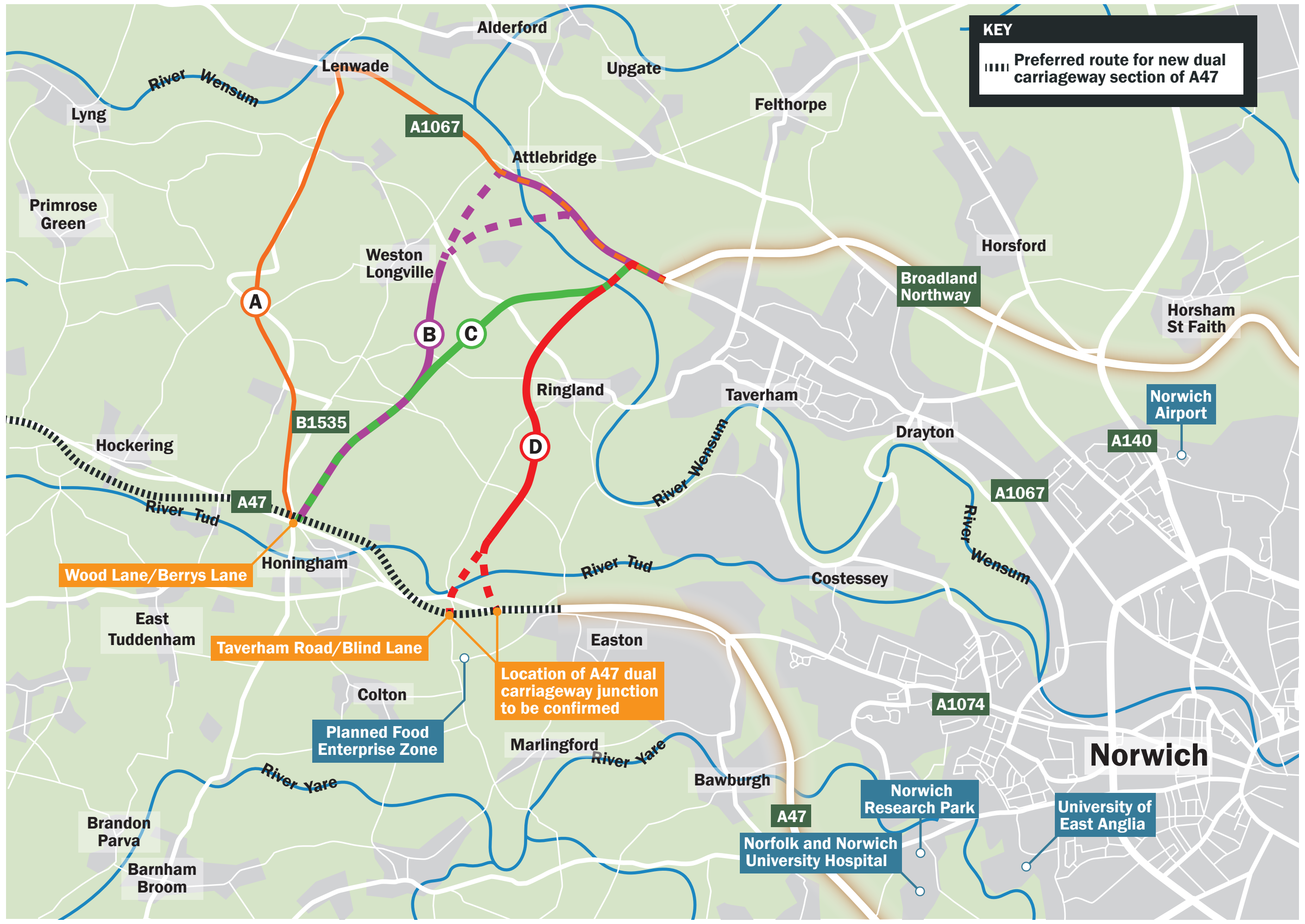
- New dual and single carriageway roads
- Improving existing roads
- Public transport
- Cycling and walking facilities
- Junction improvements
- HGV management
- The use of smart technology
- Tolling

We then used a Department for Transport approved 'sifting' method to refine these and eliminate those that were not effective options. This was based on a number of factors including how well they tackled the transport problems to the west of Norwich, deliverability and environmental impact.

Balancing all these factors, and reflecting on the outcome of the initial consultation in summer 2018, road options came out as the best solution for a Norwich Western Link.

However we are keen to make sure the Norwich Western Link encourages people to use other, more sustainable forms of transport such as walking, cycling and public transport. So when we come to select a preferred route we will consider if we need to put in any additional transport measures that could complement this route.

Our shortlisted options



We have shortlisted four road options and, through our consultation, we want your views on how effective you think they could be as a Norwich Western Link.

The shortlist contains three new dual carriageway roads and a single carriageway upgrade to the B1535. While the majority of the new or improved roads would be built at or near ground level, viaduct-style bridges over river flood plains are included in some of the options.

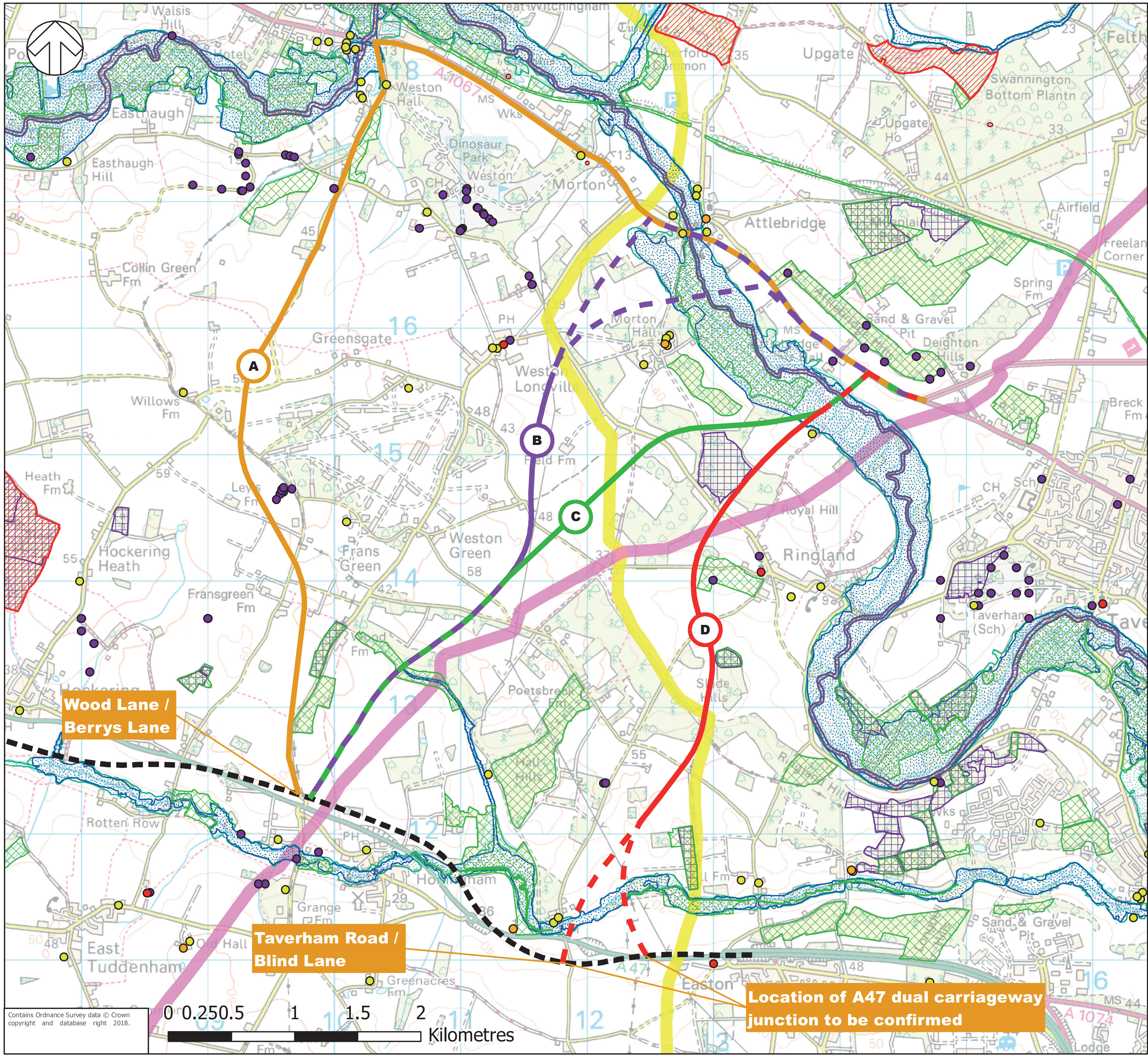
All of the routes also include improvements to the A1067 Fakenham Road.

As far as possible, we have sought to avoid sensitive environmental areas and physical constraints, such as homes, businesses and listed buildings.

The options also take account of Highways England's plans to dual the section of the A47 between North Tuddenham and Easton, which has a planned construction start date of 2021. Due to the complexity of joining any road to a dual carriageway, a Norwich Western Link would need to join the dualled A47 at one of its proposed junctions.

These routes are indicative at this stage and further detailed design work on a preferred option would be needed before an exact alignment can be confirmed. Feedback from this consultation will be used to inform this work.

Route options and physical and environmental constraints



Key

A47 Preferred Route Alignment

Constraints

- Listed Building, Grade I
- Listed Building, Grade II*
- Listed Building, Grade II
- Veteran Trees
- Special Area of Conservation
- Site of Special Scientific Interest
- County Wildlife Site
- Ancient Woodland
- Scheduled monument
- Roadside Nature Reserve
- Flood Zone 3
- Flood Zone 2
- National Grid Gas Pipeline
- Hornsea Project Three

Shortlisted Options

- Option A
- Option B
- Option B
- Option C
- Option D
- Option D

Option A

Route length 7.2 miles

Estimated cost £60m

Value for Money Low

10,000 vehicles per day predicted to use this route by 2040

What

Single carriageway upgrade of the B1535 and a section of the A1067, significantly realigning the current B road and smoothing it out to make it a higher standard route.

Where

Linking to the A47 at the Wood Lane junction north of Honingham and joining the A1067 via a new junction at Lenwade, making use of the existing bridge across the River Wensum at Attlebridge.

Environment

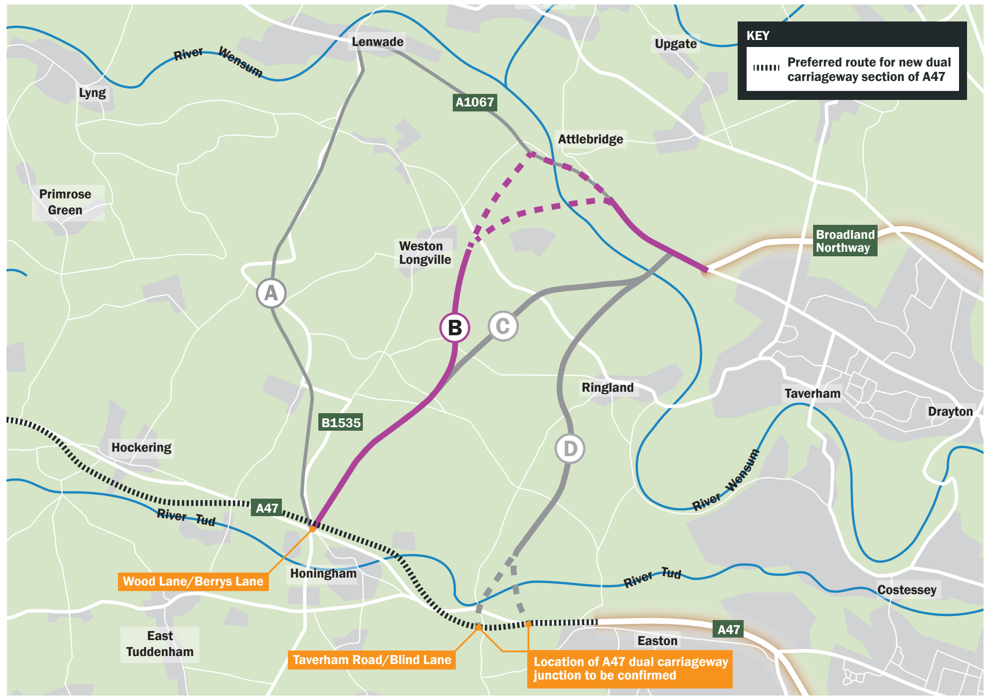
It would use the existing river crossing at Attlebridge and therefore does not require a new crossing of the River Wensum. This option does not cross the River Tud.

It is anticipated that this option would have low impact on the River Wensum Special Area of Conservation and Site of Special Scientific Interest. It would however mean that higher levels of traffic would use the Wensum crossing at Attlebridge and be close to the river at Lenwade. Careful consideration of the treatment of highway water run-off and the volumes of run-off during flood events would be required.

Near to Lenwade the route is likely to lead to loss of woodland in order to provide a connection with the A1067 and provide a higher standard of road along the existing B1535. This would require mitigation such as planting new trees to reduce the effects upon habitats and protected species.

The route would pass immediately adjacent to three County Wildlife Sites and passes within 500m of 15 listed buildings.

Option B



Route that uses the existing bridge: 5.1 miles
Route with new viaduct: 4.7 miles

Estimated cost using existing bridge: £129m
With new viaduct: £155m
Value for Money High

30,000 vehicles per day predicted to use this route by 2040

What

A new dual carriageway route and dual carriageway upgrade of a section of the A1067.

Where

The new route is to the east of Weston Longville and links to the A47 at Wood Lane. At the northern end of this route, two alternatives are given for how it could join the A1067:

- One via a new junction just west of Attlebridge which would be routed on the A1067 through the edge of the village and include widening the existing River Wensum bridge.
- The other would see a new 660 metre viaduct crossing of the River Wensum, joining the A1067 to the east of Attlebridge, avoiding the village.

Environment

The route through Attlebridge that would widen the River Wensum bridge could have impacts on the Special Area of Conservation and Site of Special Scientific Interest. This is due to the low clearance of this bridge to the watercourse and is subject to ongoing liaison with statutory environmental bodies. The alternative route to the south of Attlebridge would consist of a 660m viaduct crossing of the River Wensum flood plain with significantly higher clearance, which is not anticipated to affect the integrity of the River Wensum environmental designations. Careful consideration of the treatment of highway water run-off would also be required for both crossing options.

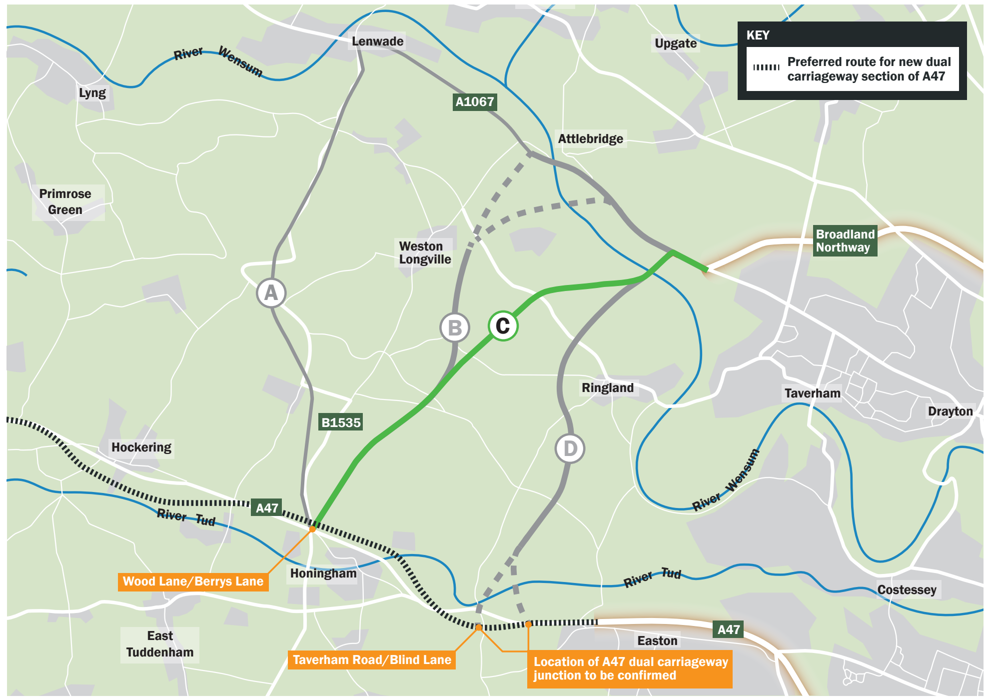
Works within the flood plain would require compensatory flood storage ponds. The management of water run-off during flood events will also need to be considered.

This option does not cross the River Tud.

The route would bisect a County Wildlife Site if it uses the Attlebridge river crossing, the other route bisects two County Wildlife Sites. The routes would also lead to loss of woodland at some undesignated sites. This would require mitigation such as planting new trees to reduce the effects upon habitats and protected species.

Both routes would pass within 500m of four listed buildings.

Option C



Route length **3.9 miles**

Estimated cost **£153m**

Value for Money **High**

32,000 vehicles per day predicted to use this route by **2040**

What

A new dual carriageway route and a short section of dual carriageway upgrade of the A1067.

Where

Linking to the A47 at Wood Lane, the new route would be located approximately halfway between Weston Longville and Ringland, crossing the River Wensum on a 720 metre-long viaduct. It would join the A1067 at a new junction. Around 400 metres of the A1067 would be dualled.

Environment

The route would require a new viaduct crossing of the River Wensum flood plain. The viaduct crossing would provide significant clearance above the river so as to not affect the integrity of the River Wensum Special Area of Conservation and Site of Special Scientific Interest. Careful consideration of the treatment of highway water run-off would also be required.

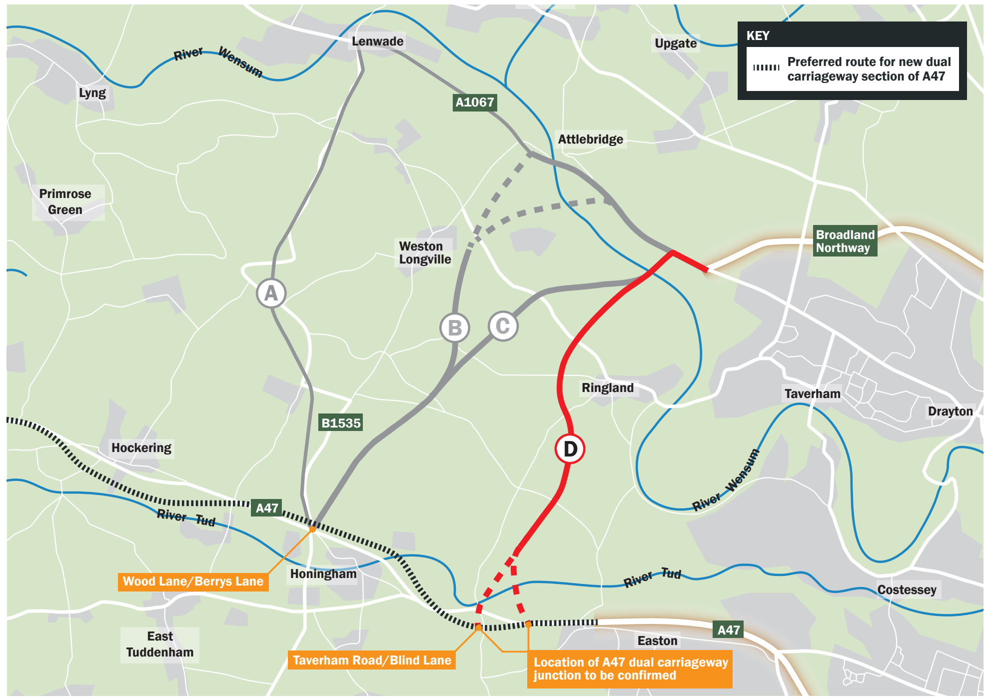
Works within the flood plain would require compensatory flood storage ponds. The management of water run-off during flood events will also need to be considered.

This option does not cross the River Tud.

This route would bisect one County Wildlife Site. The route would also lead to loss of woodland at some undesignated sites. This would require mitigation such as planting new trees to reduce the effects upon habitats and protected species.

This route passes within 500m of one listed building.

Option D



Route that connects to the A47 further to the West: **3.8 miles**
East: **3.7 miles**

Estimated cost **£161m**

Value for Money **High**

31,000 vehicles per day predicted to use this route by **2040**

What

A new dual carriageway route and a short section of dual carriageway upgrade of the A1067.

Where

This is the only option to link to the A47 further east and would cross the River Tud on a 120 metre viaduct. It would pass to the west of Ringland and then cross the River Wensum on a 660 metre-long viaduct. It would join the A1067 at a new junction and around 400 metres of the A1067 would be dualled.

Two alternatives are given for how it could join the A47, one at Taverham Road and one closer to Easton. This is because of Highways England's plans to dual the A47 between North Tuddenham and Easton, which include the removal of the existing A47 roundabout at Easton. There is little information currently available about the proposed junction at this location and, because of this, we have accounted for the possibility of the junction being located closer to the current Easton roundabout junction.

Environment

The route would require a new viaduct crossing of the River Wensum flood plain. The viaduct crossing would provide significant clearance above the river so as to not affect the integrity of the River Wensum Special Area of Conservation and Site of Special Scientific Interest. Careful consideration of the treatment of highway water run-off would also be required.

This option requires an additional viaduct across the flood plain of the River Tud and similar requirements to that of the Wensum may be expected.

Works within the flood plain would require compensatory flood storage ponds. The management of water run-off during flood events will also need to be considered.

The routes would lead to loss of woodland at some undesignated sites. This would require mitigation such as planting new trees to reduce the effects upon habitats and protected species.

This route passes within 500m of one listed building and a further two listed buildings if the more westerly connection to the A47 was followed.

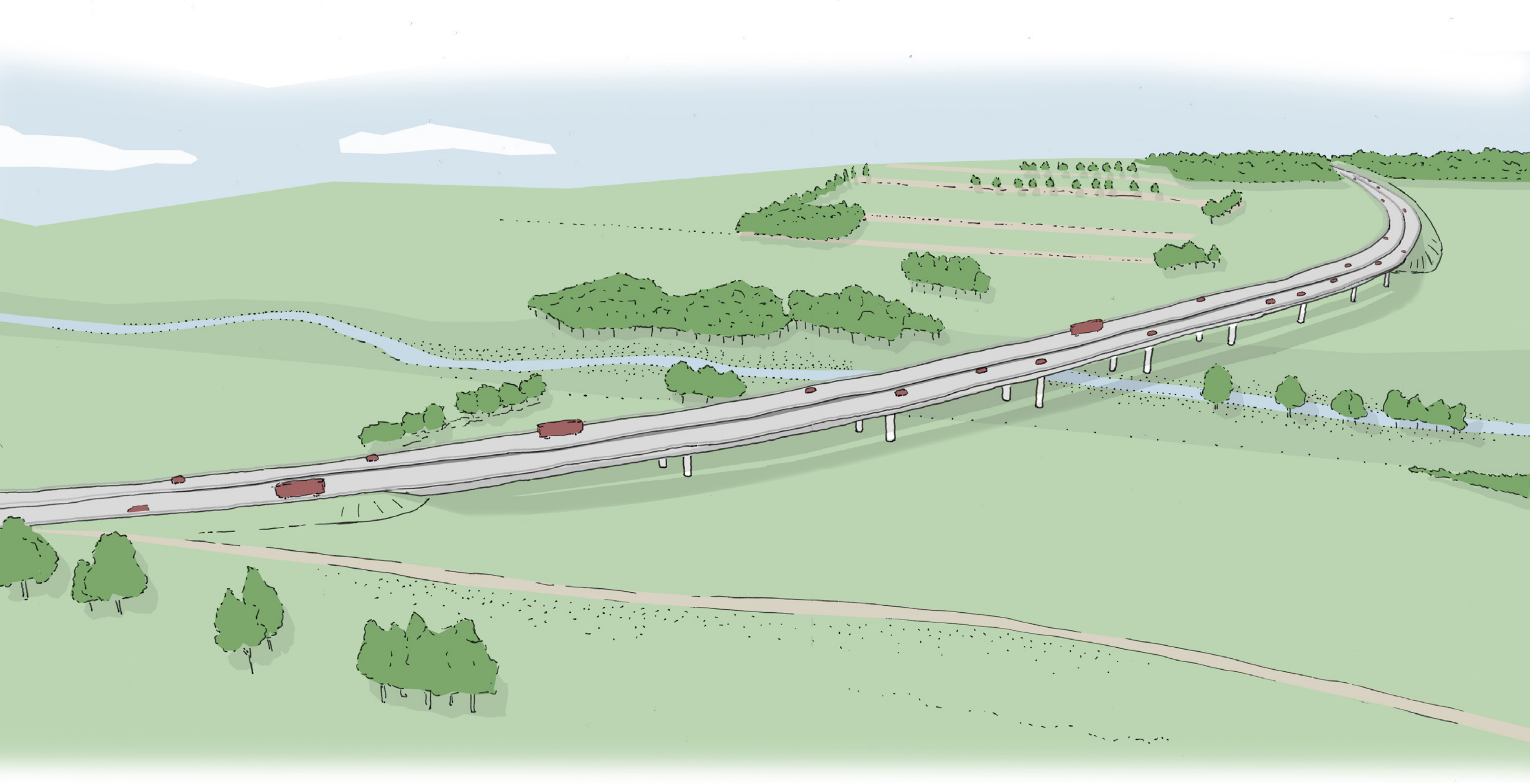
Crossing the rivers

For some options we are considering making use of or widening the existing bridge at Attlebridge. However, for any new crossings we are proposing viaduct-style bridges and this is largely for environmental reasons.

The height of the viaducts would be dictated by the extent of the floodplains on either side of the rivers. We need to minimise construction within these floodplains because this could have a knock-on effect on where and how the river floods.

Higher bridge crossings are more likely to protect the state of the rivers and their ecology. This is the case both during the construction phase, as supports would be built further from the river bed, and on an ongoing basis due to them creating significantly less shade on the river and causing less disruption to wildlife than a lower bridge.

The exact design of the bridge is yet to be confirmed – further detailed work on this will be done once we have identified a preferred route for the Norwich Western Link. The artist's impression below gives an indication of what a new viaduct over the River Wensum could look like.



Traffic modelling

To predict how traffic flows and movements are likely to change as a result of each of the four Norwich Western Link options, we have used traffic modelling software.

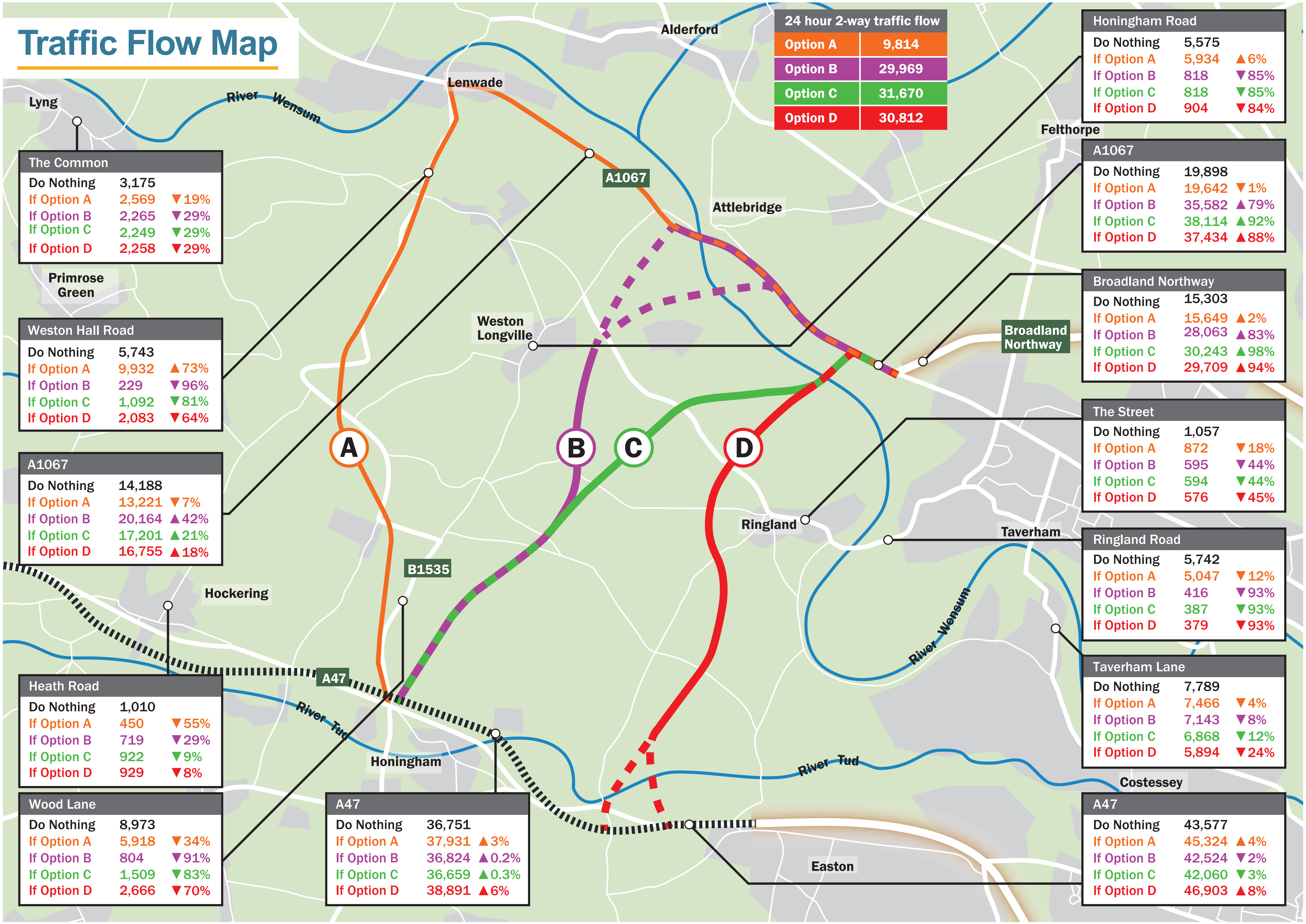
We've used the Norwich Area Transportation Strategy traffic model which includes Highways England's A47 improvement schemes. The model has been refined by adding more local data for use in relation to our work on the Norwich Western Link. This included using recent traffic surveys to better reflect traffic levels on minor roads in the area to the west of Norwich.

Our modelling, shown on the traffic flow map, predicts what daily traffic levels are likely to be on identified routes in 2040. The four potential Norwich Western Link route options have been modelled with the assumption that their junctions with the A47 are 'grade separated' (junctions which don't interrupt the dual carriageway, by using slip roads at a different level). The impact each of the routes is predicted to have on traffic levels is also compared with a 'Do Nothing' option for 2040, with no Norwich Western Link.

Journey time impacts

In order to give an indication of how the Norwich Western Link options would impact on journey times we have calculated travel times between key points on the A47, Broadland Northway and the A1067. Results for each of the Norwich Western Link options are compared with a 'Do Nothing option below.

Route	Time (minutes)				
	Do Nothing	Option A	Option B	Option C	Option D
Taverham Road/Blind Lane A47 junction to western end of Broadland Northway	11	11	6	6	5
Between Wood Lane/Berrys Lane junction to western end of Broadland Northway	12	10	5	5	7
Between Taverham Road/Blind Lane A47 junction to B1535 junction with A1067 at Lenwade	11	7	8	9	8
Between Wood Lane/Berrys Lane junction to B1535 junction with A1067 at Lenwade	9	5	9	9	9


Traffic Flow Map
24 hour 2-way traffic flow
Option A 9,814
Option B 29,969
Option C 31,670
Option D 30,812
Alderford
Lenwade
Lyng
River Wensum
A1067
Attlebridge
Felthorpe
Primrose Green
Weston Longville
Broadland Northway
A
B
C
D
Ringland
Taverham
B1535
Hockering
A47
River Tud
Honingham
River Wensum
River Tud
Costessey
Easton
The Common
Do Nothing 3,175
If Option A 2,569 ▼19%
If Option B 2,265 ▼29%
If Option C 2,249 ▼29%
If Option D 2,258 ▼29%
Weston Hall Road
Do Nothing 5,743
If Option A 9,932 ▲73%
If Option B 229 ▼96%
If Option C 1,092 ▼81%
If Option D 2,083 ▼64%
A1067
Do Nothing 14,188
If Option A 13,221 ▼7%
If Option B 20,164 ▲42%
If Option C 17,201 ▲21%
If Option D 16,755 ▲18%
Heath Road
Do Nothing 1,010
If Option A 450 ▼55%
If Option B 719 ▼29%
If Option C 922 ▼9%
If Option D 929 ▼8%
Wood Lane
Do Nothing 8,973
If Option A 5,918 ▼34%
If Option B 804 ▼91%
If Option C 1,509 ▼83%
If Option D 2,666 ▼70%
A47
Do Nothing 36,751
If Option A 37,931 ▲3%
If Option B 36,824 ▲0.2%
If Option C 36,659 ▲0.3%
If Option D 38,891 ▲6%
Honingham Road
Do Nothing 5,575
If Option A 5,934 ▲6%
If Option B 818 ▼85%
If Option C 818 ▼85%
If Option D 904 ▼84%
A1067
Do Nothing 19,898
If Option A 19,642 ▼1%
If Option B 35,582 ▲79%
If Option C 38,114 ▲92%
If Option D 37,434 ▲88%
Broadland Northway
Do Nothing 15,303
If Option A 15,649 ▲2%
If Option B 28,063 ▲83%
If Option C 30,243 ▲98%
If Option D 29,709 ▲94%
The Street
Do Nothing 1,057
If Option A 872 ▼18%
If Option B 595 ▼44%
If Option C 594 ▼44%
If Option D 576 ▼45%
Ringland Road
Do Nothing 5,742
If Option A 5,047 ▼12%
If Option B 416 ▼93%
If Option C 387 ▼93%
If Option D 379 ▼93%
Taverham Lane
Do Nothing 7,789
If Option A 7,466 ▼4%
If Option B 7,143 ▼8%
If Option C 6,868 ▼12%
If Option D 5,894 ▼24%
A47
Do Nothing 43,577
If Option A 45,324 ▲4%
If Option B 42,524 ▼2%
If Option C 42,060 ▼3%
If Option D 46,903 ▲8%

Environmental considerations

Rivers Wensum and Tud

The River Wensum is a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI), which means it is a protected site and internationally important for its wildlife. The River Tud also supports many species of wildlife.

Following discussions with Natural England and the Environment Agency, agreement was reached that a bridge crossing of the rivers could be possible, but this would be subject to more detailed design and mitigation proposals.

There is the potential for a Norwich Western Link to reduce the amount of silt that runs off the existing road network into the rivers due to HGVs and other vehicles overrunning and damaging verges. Drainage and management of this ‘run-off’ will be carefully considered in our detailed design work.

Ecology and habitats

Any potential loss of habitat caused by a Norwich Western Link would need to be assessed and mitigation measures put in place. Comprehensive ecological monitoring will be carried out to identify which protected species are present in the area.

Noise and air pollution

By re-routing traffic onto a higher quality road, the Norwich Western Link options would reduce traffic noise and emissions in some areas, including in areas where people live and work. Additional noise and pollution would be created along any of the Norwich Western Link options, all of which are routed through a mostly rural landscape. Noise mitigation measures, such as planting and embankments, would be factored into our design work.

Landscape and visual impact

The bridges would have to be built high enough to ensure they clear the floodplains and to minimise the impact on the environment. We expect the bridge over the River Wensum to provide around 12 metres (39 feet) clearance above the river. Because the bridges would be built in low-lying ground, we don’t expect them to dominate the wider landscape; we would look to integrate any new bridges within their surroundings through appropriate planting and landscaping.

Archaeology

It is likely that any of the Norwich Western Link options could pass through areas containing unrecorded archaeological remains. Before any construction work would begin, a full archaeological appraisal would be needed and there is a potential opportunity to enhance understanding of the archaeological history of the Wensum Valley.

Wider context

Across the county, there are plans to provide more housing and create more jobs to meet demand and match population growth and there is currently a separate local plan review underway to assess and confirm future targets for this.

There are also plans to create a Food Enterprise Zone to the west of Easton, which could provide around 2,000 jobs in the agri-food sector.

Highways England is intending to dual the A47 from North Tuddenham to Easton, with the aim of reducing congestion and improving safety on this stretch of road. Construction is due to start in 2021 and comprises a new dual carriageway to the south and north of the existing road. Highways England are also planning to make capacity improvements to the A11/A47 Thickthorn roundabout south of Norwich, with this work due to start in 2020.

Land and property owners

If you notice that any of the four presented options has a potential impact on your land or property at this stage, be assured that this does not necessarily mean that the preferred option will have an impact as the design develops. Once we have a preferred option there is still scope to make minor adjustments to the alignment as we go through the detailed design process. Detailed design will include further consideration of properties and land ownership and, where possible, the mitigation of any impacts of the chosen option.

Once the preferred route is announced in 2019 we will look to engage further with property and landowners who may be affected by the preferred route. If you have concerns about the impact on your property or land at this stage please contact us using details provided in the ‘Have your say’ section and we will be happy to discuss with you.

There are a number of statutory processes in place to protect your interests and we can advise you on these if appropriate.

Find out more

The consultation runs from Monday 26 November 2018 to midnight on Friday 18 January 2019.

We would encourage everyone to look through all the information available as part of the consultation before making their response. This information will be available to view via **www.norfolk.gov.uk/nwl** throughout the consultation period and at a series of consultation events where people will also be able to talk to staff involved in the project and respond to the consultation in person.

Consultation events

All consultation events will run between 2 and 8pm unless otherwise stated.

Ringland Village Hall	Wednesday 28 November
Drayton Village Hall	Monday 3 December
The Forum, Norwich	Tuesday 4 December (12 – 5pm)
Hockering Village Hall	Wednesday 5 December
Easton Village Hall	Monday 10 December
Taverham Village Hall	Tuesday 11 December (12 – 6pm)
Hall for All, Weston Longville	Wednesday 12 December
Salvation Army Church, Fakenham	Friday 14 December
Aylsham Town Hall	Tuesday 8 January
Diamond Jubilee Lodge, Hellesdon	Thursday 10 January
Great Witchingham Village Hall	Friday 11 January
The Costessey Centre	Monday 14 January
Dereham Memorial Hall	Tuesday 15 January
Honingham Village Hall	Wednesday 16 January

Have your say

We want people to tell us what they think of our shortlisted options to help us identify a preferred option for a Norwich Western Link – we expect to be able to announce this in spring 2019.

We also want to make sure we have considered everything we need to before deciding on a preferred route, so it's important to tell us any information you think is relevant at this stage through the consultation.

There are several ways you can respond to the consultation. You can:

- Complete the consultation questionnaire online via **www.norfolk.gov.uk/nwl**
- Respond in person at one of our consultation events (see above)
- Email us at **norwichwesternlink@norfolk.gov.uk**
- Writing to Norwich Western Link, Infrastructure Delivery Team, Norfolk County Council, County Hall, Floor 2, Martineau Lane, Norwich, NR1 2DH.

Norfolk County Council

Annex D - Quantitative analysis

Norwich Western Link Options

Consultation report (quantitative analysis) produced by Commonplace for Norfolk County Council

Version 1.3 | 20/02/2019

Norfolk County Council

Commonplace

Index

Introduction & observations

Introduction

The ‘Options’ stage of consultation on the Norwich Western Link (NWL) opened on 26th November 2018 and ran until 18th January 2019. It sought people’s views on four shortlisted options for a new or improved link road to connect the A47 trunk road to the western end of Broadland Northway (the A1270).

The consultation followed an initial consultation in summer 2018, which used Commonplace to identify transport issues in the area to the west of Norwich and what, if anything, people thought should be done to tackle them.

The key concerns that came out of this first consultation formed part of the ‘Options’ consultation, as people were asked how well each of the NWL route options addressed the issues raised by the public.

Engagement

Engagement rates have been high in both Commonplace phases. In all the website content was viewed by 3475 people, of whom 1825 responded.

Traffic to Commonplace was strong throughout the NWL Options engagement period, which reflects the successful publicity, dissemination and engagement work of the Norfolk County Council team.

Conclusions

There was strong agreement among respondents that there is a need for a Norwich Western Link Road. Option D was the most popular solution, with Option C the second most popular and Option A the least popular.

Methodology

The analysis in this report includes all comments and agreements that were made on the NWL Options website. At consultation events, paper forms were provided and comments were inputted by staff via ‘survey mode’ - the questions with these methods mirrored the online form exactly.

Pages 5-7 describe the types of contribution a respondent can make, and the various categories of user based on whether or not they provided and verified an email address or contributed at a consultation event - the proportion of each of these categories making up the total respondent base is then shown.

The NWL Options website closed at midnight on 18th January 2019 - the final dataset was extracted on 25th January to allow for any final paper surveys to be inputted and comment verifications to take place.

This analysis only takes account of the quantitative data gathered through consultation responses to the NWL options website. Any information inputted into the ‘free text’ boxes on the website and consultation responses submitted by letter or email are being analysed separately and will be accounted for through a separate report.

Definitions of terms

There are two main ways someone can contribute to a consultation on Commonplace:

The first is to add a **comment**, which can contain a combination of free text and multiple choice answers. Because people are able to pick and choose which pages they comment on, comments are counted individually rather than cumulatively - i.e. a person commenting on Option A, Option C and the options comparison has made three separate comments.

The second is to add an **agreement** - respondents can add one agreement to any comment other than their own.

Unless a person is already logged in, they are asked to provide an email address.

If the person chooses not to provide their email address, they are treated as **anonymous** and their comments are collected in the database but not displayed publicly.

People who provide their email address are sent an email with a verification link. Until they click this link, they are treated as **pending** and their comments are collected in the database but not displayed publicly. If the link is not clicked within three days, a reminder email is sent out.

Once they click the link, a person becomes **confirmed** and all their comments become publicly visible.

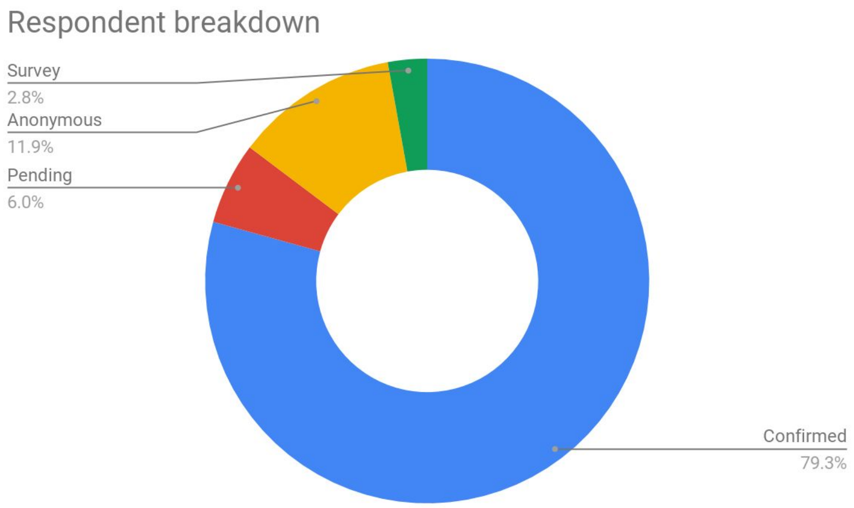
People interviewed by a team member at an event have their comments displayed publicly automatically, and their comments are marked as **survey** comments.

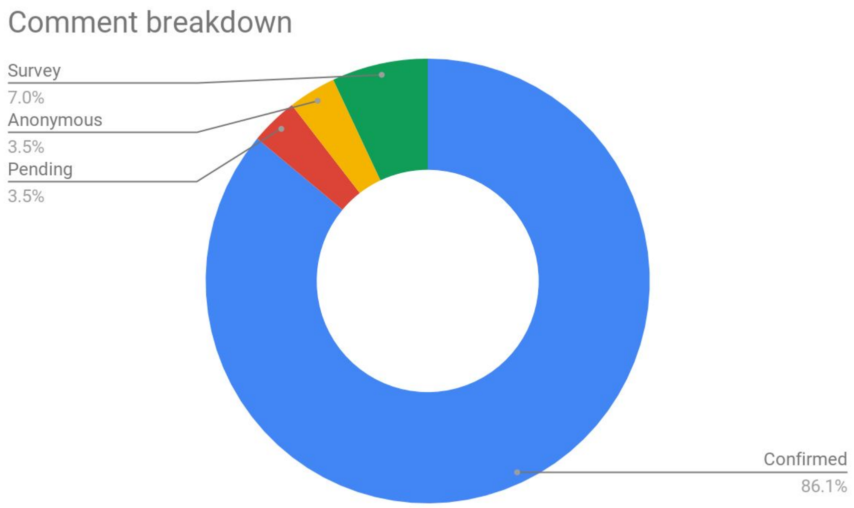
Headline figures

Categories	Total	Confirmed	Pending	Anonymous	Survey
Unique visitors	4506				
Read the website content	3475				
Respondents	1825	1447 (79%)	109 (6%)	217 (12%)	52 (3%)
Comments	4047	3483 (86%)	140 (3.5%)	141 (3.5%)	283 (7%)
Agreements	8211	8083 (98%)	10 (0%)	118 (2%)	
Subscribed to news	915				

Figures correct as of 25/01/19

Verification status of respondents and comments





Referrals

Referrals track the sources people were linked to the NWL Options website from. The table below shows the top referral sources. Please note that this does not account for all visitors - for example, people who typed the web address into their browser manually are not shown here.

Source	Visitors
norfolk.gov.uk	2,439
Facebook	629
Email	190
Twitter	45

Source	Visitors
Google	27
commonplace.is	15
nwl.commonplace.is	5
norfolkchamber.co.uk	5

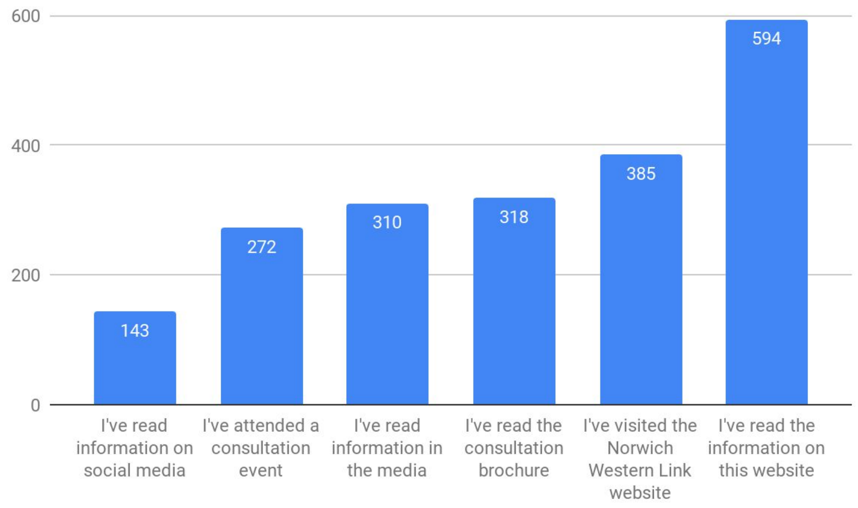
Respondent analysis

What information had people seen about the scheme?

The options comparison section of the website included a question asking people which of the following statements best describes the information they had seen about the scheme:

- I've read the information on this website
- I've read information on social media
- I've read the consultation brochure
- I've visited the Norwich Western Link website
- I've read information in the media
- I've attended a consultation event

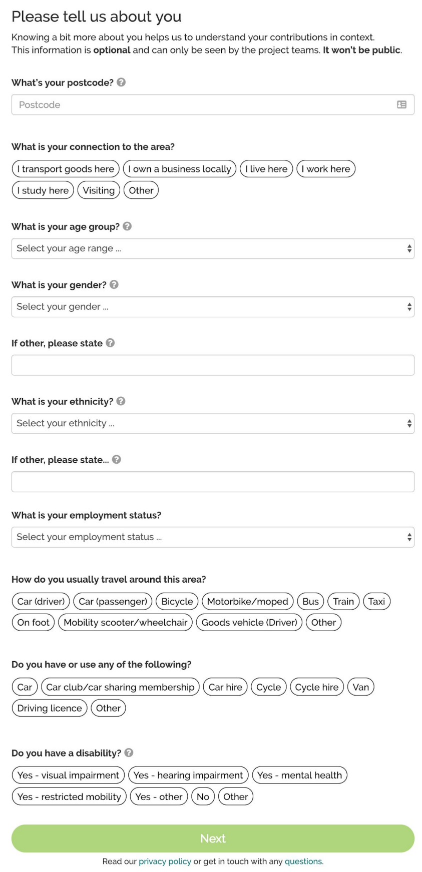
The results are shown on the right - please note that this question was optional (a response to this question was given in 83% of the comments made on this page) and that multiple answers could be selected.



Demographic analysis

Respondents were asked to provide the following information about themselves. All fields were optional, and the fields marked with an asterisk below allowed respondents to select multiple answers.

- Postcode
- Connection to the area *
- Age group
- Gender
- Ethnicity
- Employment status
- Usual transport mode *
- Do you have or use any of the following? *
- Disability *



Please tell us about you

Knowing a bit more about you helps us to understand your contributions in context.
This information is **optional** and can only be seen by the project teams. **It won't be public**.

What's your postcode?

Postcode

What is your connection to the area?

I transport goods here | I own a business locally | I live here | I work here | I study here | Visiting | Other

What is your age group?

Select your age range ...

What is your gender?

Select your gender ...

If other, please state

What is your ethnicity?

Select your ethnicity ...

If other, please state...

What is your employment status?

Select your employment status ...

How do you usually travel around this area?

Car (driver) | Car (passenger) | Bicycle | Motorbike/moped | Bus | Train | Taxi | On foot | Mobility scooter/wheelchair | Goods vehicle (Driver) | Other

Do you have or use any of the following?

Car | Car club/car sharing membership | Car hire | Cycle | Cycle hire | Van | Driving licence | Other

Do you have a disability?

Yes - visual impairment | Yes - hearing impairment | Yes - mental health | Yes - restricted mobility | Yes - other | No | Other

Next

Read our privacy policy or get in touch with any questions.

Postcode analysis

The postcode question was optional - 1301 (81%) respondents chose to provide their postcode.

The full counts of respondents per postcode can be found on the following page. The top ten postcodes are shown opposite, as well as highlighted in bold on the table.

There were 52 postcodes provided without an NR (Norwich) prefix. 39 of these had either an IP (Ipswich) or PE (Peterborough) prefix - the remaining 13 had only 1-2 instances each.

Top ten responding postcodes:

- NR8 (316 respondents)
- NR9 (196 respondents)
- NR10 (91 respondents)
- NR6 (75 respondents)
- NR20 (71 respondents)
- NR11 (56 respondents)
- NR5 (54 respondents)
- NR2 (44 respondents)
- NR7 (42 respondents)
- NR1 (41 respondents)

Postcode table

Postcode	Respondents
NR1	41
NR2	44
NR3	24
NR4	27
NR5	54
NR6	75
NR7	42
NR8	316
NR9	196
NR10	91

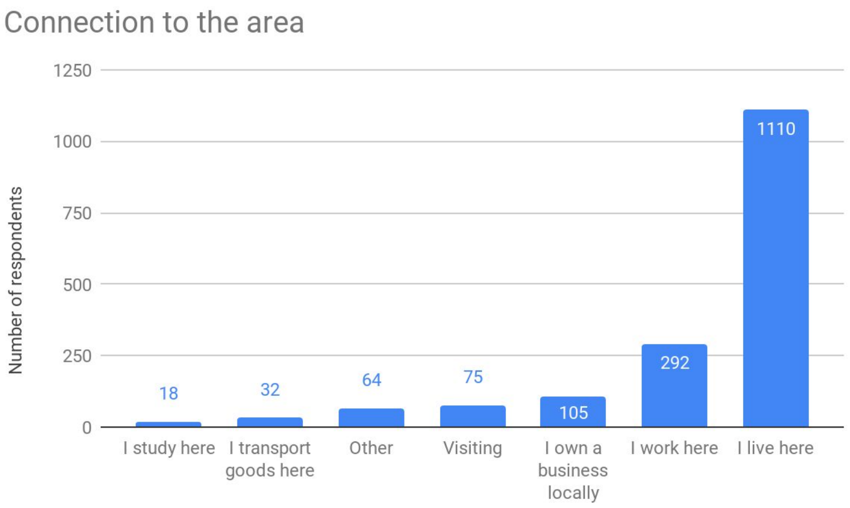
Postcode	Respondents
NR11	56
NR12	19
NR13	23
NR14	27
NR15	13
NR16	8
NR17	5
NR18	28
NR19	23
NR20	71

Postcode	Respondents
NR21	15
NR22	0
NR23	0
NR24	8
NR25	9
NR26	3
NR27	5
NR28	13
NR29	6
NR30	2

Postcode	Respondents
NR31	1
NR32	2
NR33	0
NR34	0
NR35	2
IP	25
PE	14
Other	13

Connection to the area

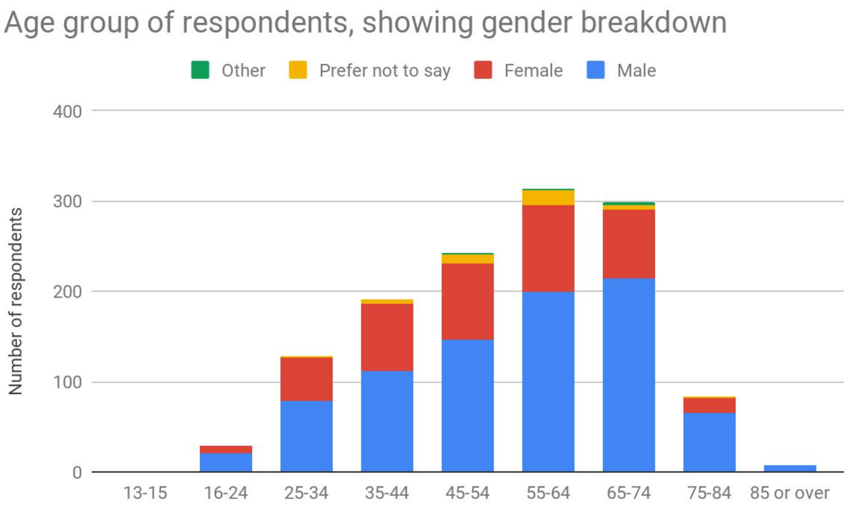
The vast majority of respondents live in the area, with a relatively small proportion working in the area - people may have had differing interpretations of what location 'the area' refers to. Respondents were able to select multiple answers for this question.



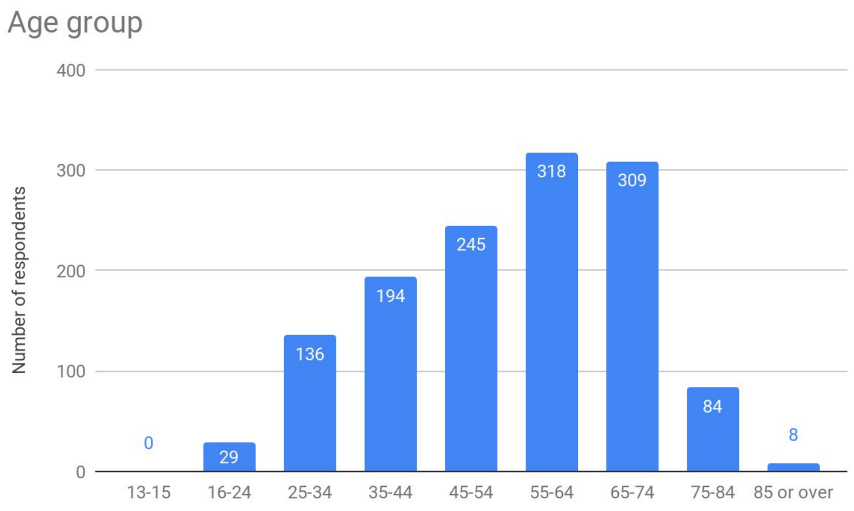
Age and gender

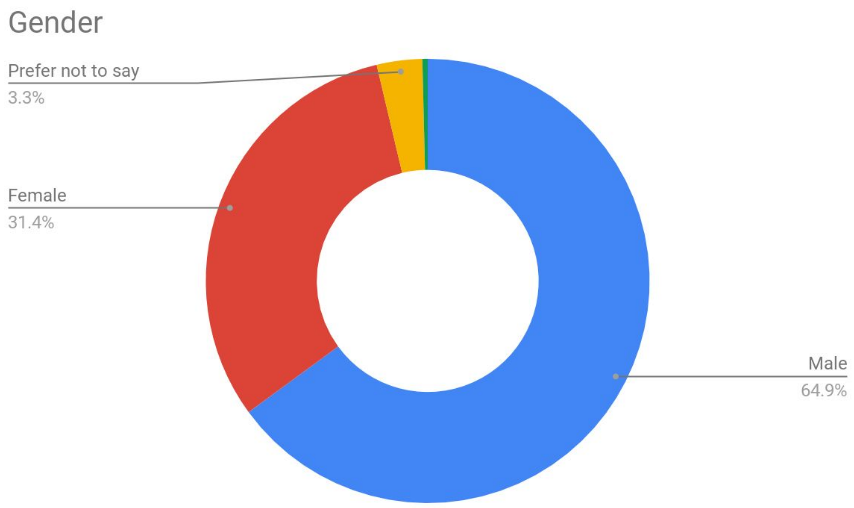
The chart adjacent shows the gender breakdown for each age group of respondents. On the following page you can see separate charts for age and gender.

Most respondents were of working age (25-64) and slightly older (65-74). There was a relatively low proportion of younger people responding. Significantly more men than women responded in all age groups.



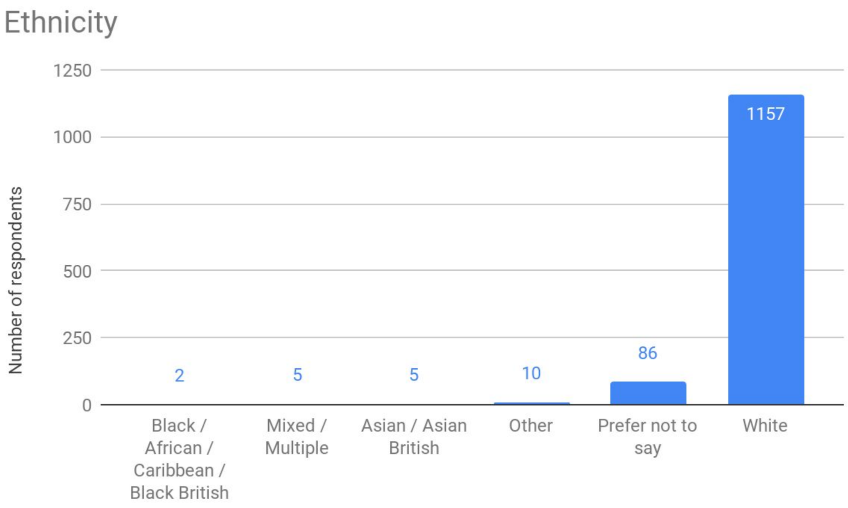
Age and gender (continued)





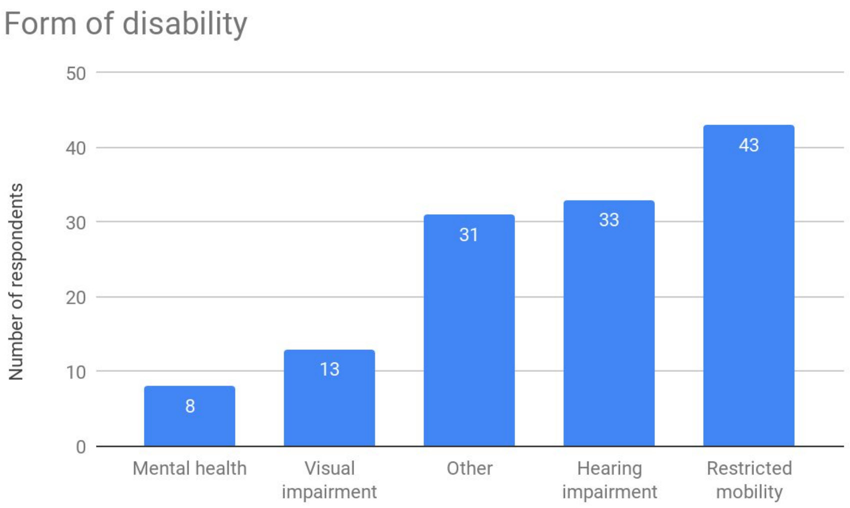
Ethnicity

Respondents were asked to choose their ethnicity from a predefined list of options. Only one category could be selected and the question was optional. 91.5% of respondents who provided their ethnicity were white. In the 2011 census, the ethnic composition of Norwich was 90.8% white (source).



Disability

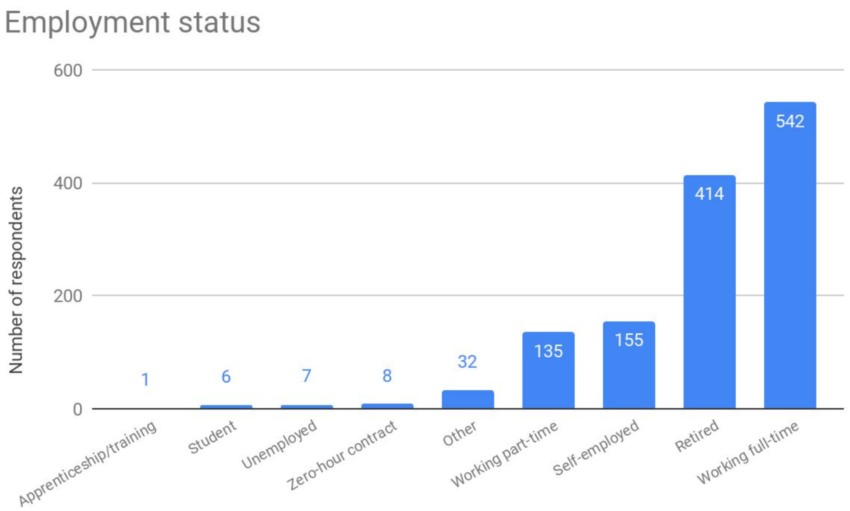
Respondents were asked if they have disability, with several answers available (multiple answers could be chosen and the question was optional). 10% of respondents who answered the question selected that they had a disability - the breakdown of the options they chose are shown opposite.



Employment status

Respondents were only able to select a single answer for this question. The responses correlate with the age profile of the respondents.

The small number of students may indicate that this group, although significant in Norwich (the University of East Anglia alone has over 14,000 students), does not experience regional transport issues to the same extent as those in work or with more extensive local connections.

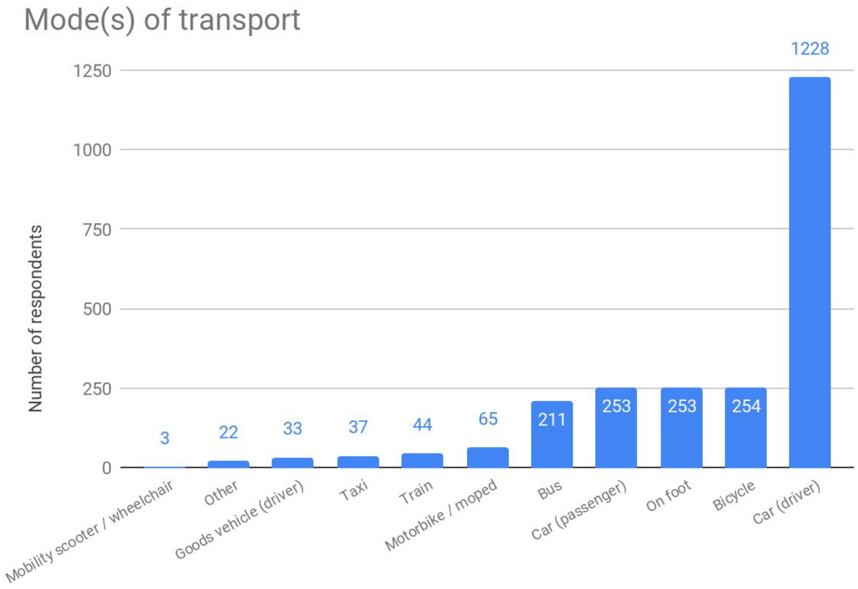


Travel and transport

Respondents were asked 'How do you usually travel around this area?'.

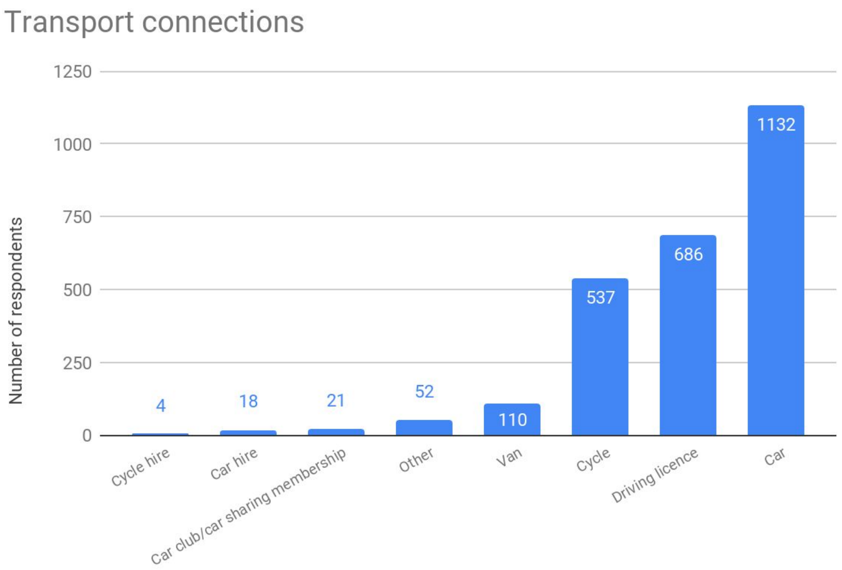
A large majority of respondents stated that they were car drivers - though as it was possible to select multiple options for this question, that does not preclude them from also using other modes.

Bus use, car use (as a passenger), walking and cycling were all fairly close, with other modes of transport much lower.



Travel and transport (continued)

Respondents were asked ‘Do you have or use any of the following?’, referring to the options shown in the chart opposite. The purpose of the question was to understand what personal transport options were available and to monitor the proportion of non-drivers engaged. Multiple answers could be selected.



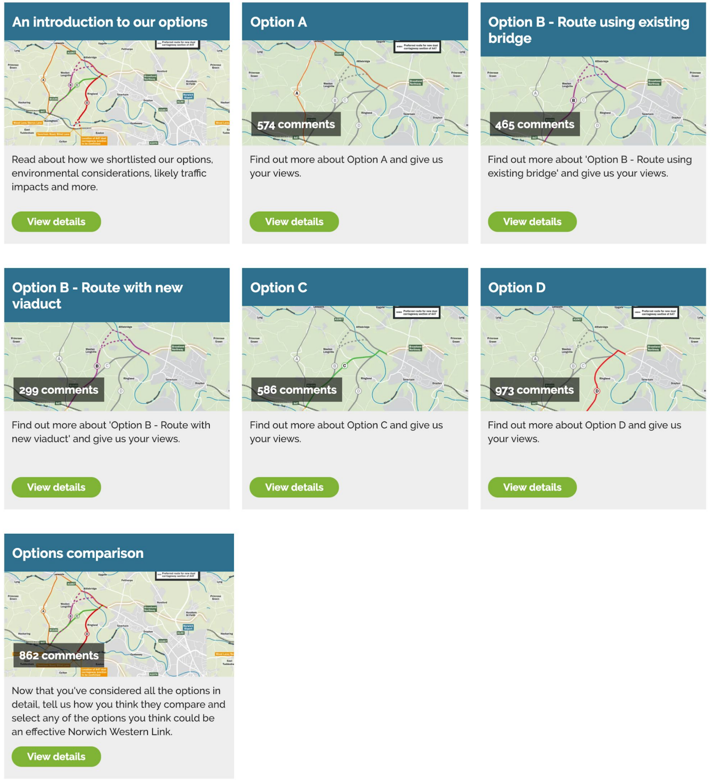
Contribution analysis

Options analysis methodology

Respondents were asked to provide feedback on each of the four options (including two sub-options for Option B), and then to select which options they would support for a Norwich Western Link on the 'options comparison' page.

On the Commonplace platform, respondents are able to pick and choose which pages they would like to comment on - there is no requirement that they comment on all sections, and they are permitted to make multiple comments on a single section. More information on respondents who commented more than once on each section can be found on page 46.

For these reasons, some pages received more comments than others - the chart on the following page displays how many comments each page received. Please note that as the live website only displays confirmed comments, numbers in this report may differ to what is shown online.



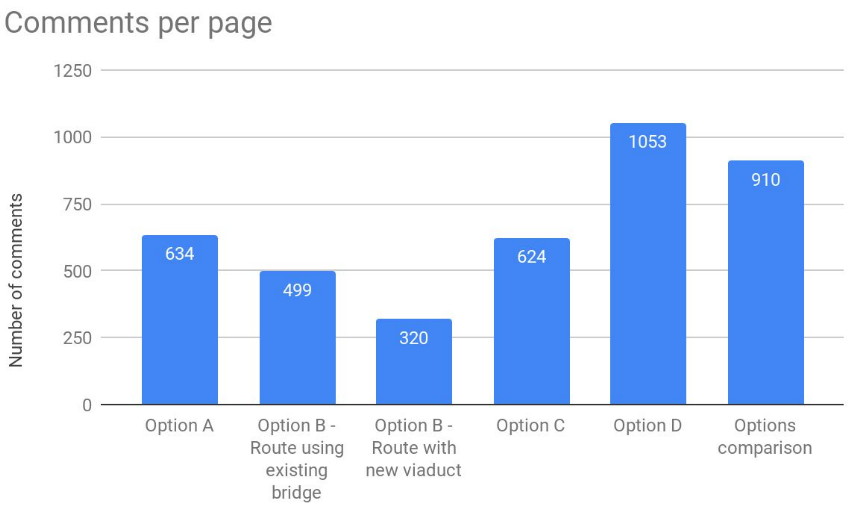
Options analysis methodology (continued)

The results of questions about the individual options can be found on pages 27-36. Pages 37 and 38 then compare this data. Due to the difference in the number of comments on each option, the data is shown in two forms - the raw figures, and '100% stacked', with each bar displayed at the same length so that people's views on the options can be compared proportionally.

Pages 39-44 analyse comments taken specifically from the options comparison page.

The comment form also included several free text fields, asking people to explain their answers, as well as any other commentary they would like to provide. Analysis on these and consultation responses received via letter and email are being undertaken and reported on separately to this report.

Towards the end of the engagement period (on 15th January) respondents who had not commented on the options comparison page were sent a reminder email.



Options analysis methodology (continued)

For each option, respondents were asked how effective they thought the option would be as a Norwich Western Link, as well as to highlight which of the top ten transport issues raised in the previous phase of consultation they thought the option would help to tackle:

- Boosting the local economy
- Improving emergency response times
- Better access to Norfolk & Norwich Hospital
- Better journey reliability
- Shortening journey times
- Road safety
- Reducing emissions from queuing vehicles
- Reducing congestion
- Reducing rat-running
- Protecting the environment

The results of this question for each option can be compared side by side on page 38.

Explanation of the sliding scale

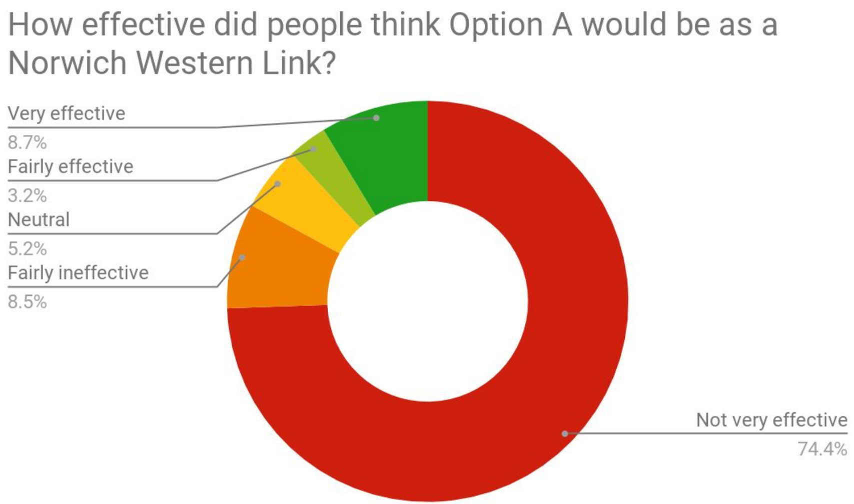
The comment form on each page contained a question in the 'sliding scale' format. This scale outputs a value between 0 and 100. On the individual option pages, the two ends of the sliding scale were labelled 'Not very effective' (0) and 'Very effective' (100), and on the options comparison page the two ends were labelled 'Disagree' (0) and 'Agree' (100).

Data here has been presented in five segments of 20% each, to show opinions between the two extremes. For ease of understanding, the intermediate sections have been labelled 'fairly ineffective', 'neutral' and 'fairly effective' for the individual options, and 'mostly disagree', 'neutral' and 'mostly agree' for the options comparison.

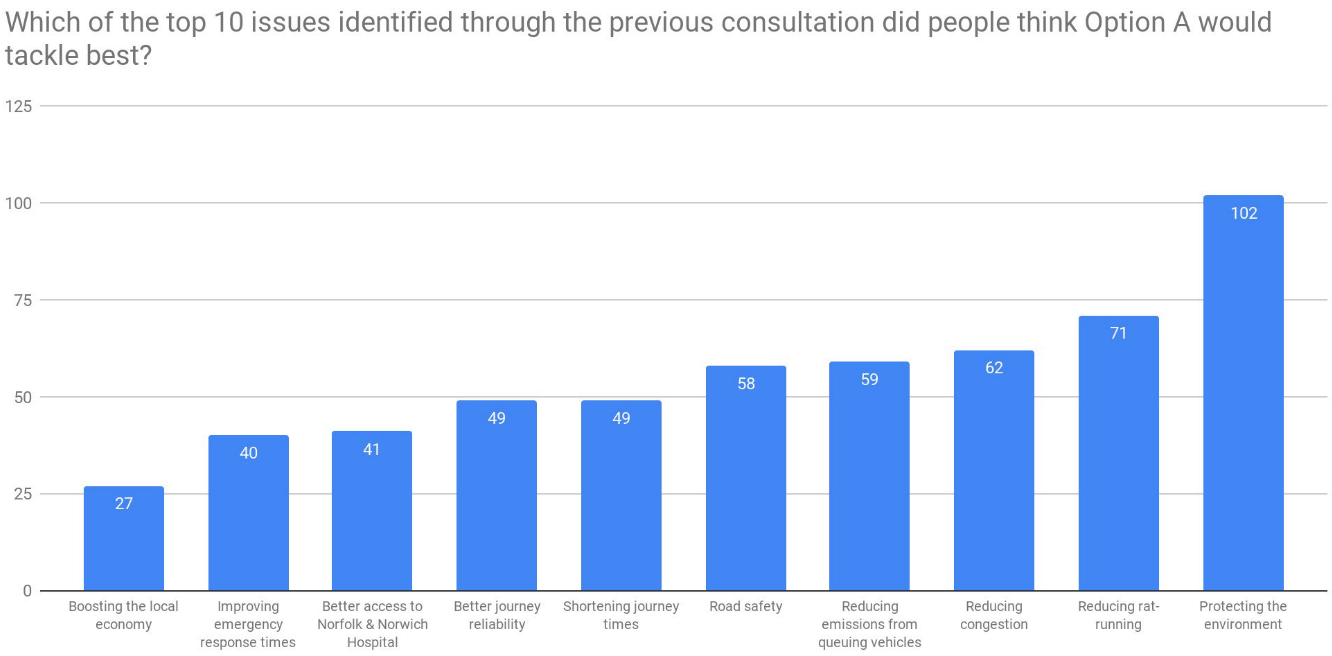
Please note that while the sliding scale's default position is neutral (50), the scale must be moved in order for the question to be saved - so neutral responses are truly neutral, and not the result of this question having been skipped by the respondent.

Option A

Respondents were asked 'Based on all the information provided, how effective do you think this option would be as a Norwich Western Link?'. The question was mandatory.

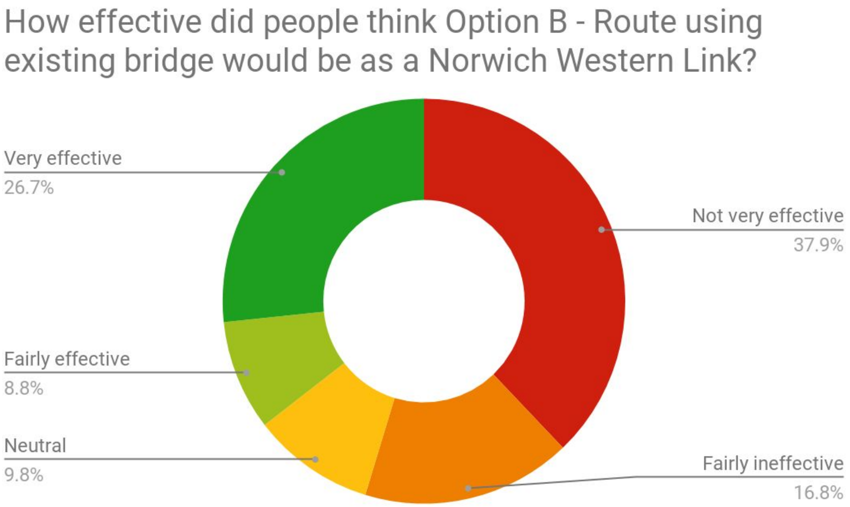


Option A (continued)

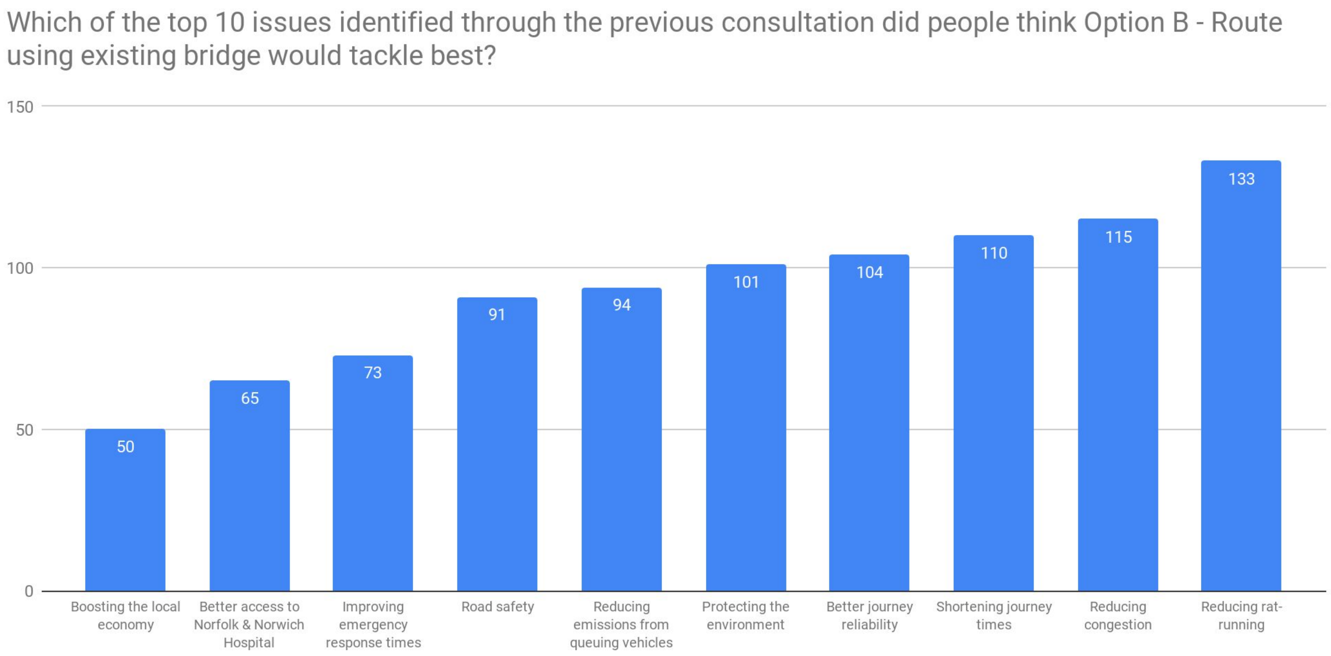


Option B - Route using existing bridge

Respondents were asked 'Based on all the information provided, how effective do you think this option would be as a Norwich Western Link?'. The question was mandatory.

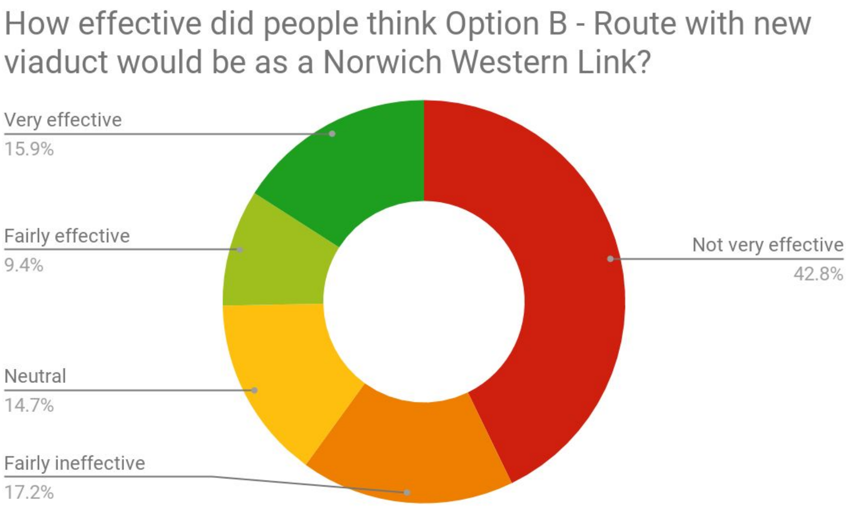


Option B - Route using existing bridge (continued)

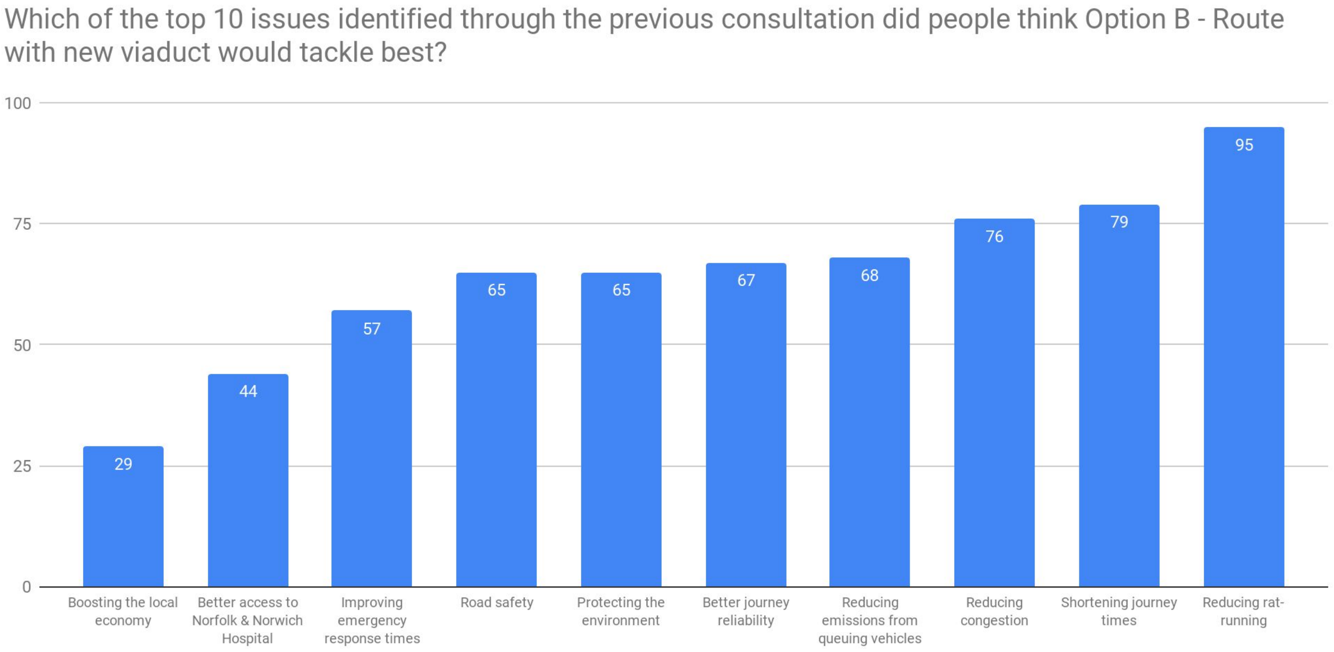


Option B - Route with new viaduct

Respondents were asked 'Based on all the information provided, how effective do you think this option would be as a Norwich Western Link?'. The question was mandatory.

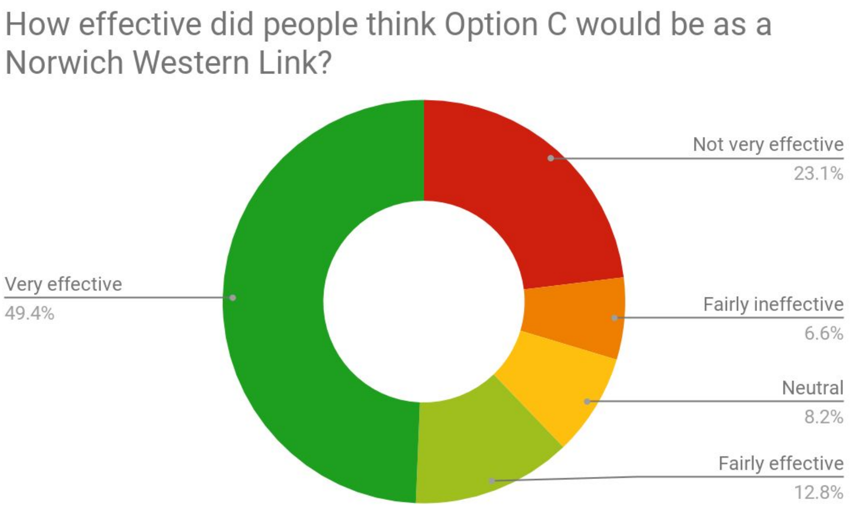


Option B - Route with new viaduct (continued)

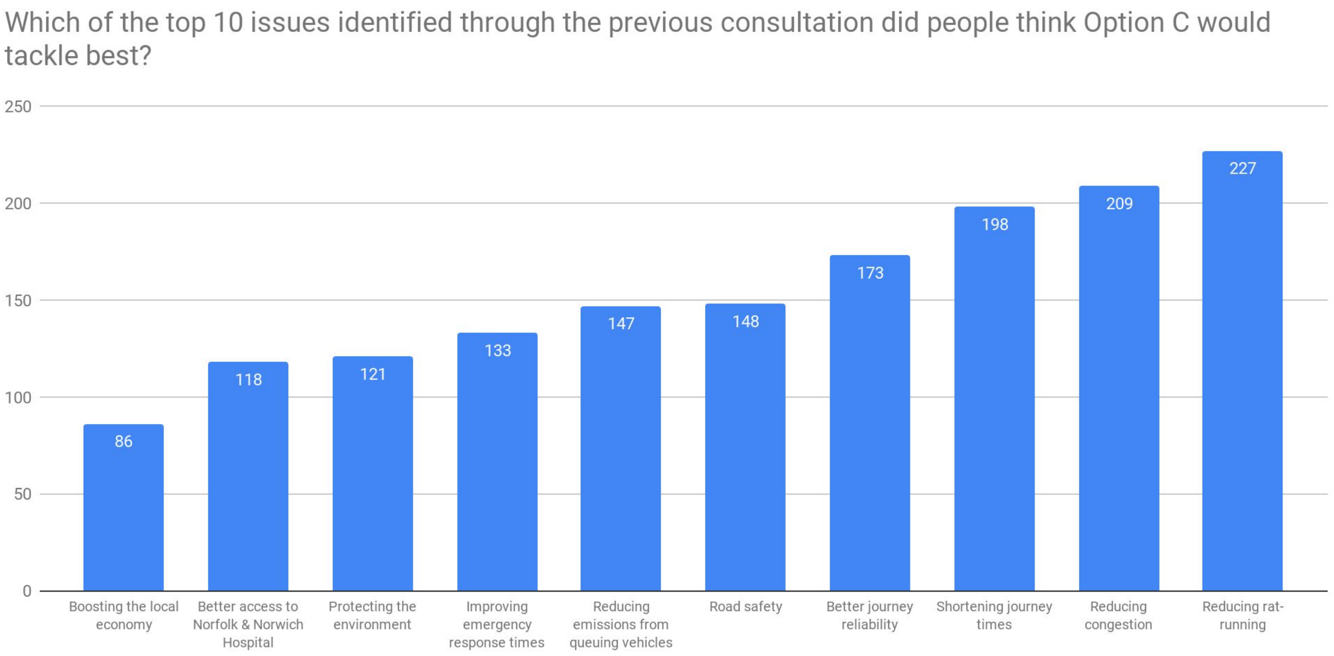


Option C

Respondents were asked 'Based on all the information provided, how effective do you think this option would be as a Norwich Western Link?'. The question was mandatory.

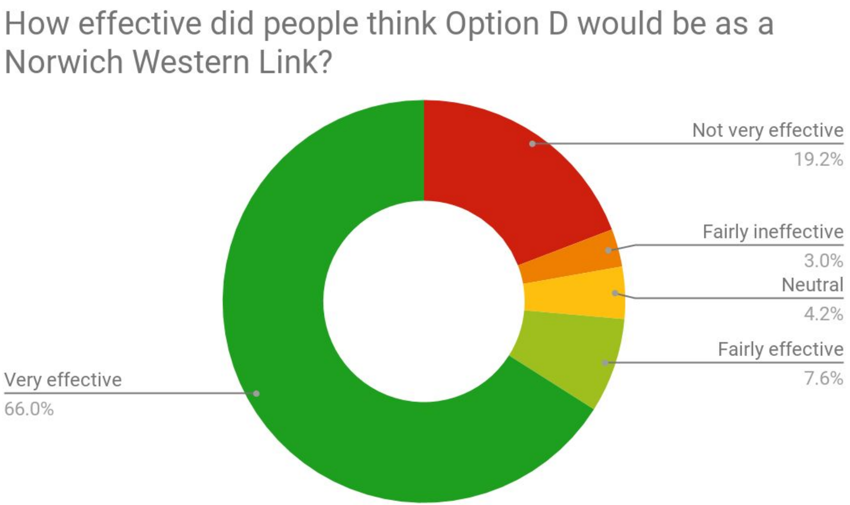


Option C (continued)



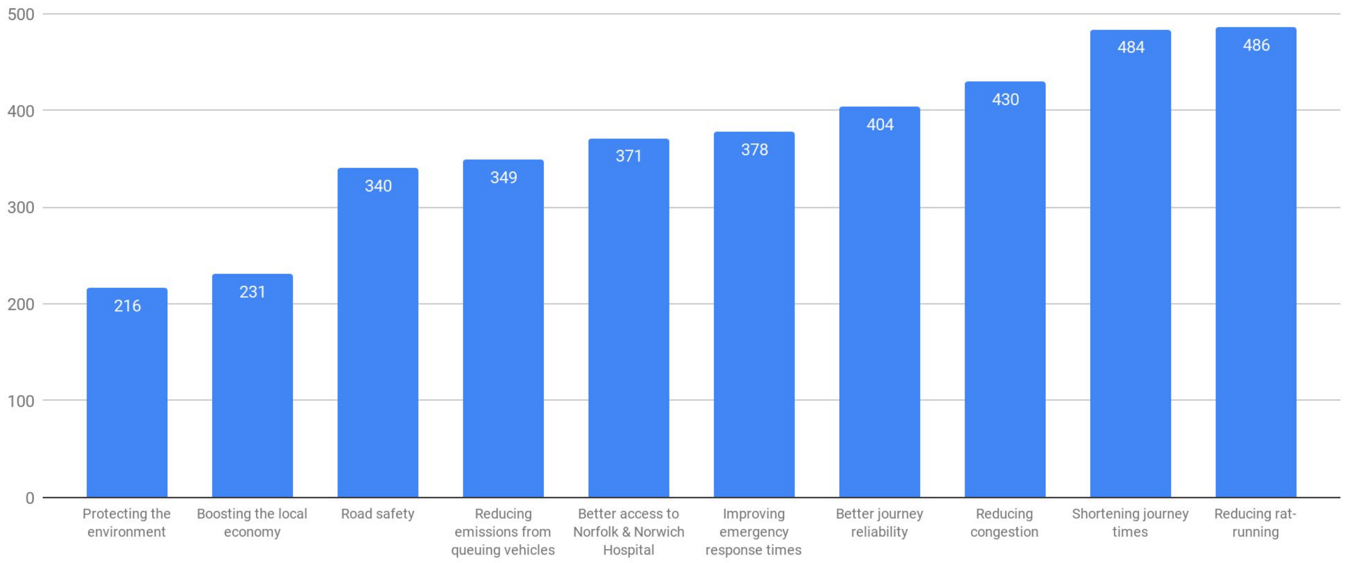
Option D

Respondents were asked 'Based on all the information provided, how effective do you think this option would be as a Norwich Western Link?'. The question was mandatory.



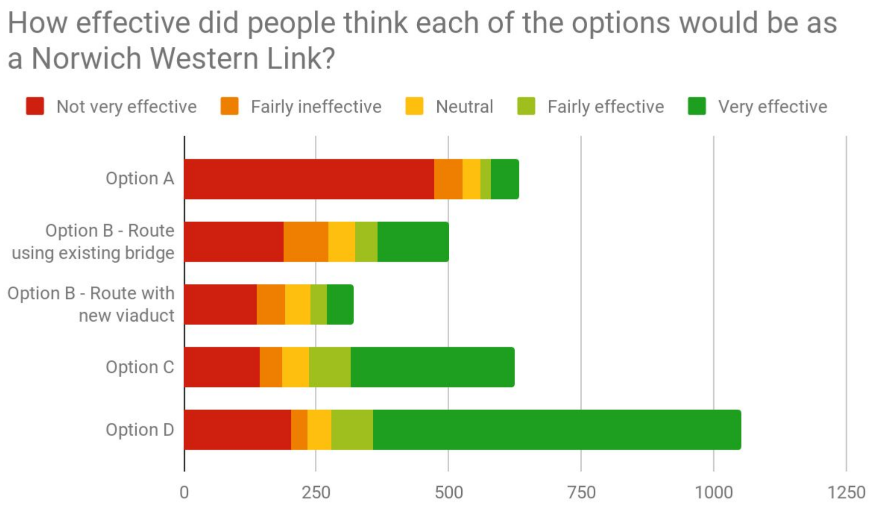
Option D (continued)

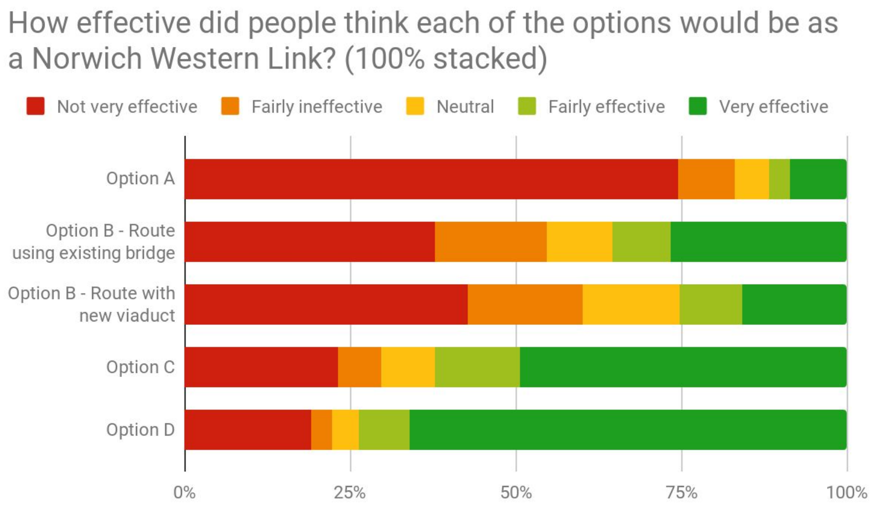
Which of the top 10 issues identified through the previous consultation did people think Option D would tackle best?



Comparing views on the individual options

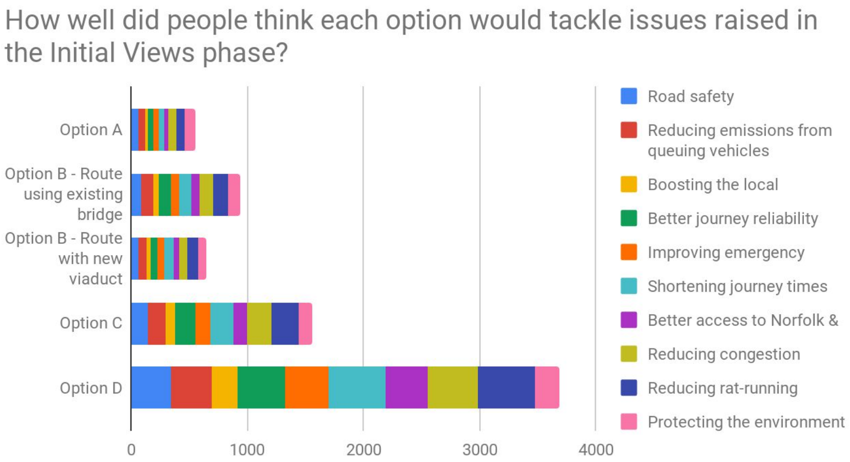
The charts below show the data for how effective people thought each option would be as a Norwich Western Link. The left hand chart shows the number of times each 'sentiment' score was selected, therefore the bars are longer on the pages that received more comments. The right hand chart shows the bars all adjusted to the same length, so that the proportions of the 'sentiment' score for each option can be compared.

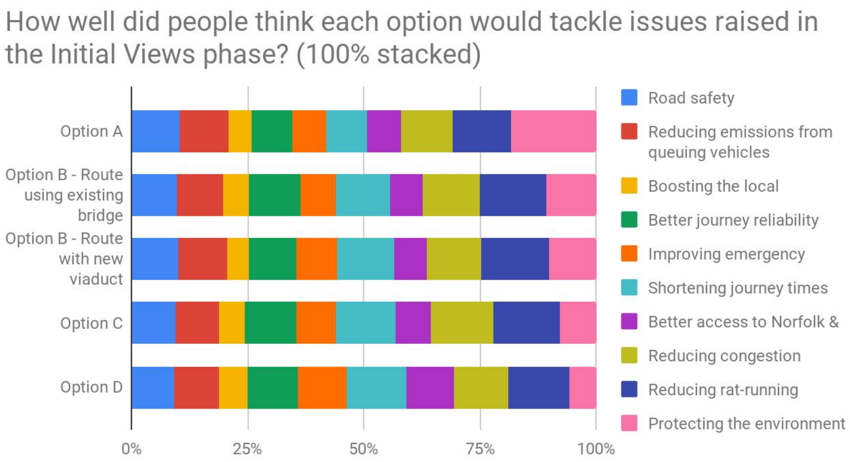




Comparing views on the individual options (continued)

The charts below show the data for how effective people thought each option would be at tackling the top 10 issues raised in the previous consultation. The left hand chart shows the number of times each issue was selected (people could select multiple issues, or no issues at all), therefore the bars are longer on the pages that received more comments. The right hand chart shows the bars all adjusted to the same length, so that the proportions of each transport issue for each option can be compared.



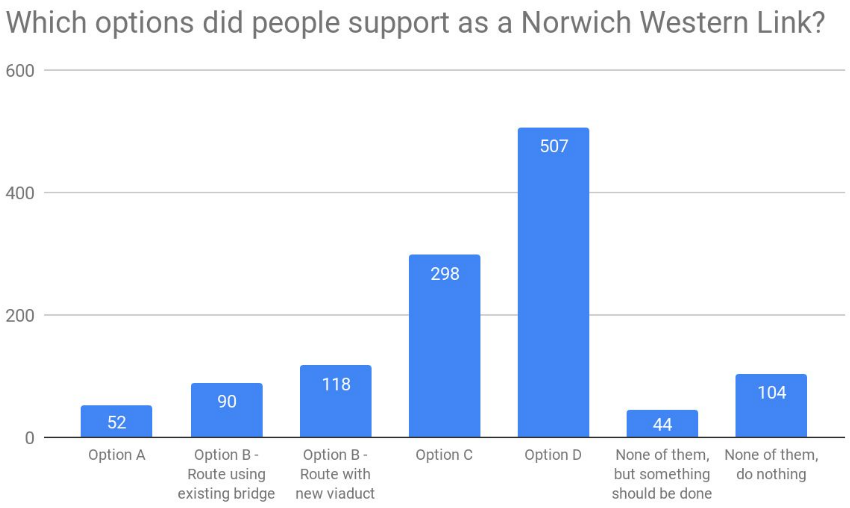


Options comparison

Respondents were asked which options they would support as a Norwich Western Link, including 'none of them, do nothing' and 'none of them, but something should be done'. The question was optional and multiple answers could be selected. A response to this question was given in 98% of the comments made on this page.

Support for each option as a percentage of total comments is as follows:

- Option A: 6%
- Option B - Route using existing bridge: 10%
- Option B - Route with new viaduct: 13%
- Option C: 34%
- Option D: 57%
- None of them, but something should be done: 5%
- None of them, do nothing: 12%

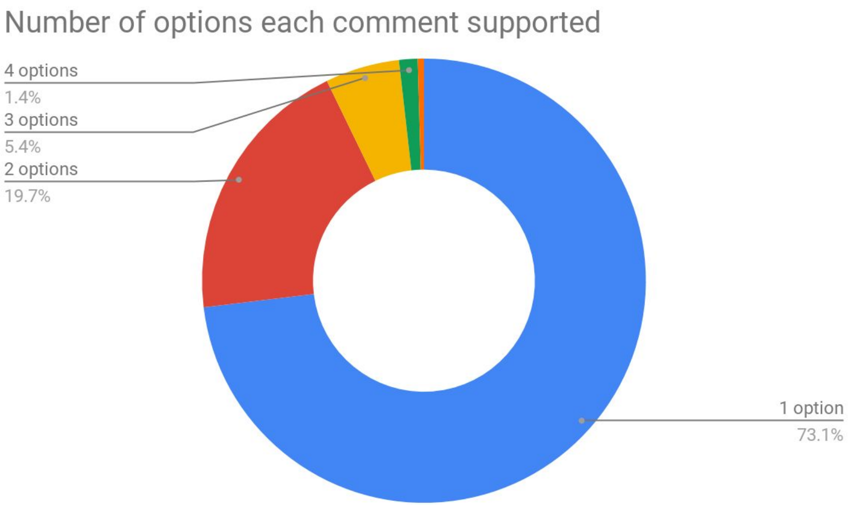


Options comparison (continued)

The options people identified that they would support as a Norwich Western Link reflect fairly closely how suitable people thought each of the individual options were.

Option D was the most popular option, with Option C as a clear second place. Support for not going with any of the options was fairly low, whether or not people thought something should be done at all.

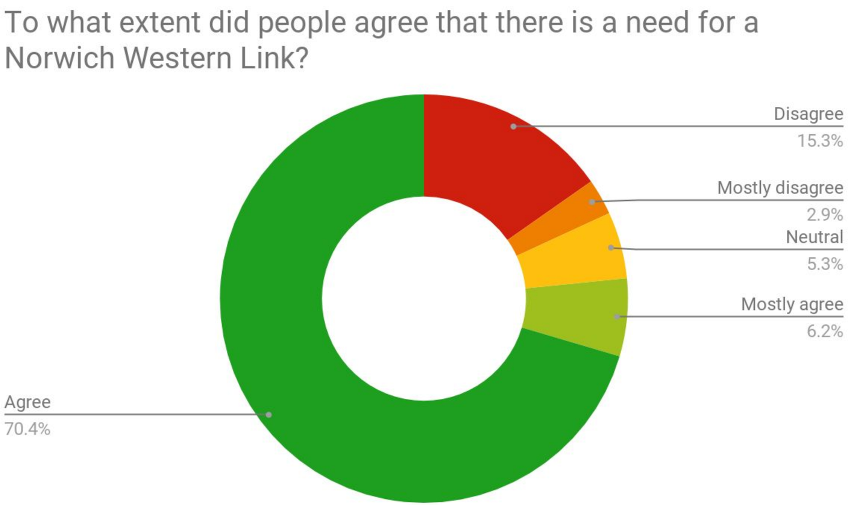
The chart opposite shows how many options were supported for each comment. The vast majority of comments only supported one or two options, and no comment supported more than five (please remember that 'none of them, do nothing' and 'none of them, but something should be done' were also options for this question).



Options comparison (continued)

The sliding scale question on the options comparison page asked respondents “To what extent do you agree or disagree that there is a need for a new or improved road linking the western end of Broadland Northway (previously known as the NDR) to the A47?”. The question was mandatory.

There was overwhelming agreement that there is a need for a Norwich Western Link.

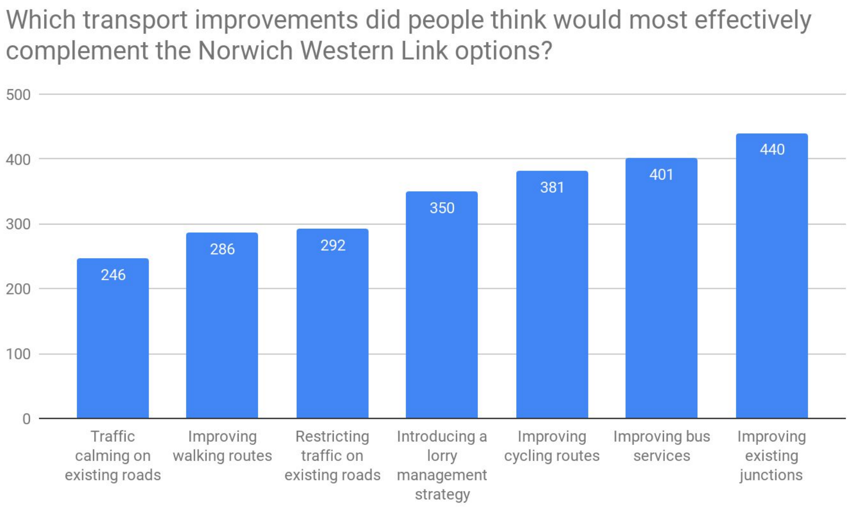


Options comparison (continued)

Respondents were asked to select transport improvements which could complement the options. The question was optional (a response to this question was given in 84% of the comments made on this page) and multiple choice. Support for each improvement as a percentage of total comments is as follows:

- Traffic calming on existing roads (32%)
- Improving walking routes (37%)
- Restricting traffic on existing roads (38%)
- Introducing a lorry management strategy (46%)
- Improving cycling routes (50%)
- Improving bus services (52%)
- Improving existing junctions (57%)

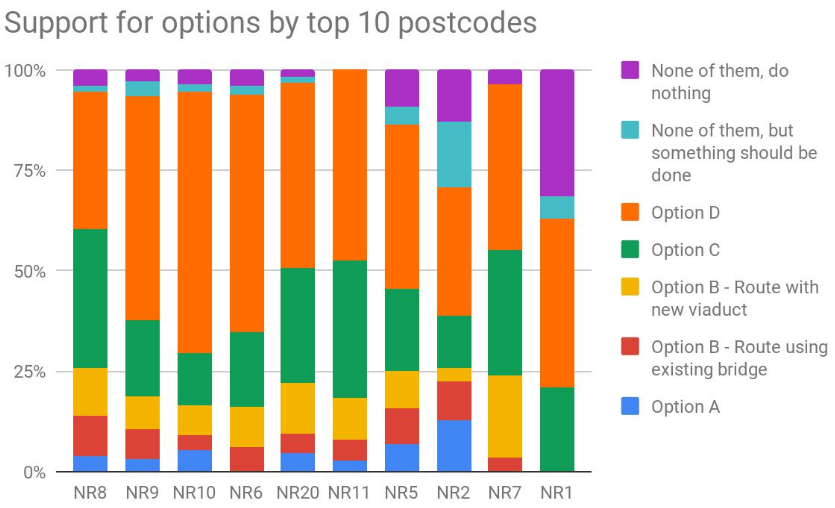
There was support for all improvements, but improving existing junctions came out on top - perhaps a reflection of the high proportion of car drivers responding.



Options by postcode

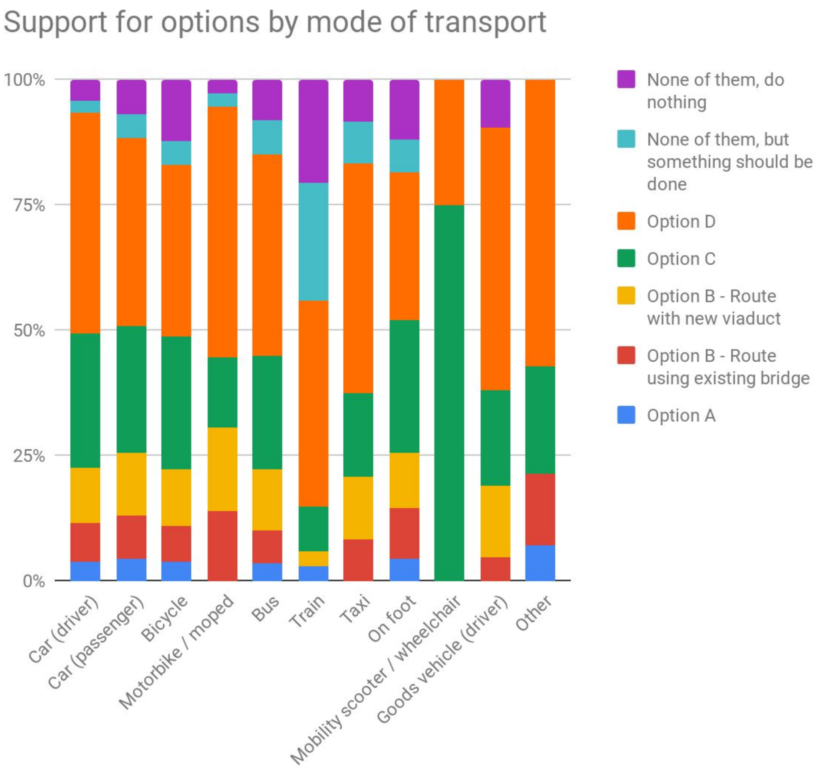
The adjacent chart shows support for each of the options on the options comparison page, by the top 10 postcodes.

NR1 was by a wide margin the postcode most in favour of not pursuing any of the options, as well as having no interest in Option A or the two variants of Option B.



Options by mode of transport

The chart opposite shows support for each option by mode of transport. It should be noted that some modes (e.g. mobility scooter/wheelchair) were selected very few times (see page 20 for more details on mode of transport).



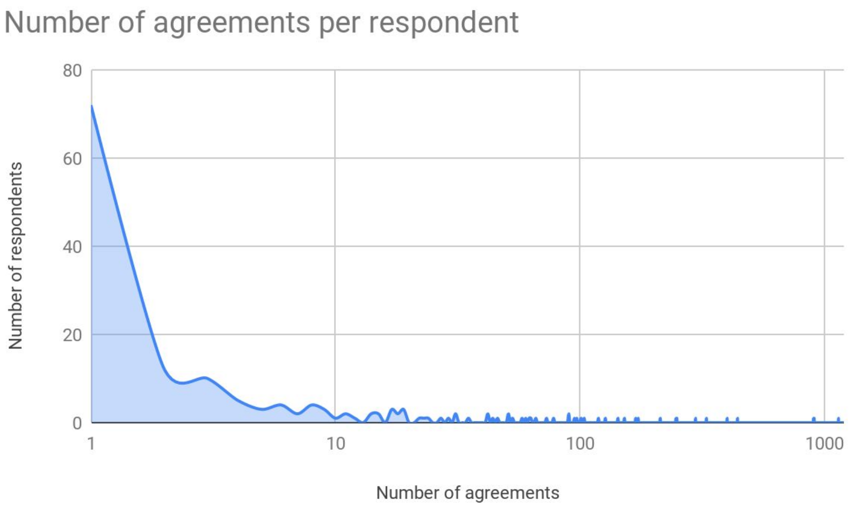
Agreements analysis

Agreements are a way for respondents to provide quick feedback on an existing comment. Respondents can agree once with any comment and cannot agree with their own comments. Agreements do not add any 'weighting' to a comment in our analysis.

In total, 8211 agreements were made, including 128 pending and anonymous agreements. 74% of comments had 1 or more agreements made with them, though the greatest number of agreements on a single comment was 14.

18 users made over 100 agreements each, with the top 10 accounting for over half of all agreements made. The respondent who made the most agreements made 1141, with the following two making slightly over 900 each.

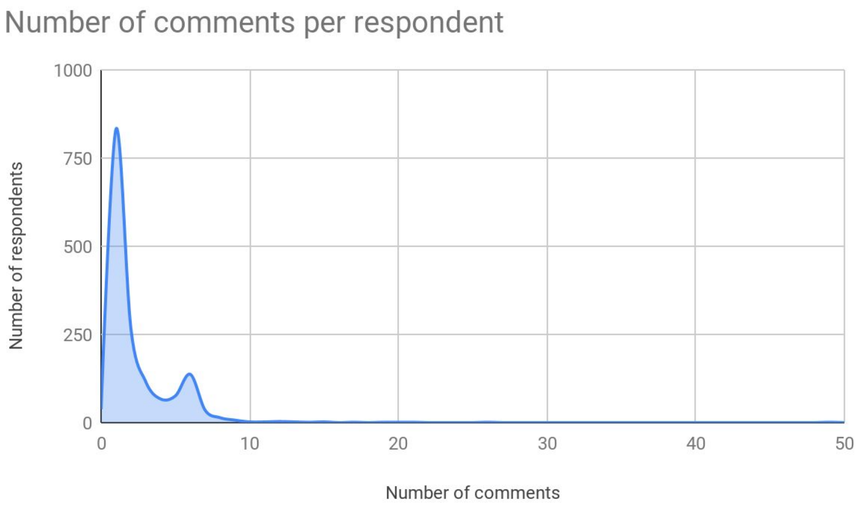
Please note that for readability the adjacent chart does not include those who did not make any agreements (1433), and that the horizontal axis is shown with a logarithmic scale - meaning that higher values are compressed into a smaller space.



Respondents making multiple comments

The chart opposite shows the number of comments made by each respondent. The majority of respondents made 1-2 comments, with a spike at 6 comments representing those who commented on every page.

The most comments made by a single respondent was 49, with 4 respondents having made 20 or more comments.

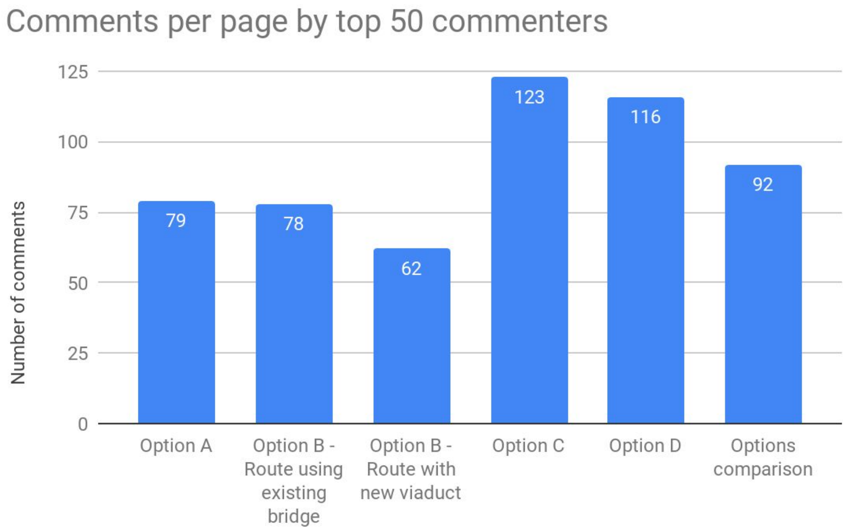


Respondents making multiple comments (continued)

The chart opposite shows the distribution of comments across each page by the 50 respondents who made the most comments, in order to help identify any attempt to influence the results of the consultation.

Looking at the top 50 commenters only, Option C received more comments than Option D - whereas Option D received more comments when looking at the full set of comments. This is mainly accounted for by the top two commenters, who added 18 and 21 comments on Option C respectively.

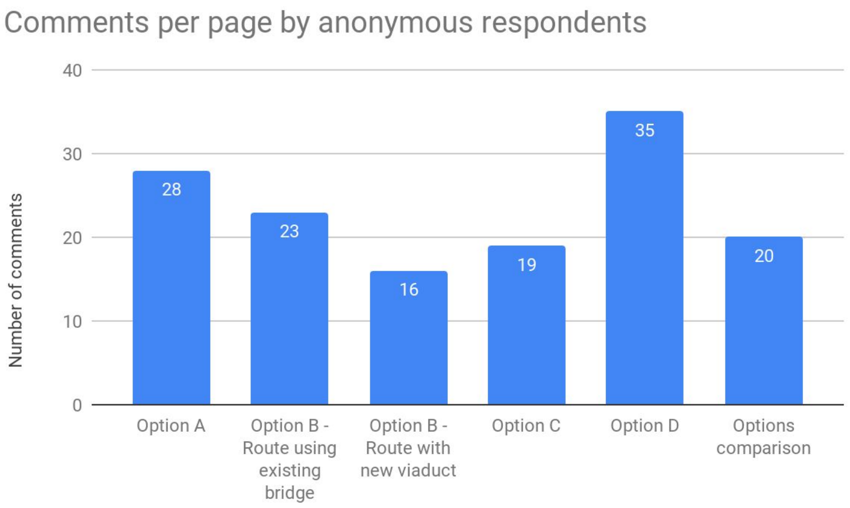
However, the remainder of the top 50 commenters show a reasonable balance of comments per section, and the comments on Option C by the top two commenters account for less than 1% of the total set of comments.



Comments by anonymous respondents

The chart opposite shows the number of comments per page by anonymous respondents (i.e. those who did not supply an email address or any personal information).

Anonymous comments accounted for between 2 and 5% of comments on each page, so there does not seem to have been a deliberate effort to influence the results of the consultation by anonymous users.



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Annex E – Full list of qualitative comments

Option A Comments

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Does not improve connectivity between roads and places	8	0.7
CONNECTIVITY	Not improve access to hospital	6	0.5
CONNECTIVITY	Not improve emergency response times	4	0.3
CONNECTIVITY	Opposed to A47 link at Wood Lane	2	0.2
COST	Not cost effective/waste of money and time	86	7.5
COST	Low cost/ Cheapest option	36	3.1
COST	Not benefit economy	10	0.9
COST	Cost effective	8	0.7
DESIGN	Single carriageway not fit for purpose/ road capacity insufficient	117	10.2
DESIGN	Route too long/no journey time improvement or journey reliability	93	8.1
DESIGN	Will not solve the problem/Route will not be used/ Too much of a diversion	76	6.6
DESIGN	Not effective route/ not fit for purpose	38	3.3
DESIGN	Too far west/away from Norwich/ in the wrong place	3	0.3
ENVIRONMENT	Impact on environment (natural beauty, Wensum Valley emissions, noise/ air pollution)	69	6.0
ENVIRONMENT	Lowest environmental impacts (general) and low impact on villages/ community	45	3.9
ENVIRONMENT	Lowest impact on Wensam valley	13	1.1
ENVIRONMENT	Uses existing bridge/no viaduct needed	13	1.1
GENERAL OPPOSITION	Opposed to scheme/scheme not needed - general/ opposed to all schemes	151	13.2
GENERAL OPPOSITION	Negative to consultation process/ entire project (against all options)	16	1.4
GENERAL SUPPORT	Supportive of scheme - general	20	1.7
GENERAL SUPPORT	Upgrade is needed	10	0.9
GENERAL SUPPORT	Best route	9	0.8
GENERAL SUPPORT	Least invasive overall	3	0.3
HOUSING	Would increase housing developments/Against developments	6	0.5
MORE INFO NEEDED	Request for more information	4	0.3
NEUTRAL OTHER	Neutral - Other (try not to use often)	1	0.1

Theme	Comment	N° of times mentioned	% of comments
NEUTRAL OTHER	Dual carriageway between NDR and Lenwade	1	0.1
RAT RUNNING	Does not solve rat running/traffic will not divert from villages/ congestion be reduced in general	200	17.5
RAT RUNNING	Impact on local towns/ houses nearby/ too disruptive	16	1.4
RAT RUNNING	Impact on road to Lenwade	3	0.3
ROAD SAFETY	Road safety issue	14	1.2
SUGGESTION	Needs to be dual carriageway/ HGVs are common users	31	2.7
SUGGESTION	Alternative route suggestion/ option given/ in combination with another option/ route needs improving	20	1.7
SUGGESTION	Suggestion to stop rat running/block local roads/ divert traffic	7	0.6
TRAFFIC	Will create a bottleneck	5	0.4
	TOTAL:	**1144**	**100**

Option B WEST Comments

Theme	Comment	N° of times mentioned	% of comments
BRIDGE	Neutral comment about bridge	14	1.2
CONNECTIVITY	Option is too far west	111	9.8
CONNECTIVITY	Concern over ineffective links	42	3.7
CONNECTIVITY	Dislike link at Woodlane/Berry Lane	6	0.5
CONNECTIVITY	Option improves access to local amenities / communities	3	0.3
CONNECTIVITY	Options provides easier access to hospital	3	0.3
CONNECTIVITY	Option provides good links to other major roads	1	0.1
CONSTRUCTION	Too much construction/destruction	3	0.3
CONSULTATION	Consultation unhelpful / not informative	5	0.4
COST	Option is most cost effective	43	3.8
COST	Option is not cost effective/waste of money	27	2.4
DEVELOPMENT	Oppose to increase in new housing developments	2	0.2
DEVELOPMENT	Oppose all options as too close to housing	2	0.2
DEVELOPMENT	Concern with widening existing bridge	12	1.1

Theme	Comment	N° of times mentioned	% of comments
ENVIRONMENT	Concern about environmental impacts	71	6.2
ENVIRONMENT	Option has less environmental impacts	61	5.4
ENVIRONMENT	Concern about impact on wildlife/County Wildlife site	25	2.2
ENVIRONMENT	Concern about noise/air pollution	20	1.8
ENVIRONMENT	Concern about loss of woodland/countryside	13	1.1
ENVIRONMENT	Option has smallest impact on wildlife	10	0.9
ENVIRONMENT	Concern over impact on Wensum Valley/Wensum River	7	0.6
ENVIRONMENT	Opposition to passing listed buildings	6	0.5
ENVIRONMENT	Concern over negative impact on health	5	0.4
ENVIRONMENT	Concerns about effects on River Wensum	2	0.2
ENVIRONMENT	Will destroy the environment of Weston Longville	2	0.2
GENERAL OPPOSITION	Other options are better	51	4.5
GENERAL OPPOSITION	General opposition to this option	33	2.9
GENERAL OPPOSITION	General opposition to the scheme	26	2.3
GENERAL SUPPORT	General support for Option B WEST	101	8.9
GENERAL SUPPORT	Positive comments regarding use of existing bridge	32	2.8
GENERAL SUPPORT	Option is best solution	29	2.5
GENERAL SUPPORT	Supportive of scheme	1	0.1
NEUTRAL OTHER	Neutral - Other (try not to use often)	12	1.1
RAT RUNNING	Traffic will still use local roads/rat run	68	6.0
RAT RUNNING	Concern over impact on Western Longville community	28	2.5
RAT RUNNING	Concern over impact on local communities	23	2.0
RAT RUNNING	Option will discourage rat running	14	1.2
RAT RUNNING	Option has minimum impact on communities	11	1.0
RAT RUNNING	Concern over construction/disruption	8	0.7
RAT RUNNING	Concern over impact on Attlebridge community	6	0.5
RAT RUNNING	Rat running is dangerous on small roads	6	0.5
RAT RUNNING	Option is too close to residential properties	6	0.5
RAT RUNNING	Option Improves traffic in local villages	2	0.2
RAT RUNNING	Scheme will improve traffic in local villages	1	0.1

Theme	Comment	N° of times mentioned	% of comments
RAT RUNNING	Concern over impact on local businesses	1	0.1
ROUTE/DESIGN	Route is too long/increased journey times	32	2.8
ROUTE/DESIGN	Road is not big enough for volume of traffic	5	0.4
ROUTE/DESIGN	Oppose new junction west of Attlebridge	4	0.4
ROUTE/DESIGN	Scheme only thinks of motorists	3	0.3
ROUTE/DESIGN	Oppose dual carriageway	2	0.2
ROUTE/DESIGN	Opposed to upgrade of A1067	1	0.1
SAFETY	Route is not safe	5	0.4
SAFETY	Option improves road safety	2	0.2
SUGGESTIONS	Must mitigate environmental impacts	14	1.2
SUGGESTIONS	Alternative route suggestion given	11	1.0
SUGGESTIONS	B WEST better than B EAST - West of Attlebridge better	10	0.9
SUGGESTIONS	Provide better bus links	6	0.5
SUGGESTIONS	B EAST better than B WEST - East of Attlebridge better	6	0.5
SUGGESTIONS	Improve rail links	5	0.4
SUGGESTIONS	Provide infrastructure for sustainable transport	4	0.4
SUGGESTIONS	Do not include roundabouts	1	0.1
SUGGESTIONS	Block local roads to help rat running	1	0.1
TRAFFIC	Option will not reduce traffic	22	1.9
TRAFFIC	Support for dual carriageway	16	1.4
TRAFFIC	Option would reduce traffic/bottlenecks	16	1.4
TRAFFIC	Option would reduce journey times	12	1.1
TRAFFIC	Support for upgrade of A1067	3	0.3
TRAFFIC	Support for new junction west of Attlebridge	1	0.1
TRAFFIC	Option provides shortest/most direct route	1	0.1
	TOTAL:	**1138**	**100.0**

Option B EAST Comments

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Option is too far west	77	10.6
CONNECTIVITY	Concern over ineffective links	24	3.3
CONNECTIVITY	Option provides good links to other major roads	4	0.6

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Option provides good links to NDR	4	0.6
CONNECTIVITY	Dislike link at Woodlane/Berry Lane	3	0.4
CONNECTIVITY	Option improves access to local amenities / communities	2	0.3
CONNECTIVITY	Option is an effective link for A47 to north	2	0.3
CONNECTIVITY	Option provides easier access to hospital	2	0.3
CONSTRUCTION	Too much construction/destruction	5	0.7
CONSULTATION	Consultation unhelpful/not informative	6	0.8
COST	Option is not cost effective/waste of money	32	4.4
COST	Option is most cost effective	5	0.7
DEVELOPMENT	Oppose all options as too close to housing	2	0.3
DEVELOPMENT	Oppose to increase in new housing developments	1	0.1
ENVIRONMENT	Concern about environmental impacts	53	7.3
ENVIRONMENT	Option has less environmental impacts	26	3.6
ENVIRONMENT	Concern about noise/air pollution	24	3.3
ENVIRONMENT	Concern about impact on wildlife/County Wildlife site	22	3.0
ENVIRONMENT	Concern about loss of woodland/countryside	13	1.8
ENVIRONMENT	Will destroy the environment of Weston Longville	3	0.4
ENVIRONMENT	Concern over negative impact on health	3	0.4
ENVIRONMENT	Option has smallest impact on wildlife	1	0.1
ENVIRONMENT	Concerns about effects on River Wensum	1	0.1
GENERAL OPPOSITION	Opposed to new bridge/viaduct	25	3.5
GENERAL OPPOSITION	General opposition	25	3.5
GENERAL OPPOSITION	Other options are better	20	2.8
GENERAL OPPOSITION	General opposition to scheme / not needed	15	2.1
GENERAL OPPOSITION	Opposed to widening bridge	4	0.6
GENERAL SUPPORT	Support for new bridge/viaduct	24	3.3
GENERAL SUPPORT	Option is best solution	19	2.6
GENERAL SUPPORT	Support for use of existing bridge	13	1.8
GENERAL SUPPORT	General support for the option	13	1.8
GENERAL SUPPORT	General support for the scheme	7	1.0
MORE INFO NEEDED	Request for more info- general	1	0.1
NEUTRAL OTHER	Neutral - Other (try not to use often)	3	0.4

Theme	Comment	N° of times mentioned	% of comments
RAT RUNNING	Traffic will still use local roads/rat run	40	5.5
RAT RUNNING	Option has minimum impact on communities	24	3.3
RAT RUNNING	Concern over impact on local communities	15	2.1
RAT RUNNING	Concern over impact on Western Longville community	13	1.8
RAT RUNNING	Option will discourage rat running	6	0.8
RAT RUNNING	Concern over impact on Attlebridge community	5	0.7
RAT RUNNING	Concern over impact on local businesses	2	0.3
RAT RUNNING	Option is too close to residential properties	2	0.3
RAT RUNNING	Scheme improves traffic in local villages	1	0.1
RAT RUNNING	Option improves traffic in local villages	1	0.1
RAT RUNNING	Concern over construction/disruption	1	0.1
ROUTE/DESIGN	Route is too long/increased journey times	20	2.8
ROUTE/DESIGN	Neutral comment about bridge/viaduct	12	1.7
ROUTE/DESIGN	Scheme only thinks of motorists	2	0.3
ROUTE/DESIGN	Oppose new junction/link to A1067 east of Attlebridge	2	0.3
ROUTE/DESIGN	Oppose to new dual carriageway	1	0.1
ROUTE/DESIGN	Opposed to upgrade of A1067	1	0.1
SAFETY	Option improves road safety	3	0.4
SAFETY	Route is not safe	1	0.1
SUGGESTION	Provide infrastructure for sustainable transport	8	1.1
SUGGESTION	B EAST better than B WEST - East of Attlebridge better	8	1.1
SUGGESTION	Provide better bus links	7	1.0
SUGGESTION	B WEST better than B EAST - West of Attlebridge better	7	1.0
SUGGESTION	Improve rail links	6	0.8
SUGGESTION	Must mitigate environmental impacts	6	0.8
SUGGESTION	Alternative route suggestions	5	0.7
SUGGESTION	Block local roads to help rat running	2	0.3
SUGGESTION	Have a tunnel instead	1	0.1
TRAFFIC	Will not reduce traffic	16	2.2
TRAFFIC	Option would reduce journey times	7	1.0
TRAFFIC	Option would reduce traffic	7	1.0
TRAFFIC	Support for new dual carriageway	5	0.7

Theme	Comment	N° of times mentioned	% of comments
TRAFFIC	Options is shortest/most direct route	3	0.4
	TOTAL:	**724**	**100.0**

Option C Comments

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Route is too far west/away from Norwich	69	4.4
CONNECTIVITY	Good links to NDR/close to the NDR	56	3.6
CONNECTIVITY	Best connectivity/Best east west connection - general	53	3.4
CONNECTIVITY	Ineffective links	32	2.1
CONNECTIVITY	Best for linking A1067 to A47	24	1.5
CONNECTIVITY	Easier access to hospital	10	0.6
CONNECTIVITY	Easier to access the town/amenities	8	0.5
CONNECTIVITY	Joining A47 needs to be nearer Southern Bypass	6	0.4
CONNECTIVITY	Hard to get to Taverham/Drayton/Hellesdon	5	0.3
CONNECTIVITY	Will not improve emergency response times	5	0.3
CONSULTATION	Consultation material/process/events unhelpful/not informative	3	0.2
COST	Most cost effective	68	4.4
COST	Not cost effective/waste of money	26	1.7
COST	Provides economic benefits	12	0.8
COST	Lower cost does not justify environmental impacts	6	0.4
ENVIRONMENT	Less environmental impacts	111	7.2
ENVIRONMENT	Concern about environmental impacts - general/natural beauty/emissions	103	6.6
ENVIRONMENT	Lowest impact on Wensum Valley/River	42	2.7
ENVIRONMENT	Against damage to County Wildlife site/wildlife	41	2.6
ENVIRONMENT	Concern about loss of woodland/countryside	28	1.8
ENVIRONMENT	Dual carriageway/Road too noisy	27	1.7
ENVIRONMENT	Opposed to new viaduct	23	1.5
ENVIRONMENT	Impact on Wensum Valley/Wensum River	23	1.5
ENVIRONMENT	Support new viaduct	12	0.8
ENVIRONMENT	Negative impact on health	8	0.5

Theme	Comment	N° of times mentioned	% of comments
ENVIRONMENT	Option too intrusive	7	0.5
GENERAL OPPOSITION	General - opposed (option)	43	2.8
GENERAL OPPOSITION	Opposed to scheme/scheme not needed - general	19	1.2
GENERAL SUPPORT	Most viable option/best solution/better than other routes general	191	12.3
GENERAL SUPPORT	General - supportive (option specific)	56	3.6
GENERAL SUPPORT	Supportive of scheme/scheme is needed general	13	0.8
HOUSING	Supports housing developments	1	0.1
HOUSING	Oppose to/increase in new housing developments	1	0.1
MORE INFO NEEDED	Request for more info- general	3	0.2
MORE INFO NEEDED	Further details needed on junction with A47	1	0.1
RAT RUNNING	Option will discourage rat running	62	4.0
RAT RUNNING	Will still use local roads/still rat run	51	3.3
RAT RUNNING	Impact on Ringland community	3	0.2
RAT RUNNING	Impact on the golf course/Country club	3	0.2
RAT RUNNING	Construction/disruption	1	0.1
ROUTE/DESIGN	Route is too long/increased journey times	13	0.8
ROUTE/DESIGN	Opposed to A47 link at Wood Lane	12	0.8
ROUTE/DESIGN	Not good to terminate at Horningham	6	0.4
ROUTE/DESIGN	Opposed to upgrade of A1067	3	0.2
SAFETY	Improves road safety	18	1.2
SAFETY	Route is not safe	10	0.6
SUGGESTION	Alternative route suggestion given	23	1.5
SUGGESTION	Provide facilities for sustainable transport/ walking/cycling links/infrastructure	20	1.3
SUGGESTION	Provide better bus links	10	0.6
SUGGESTION	Improve rail links	10	0.6
SUGGESTION	Block local roads to help rat running	1	0.1
TRAFFIC	Shortest/Most direct route	65	4.2
TRAFFIC	Would reduce traffic/bottlenecks	54	3.5
TRAFFIC	Would reduce journey times	28	1.8
TRAFFIC	Will not reduce traffic/Will add to traffic	19	1.2
TRAFFIC	Support upgrade of A1067	4	0.3
	TOTAL:	**1552**	**100**

Option D Comments

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Option is an effective link for A47 to north	141	5.0
CONNECTIVITY	Good links to NDR/close to the NDR	116	4.1
CONNECTIVITY	Good links to other major roads / completes a ring road	111	3.9
CONNECTIVITY	Easier to access the town/amenities/benefit nearby local communities/ connection to airport / businesses (existing)	83	2.9
CONNECTIVITY	Easier access to hospital	40	1.4
CONNECTIVITY	Improves emergency access	31	1.1
CONNECTIVITY	Ineffective links	10	0.4
CONSTRUCTION	Too much construction/destruction	6	0.2
CONSULTATION	Consultation material/process/events unhelpful/not informative	17	0.6
CONSULTATION	Consultation material/events/good informative	1	0.0
COST	Not cost effective/waste of money/ Too expensive	95	3.3
COST	Most cost effective	32	1.1
DEVELOPMENT	Supports housing developments/ local economy (promoting business growth)?	36	1.3
DEVELOPMENT	Oppose to/increase in new housing developments	10	0.4
ENVIRONMENT	Concern about environmental impacts - general/natural beauty/ conservation of area	145	5.1
ENVIRONMENT	Less environmental impacts then other options	90	3.2
ENVIRONMENT	Concern about noise/air pollution	56	2.0
ENVIRONMENT	Against the viaduct/Viaduct will ruin the landscape (general)	40	1.4
ENVIRONMENT	Impact on Wensum Valley/Wensum River	37	1.3
ENVIRONMENT	Against two viaducts	36	1.3
ENVIRONMENT	Concern about impact on wildlife	33	1.2
ENVIRONMENT	Viaduct will help to maintain wildlife	27	1.0
ENVIRONMENT	Concern about loss of woodland/countryside	24	0.8
ENVIRONMENT	Concerns about effects on River Tud	15	0.5
ENVIRONMENT	Support new viaduct	12	0.4
ENVIRONMENT	Against passing listed buildings	10	0.4
ENVIRONMENT	Smallest impact on wildlife	7	0.2

Theme	Comment	N° of times mentioned	% of comments
ENVIRONMENT	Option too intrusive	2	0.1
GENERAL OPPOSITION	General - opposed (option)	84	3.0
GENERAL OPPOSITION	Other options are better/not my first choice	57	2.0
GENERAL OPPOSITION	Opposed to scheme/scheme not needed - general	25	0.9
GENERAL SUPPORT	Most viable option/best solution/better than other options general	338	11.9
GENERAL SUPPORT	Supportive of scheme/scheme is needed general	39	1.4
GENERAL SUPPORT	Only option that meets objectives	25	0.9
GENERAL SUPPORT	General - supportive (option specific)	19	0.7
MORE INFO NEEDED	Request for more info- general	3	0.1
OTHER	Expensive but better than other options	33	1.2
RAT RUNNING	Option will discourage rat running/ solve the problem	150	5.3
RAT RUNNING	Impact on Ringland community	74	2.6
RAT RUNNING	Improves traffic in local villages	49	1.7
RAT RUNNING	Minimum impact on communities/ best option for residents	30	1.1
RAT RUNNING	Too close to residential properties	29	1.0
RAT RUNNING	Impact on local communities (general)	27	1.0
RAT RUNNING	Will still use local roads/still rat run/ not solve the problem	17	0.6
RAT RUNNING	Impact on Queenshill community	4	0.1
RAT RUNNING	Impact on the golf course/Country club/Wensum Hotel	2	0.1
RAT RUNNING	Construction/disruption	2	0.1
RAT RUNNING	Too close to Taverham Hall School	1	0.0
RAT RUNNING	Rat running dangerous on small roads/HGVs ignore weight restrictions	1	0.0
ROUTE/DESIGN	Opposed to upgrade of A1067 / Oppose to dual carriageway	4	0.1
ROUTE/DESIGN	Route is too long/increased journey times	1	0.0
SAFETY	Improves road safety	27	1.0
SAFETY	Route is not safe	1	0.0
SUGGESTION	Must mitigate environmental impacts	38	1.3
SUGGESTION	Alternative route suggestion given	18	0.6
SUGGESTION	A47 needs to be as near to the Longwater junction	13	0.5
SUGGESTION	Provide better bus links	12	0.4

Theme	Comment	N° of times mentioned	% of comments
SUGGESTION	Have no roundabouts	10	0.4
SUGGESTION	Improve rail links	8	0.3
SUGGESTION	Provide facilities for sustainable transport/ walking/cycling links/infrastructure	3	0.1
SUGGESTION	Block local roads to help rat running	2	0.1
TRAFFIC	Shortest/Most direct route/ best route	214	7.5
TRAFFIC	Would reduce traffic/bottlenecks	89	3.1
TRAFFIC	Would reduce journey times including for ambulances travelling to the N&N	63	2.2
TRAFFIC	Minimal journey time saving not worth the cost (environment/monetary)	28	1.0
TRAFFIC	Will not reduce traffic/Will add to traffic	26	0.9
TRAFFIC	Support upgrade of A1067	4	0.1
TRAFFIC	Does not need extension to A1067	3	0.1
TRAFFIC	Would create more traffic at Longwater interchange	1	0.0
	TOTAL:	**2837**	**100**

Options Comparison Comments

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Option B WEST - Improves access to amenities/the town	1	0.0
CONNECTIVITY	Option B WEST - West of Attlebridge is better link	1	0.0
CONNECTIVITY	Option A - Improves access to amenities/the town	2	0.1
CONNECTIVITY	Option A - Better links to other roads/A47/A11	3	0.1
CONNECTIVITY	Option B WEST - Better links to other roads/A47/A11	3	0.1
CONNECTIVITY	Option B EAST - Improves access to amenities/the town	3	0.1
CONNECTIVITY	Option C - Improves access to amenities/the town	3	0.1
CONNECTIVITY	Option D - Option is too far out/not good links	3	0.1
CONNECTIVITY	Option B EAST - Better links to other roads/A47/A11	9	0.3
CONNECTIVITY	Too far out/not good links - General	11	0.3
CONNECTIVITY	Easier access to the hospital	14	0.4

Theme	Comment	N° of times mentioned	% of comments
CONNECTIVITY	Option C - Option is too far out/not good links	33	1.0
CONNECTIVITY	Option D - Improves access to amenities/the town	39	1.2
CONNECTIVITY	Option B EAST - Option is too far out/not good links	42	1.3
CONNECTIVITY	Option B WEST - Option is too far out/not good links	43	1.3
CONNECTIVITY	Option C - Better links to other roads/A47/A11	50	1.5
CONNECTIVITY	Option A - Option is too far out/not good links	51	1.6
CONNECTIVITY	Would reduce traffic	54	1.7
CONNECTIVITY	Would reduce journey times	112	3.4
CONNECTIVITY	Option D - Better links to other roads/A47/A11	115	3.5
CONSTRUCTION	Concern about construction/disruption	11	0.3
COST	Option B WEST - Too expensive/not costs effective	1	0.0
COST	Option C - Too expensive/not costs effective	1	0.0
COST	Option B EAST -Too expensive/not costs effective	2	0.1
COST	Option A -Too expensive/not costs effective	4	0.1
COST	Provides economic benefits	7	0.2
COST	Option D - Too expensive/not costs effective	12	0.4
COST	Too expensive/not costs effective - general	34	1.0
COST	Most cost effective	92	2.8
DEVELOPMENT	Supports housing developments/increase in population	4	0.1
DEVELOPMENT	Oppose to/increase in new housing developments/increase in population in area	6	0.2
ENVIRONMENT	Negative impact on health	3	0.1
ENVIRONMENT	Option A - Concerns about loss of Woodland/Wildlife	3	0.1
ENVIRONMENT	Option B WEST - Concerns about loss of Woodland/Wildlife	3	0.1
ENVIRONMENT	Option B EAST - Concerns about loss of Woodland/Wildlife	3	0.1
ENVIRONMENT	Option C - Concerns about loss of Woodland/Wildlife	5	0.2

Theme	Comment	N° of times mentioned	% of comments
ENVIRONMENT	Option D - Concerns about loss of Woodland/Wildlife	7	0.2
ENVIRONMENT	Support uses existing viaduct/bridge	11	0.3
ENVIRONMENT	Option A - Negative effect on environment	11	0.3
ENVIRONMENT	Dual carriageway too noisy - general	11	0.3
ENVIRONMENT	Option A - Minimum impact on environment	13	0.4
ENVIRONMENT	Option B WEST - Negative effect on environment	13	0.4
ENVIRONMENT	Option B EAST - Negative effect on environment	16	0.5
ENVIRONMENT	Option C - Negative effect on environment	18	0.6
ENVIRONMENT	Against new viaduct/bridge	22	0.7
ENVIRONMENT	Option B WEST - Minimum impact on environment	28	0.9
ENVIRONMENT	Option B EAST - Minimum impact on environment	29	0.9
ENVIRONMENT	Option D - Negative effect on environment	34	1.0
ENVIRONMENT	Concerns about effects on Wensum Valley/River - general	50	1.5
ENVIRONMENT	Concerns about loss of Woodland/Wildlife - general	51	1.6
ENVIRONMENT	Option D - Minimum impact on environment	54	1.7
ENVIRONMENT	Option C - Minimum impact on environment	74	2.3
ENVIRONMENT	All options will have negative effect on environment	75	2.3
GENERAL SUPPORT	Option A - Improves/will reduce rat-running	5	0.2
GENERAL SUPPORT	Option B WEST - Improves/will reduce rat-running	5	0.2
GENERAL SUPPORT	Option B EAST - Improves/will reduce rat-running	6	0.2
GENERAL SUPPORT	Option C - Improves/will reduce rat-running	36	1.1
GENERAL SUPPORT	Option D - Improves/will reduce rat-running	83	2.5
GENERAL SUPPORT	Most viable option-best solution/meets objectives	130	4.0
LOCAL COMMUNITIES	Option A - Will impact on local communities	8	0.2

Theme	Comment	N° of times mentioned	% of comments
LOCAL COMMUNITIES	Option C - Will impact on local communities	8	0.2
LOCAL COMMUNITIES	Option B WEST - Will impact on local communities	11	0.3
LOCAL COMMUNITIES	Option B EAST -Will impact on local communities	12	0.4
LOCAL COMMUNITIES	Option D - Will impact on local communities	20	0.6
OPTIONS OPPOSITION	Oppose - Option C	21	0.6
OPTIONS OPPOSITION	Oppose - Option B WEST -Existing bridge	32	1.0
OPTIONS OPPOSITION	Oppose - Option B EAST - New viaduct route	32	1.0
OPTIONS OPPOSITION	Oppose - Option D	32	1.0
OPTIONS OPPOSITION	Oppose - all options but something needs to be done	45	1.4
OPTIONS OPPOSITION	Oppose - Option A	55	1.7
OPTIONS OPPOSITION	Oppose - all options - do nothing/leave as is	97	3.0
OTHER	Neutral - Other	6	0.2
OTHER	Request for more info	11	0.3
RAT RUNNING	Option D - will not improve rat-running	8	0.2
RAT RUNNING	Option C - will not improve rat-running	26	0.8
RAT RUNNING	Option B EAST -will not improve rat-running	31	0.9
RAT RUNNING	Option B WEST - will not improve rat-running	32	1.0
RAT RUNNING	Option A - will not improve rat-running	39	1.2
ROUTE/DESIGN	Route is too long	1	0.0
ROUTE/DESIGN	Option D - Route is too long	1	0.0
ROUTE/DESIGN	Option C - Route is too long	4	0.1
ROUTE/DESIGN	Option B WEST - Route is too long	6	0.2
ROUTE/DESIGN	Option B EAST - Route is too long	6	0.2
ROUTE/DESIGN	Option A - Route is too long	9	0.3
SUGGESTIONS	Alternative route suggestion given	37	1.1
SUPPORT FOR OPTIONS	Support all options/Scheme is needed	13	0.4
SUPPORT FOR OPTIONS	Support - Option A	50	1.5
SUPPORT FOR OPTIONS	Support - Option B WEST -Existing bridge	86	2.6
SUPPORT FOR OPTIONS	Support - Option B EAST - New viaduct route	112	3.4

Theme	Comment	N° of times mentioned	% of comments
SUPPORT FOR OPTIONS	Support - Option C	295	9.0
SUPPORT FOR OPTIONS	Support - Option D	506	15.5
TRAFFIC	Option D - Will not reduce traffic/Will add to traffic	4	0.1
TRAFFIC	Option A - Will not reduce traffic/Will add to traffic	5	0.2
TRAFFIC	Option B WEST - Will not reduce traffic/Will add to traffic	5	0.2
TRAFFIC	Option B EAST - Will not reduce traffic/Will add to traffic	5	0.2
TRAFFIC	Option C - Will not reduce traffic/Will add to traffic	6	0.2
TRAFFIC	Will not reduce traffic/Will add to traffic - general	28	0.9
	TOTAL:	**3270**	**100**

Transport Improvements Comments

Theme	Comment	N° of times mentioned	% of comments
BUSES	Current bus fares are too expensive/ public transport in general too expensive	5	0.7
BUSES	Reducing speed limits aren't the solution	3	0.4
BUSES	Cannot build NDR properly	1	0.1
BUSES	NDR roundabouts are dangerous/ poorly designed	4	0.6
BUSES	There is a lack of buses in the area/ buses are unreliable	1	0.1
BUSES	Bus service/public transport needs to improve/not great (i.e. unreliable/ cost)	107	14.8
BUSES	Use non-polluting electric buses	2	0.3
CONNECTIVITY	Need more options to access hospitals	3	0.4
CONNECTIVITY	Need better links to amenities/businesses/ Norwich	9	1.2
CONNECTIVITY	Need better links to roads i.e. links to NDR	5	0.7
CONSULTATION	Negative to the consultation process (i.e. insufficient information/ details	5	0.7
COST	It is cost effective	2	0.3
COST	Scheme will boost local economy	1	0.1
COST	Not cost efficient/waste of money	4	0.6

Theme	Comment	N° of times mentioned	% of comments
CYCLING / WALKING	Cyclists don't use cycle lanes/cyclists add to traffic/ cycle lanes not viable on small roads	4	0.6
CYCLING / WALKING	Not enough walking facilities/routes	64	8.8
CYCLING / WALKING	Not enough cycling facilities/routes	87	12.0
CYCLING / WALKING	Have walking/cycling facilities along Wensum Valley	6	0.8
ENVIRONMENT	The scheme will be better for the environment/ better for quality of life of communities/ community support of scheme	16	2.2
ENVIRONMENT	Wildlife in area suffering from traffic	1	0.1
ENVIRONMENT	Concerns about existing environmental impacts	4	0.6
ENVIRONMENT	Concerns about potential new impacts on environment	13	1.8
ENVIRONMENT	Concerns about effects on Wensum Valley, wildlife, woodland/ landscape in general	5	0.7
MOTORBIKES	Motorbikes	1	0.1
MOTORBIKES	Promote motorcycles -they are more efficient/ motorbikes have been disregarded in terms of traffic policy	5	0.7
RAT RUNNING	Will increase rat-running/not solve/ rat running is dangerous	14	1.9
ROADS	Roads should be improved/ better signage and street lighting (general maintenance)	24	3.3
ROADS	Lorries should use suitable roads/restrict them/ managing HGV routes/ access	47	6.5
ROADS	Remove NDR roundabout replace with slip roads	2	0.3
ROADS	Junctions with A47/ Junctions in general need improving	38	5.2
ROADS	Dual the A47	5	0.7
ROADS	New junctions should not be roundabouts/ against roundabouts in general	10	1.4
ROADS	Need roundabout at Wood Lane/ improving existing roundabouts	9	1.2
ROADS	Blind Lane should be closed as its used as rat-run	1	0.1
ROADS	Reduce impact on communities/too great an impact on locals/ villages need protection	14	1.9

Theme	Comment	N° of times mentioned	% of comments
SAFETY	Roads are dangerous for walkers and or cyclists	19	2.6
SAFETY	Cars are speeding/ speed restrictions will help	2	0.3
SAFETY	Roads are dangerous- general (including lorries and roundabouts)	15	2.1
SAFETY	Improve safety on roads/cycle, bus and walking routes/ safety needs to improve	51	7.0
TRAFFIC	Rat running will be reduced/ roads need to be used less as rat runs	18	2.5
TRAFFIC	Traffic will be deterred from local roads	1	0.1
TRAFFIC	Congestion will be reduced in general/ traffic management improved	3	0.4
TRAFFIC	Traffic calming causes more pollution (noise/air)	15	2.1
TRAFFIC	Traffic calming causes more congestion/ traffic congestion will increase/ traffic calming causing more problems i.e. noise and emissions	13	1.8
TRAFFIC	Need traffic calming measures i.e. re-routing traffic to another road/ require traffic management	33	4.6
TRAFFIC	Measures should be implemented to discourage cars	27	3.7
TRAFFIC	People need cars to get to places/ cars have been disregarded in terms of traffic policy/ alternative modes of public transport encouraged	2	0.3
TRAFFIC	Neutral other comment	3	0.4
	TOTAL:	**724**	**100**

Any Other Comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Too far out/not good links - General	3	0.7
Connectivity	Would reduce traffic	1	0.2
Connectivity	Easier access to the hospital	1	0.2
Connectivity	Option D - Option is too far out/not good links	1	0.2
Construction	Concern about construction/disruption	6	1.4
Cost	Too expensive/not costs effective - general	14	3.3
Cost	Option D - Too expensive/not costs effective	3	0.7

Theme	Comment	N° of times mentioned	% of comments
Cost	Option A - Most cost-effective option	2	0.5
Cost	The government should pay for the scheme	2	0.5
Cost	Option A -Too expensive/not costs effective	2	0.5
Cost	Option C - Too expensive/not costs effective	2	0.5
Cost	Provides economic benefits	1	0.2
Cost	Option B WEST - Most cost-effective option	1	0.2
Cost	Option D - Most cost-effective option	1	0.2
Cost	Option B WEST - Too expensive/not costs effective	1	0.2
Cost	Option B EAST -Too expensive/not costs effective	1	0.2
Dev	The consultation material/consultation is good/clear	2	0.5
Dev	Supports housing developments/increase in population	1	0.2
Dev	Other positive comment general (try not to use often)	1	0.2
Environment	All options will have negative effect on environment	27	6.4
Environment	Against new viaduct/bridge	6	1.4
Environment	Negative impact on health	6	1.4
Environment	Support uses existing viaduct/bridge	2	0.5
Environment	Option D - Negative effect on environment	2	0.5
Environment	Dual carriageway too noisy - general	2	0.5
Environment	Concerns about loss of Woodland/Wildlife - general	2	0.5
Environment	Concerns about effects on Wensum Valley/River - general	2	0.5
Environment	Option A - Minimum impact on environment	1	0.2
Environment	Option B WEST - Minimum impact on environment	1	0.2
Environment	Option B EAST - Minimum impact on environment	1	0.2
Environment	Option C - Minimum impact on environment	1	0.2
Environment	Option B WEST - Negative effect on environment	1	0.2

Theme	Comment	N° of times mentioned	% of comments
Environment	Option B EAST - Negative effect on environment	1	0.2
Environment	Option C - Concerns about loss/effects of Woodland/Wildlife	1	0.2
Environment	Option D - Concerns about loss/effects of Woodland/Wildlife	1	0.2
Housing/Population	Oppose to/increase in new housing developments/increase in population in area	6	1.4
Most viable option-best solution/meets objectives	Option D - Improves/will reduce rat-running	4	1.0
Neutral	Neutral -Other	29	6.9
Neutral	Alternative route suggestion given	21	5.0
Neutral	Create pedestrian/cycle routes/need better pedestrian/cycle facilities	11	2.6
Neutral	Request for more info/questions asked	8	1.9
Neutral	Provide facilities for sustainable transport nodes	8	1.9
Neutral	Need more road signs/ cameras/speed reductions	8	1.9
Neutral	Roundabouts need to be considered/re-designed	6	1.4
Neutral	Too many roundabouts	5	1.2
Neutral	Improve bus services	4	1.0
Oppose options	Oppose - all options - do nothing/leave as is	38	9.0
Oppose options	Oppose - Option A	12	2.9
Oppose options	Oppose - all options but something needs to be done	10	2.4
Oppose options	Oppose - Option D	9	2.1
Oppose options	Oppose - Option C	5	1.2
Oppose options	Oppose - Option B WEST -Existing bridge	3	0.7
Oppose options	Oppose - Option B EAST - New viaduct route	3	0.7
Other negative comments	Other negative comment - general (try not to use often)	12	2.9
Other negative comments	Not enough information presented	3	0.7
Other negative comments	Proposals are out of date/old fashioned	1	0.2
Rat Running	Option D - will not improve rat-running	2	0.5
Rat Running	Option A - will not improve rat-running	1	0.2

Theme	Comment	N° of times mentioned	% of comments
Rat Running	Option B WEST - will not improve rat-running	1	0.2
Rat Running	Option C - will not improve rat-running	1	0.2
Route/Design	Route is too long	1	0.2
Route/Design	Option C - Route is too long	1	0.2
Support for Options	Support all options/Scheme is needed	40	9.5
Support for Options	Support - Option D	31	7.4
Support for Options	Support - Option C	11	2.6
Support for Options	Support - Option A	3	0.7
Support for Options	Support - Option B WEST -Existing bridge	3	0.7
Support for Options	Support - Option B EAST - New viaduct route	2	0.5
Traffic	Will not reduce traffic/Will add to traffic - general	6	1.4
Traffic	Option D - Will reduce traffic	3	0.7
Traffic	Option C - Will reduce traffic	1	0.2
Traffic	Option A - Will not reduce traffic/Will add to traffic	1	0.2
Traffic	Option B WEST - Will not reduce traffic/Will add to traffic	1	0.2
Traffic	Option B EAST - Will not reduce traffic/Will add to traffic	1	0.2
Traffic	Option C - Will not reduce traffic/Will add to traffic	1	0.2
	TOTAL:	**420**	**100**

Public Letter and Email Comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option D - Better links to other roads/A47/A11	5	2.84
Connectivity	Would reduce journey times/ shortest route/ most direct route	4	2.27
Connectivity	Option A - Option is too far out/not good links	4	2.27
Connectivity	Option C - Better links to other roads/A47/A11	3	1.70
Connectivity	Option D - Improves access to amenities/the town	2	1.14

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option C - Option is too far out/not good links	1	0.57
Connectivity	Option B2 - Option is too far out/not good links	1	0.57
Connectivity	Option C - Option is too far out/not good links	1	0.57
Connectivity	Option B1 - Option is too far out/not good links	1	0.57
Construction	Concern about construction/disruption	1	0.57
Cost	Provides economic benefits	2	1.14
Cost	Cost effective - general	2	1.14
Cost	Option A -Too expensive/not costs effective	2	1.14
Environment	All options will have negative effect on environment	7	3.98
Environment	Option C - Negative effect on environment	5	2.84
Environment	Option B1 - Negative effect on environment	5	2.84
Environment	Option B2 - Negative effect on environment	5	2.84
Environment	Against new viaduct/bridge	4	2.27
Environment	Concerns about effects on Wensum Valley/River - general	4	2.27
Environment	Option D - Negative effect on environment	3	1.70
Environment	Option D - Minimum impact on environment	2	1.14
Environment	Option C - Concerns about loss/effects of Woodland/Wildlife	2	1.14
Environment	Option A - Negative effect on environment	1	0.57
Environment	Concerns about loss of Woodland/Wildlife - general	1	0.57
Environment	Option A - Concerns about loss/effects on Woodland/Wildlife	1	0.57
Environment	Option B1 - Concerns about loss/effects of Woodland/Wildlife	1	0.57
Environment	Option B2 - Concerns about loss/effects of Woodland/Wildlife	1	0.57
Local communities	Option B1 - Will impact on local communities	2	1.14
Local communities	Option B2 -Will impact on local communities	2	1.14

Theme	Comment	N° of times mentioned	% of comments
Local communities	Option C - Will impact on local communities	1	0.57
Local communities	Option D - Will impact on local communities	1	0.57
Most viable option-best solution/meets objectives	Most viable option-best solution/meets objectives	3	1.70
Most viable option-best solution/meets objectives	Option D - Improves/will reduce rat-running	3	1.70
Neutral	Alternative route suggestion given/ suggestion of scheme/ improvement	4	2.27
Neutral	Neutral - Other	3	1.70
Neutral	Create pedestrian/cycle routes/need better pedestrian /cycle facilities	3	1.70
Neutral	Improve bus services	2	1.14
Neutral	Roundabouts need to be considered/re-designed	1	0.57
Oppose options	Oppose - Option A	8	4.55
Oppose options	Oppose - Option B1 -Existing bridge	7	3.98
Oppose options	Oppose - Option B2 - New viaduct route	6	3.41
Oppose options	Oppose - Option C	6	3.41
Oppose options	Oppose - all options but something needs to be done	4	2.27
Other negative comments	Not enough information presented	4	2.27
Other negative comments	Proposals are out of date/old fashioned	2	1.14
Rat Running	Option A - will not improve rat-running	1	0.57
Support for Options	Support - Option D	18	10.23
Support for Options	Support - Option C	7	3.98
Support for Options	Support - Option A	2	1.14
Support for Options	Support - Option B1 -Existing bridge	1	0.57
Support for Options	Support - Option B2 - New viaduct route	1	0.57
Traffic	Option D - Will reduce traffic	4	2.27
Traffic	Option B1 - Will not reduce traffic/Will add to traffic	2	1.14
Traffic	Option B2 - Will not reduce traffic/Will add to traffic	2	1.14
Traffic	Option C - Will not reduce traffic/Will add to traffic	2	1.14
Traffic	Option B1 - Will reduce traffic	1	0.57
Traffic	Option B2 - Will reduce traffic	1	0.57

Theme	Comment	N° of times mentioned	% of comments
Traffic	Option C - Will reduce traffic	1	0.57
	TOTAL:	**176**	**100**

Stakeholder Organisation Letter and Email Comments

Theme	Comment	N° of times mentioned	% of comments
Connectivity	Option D - Better links to other roads/A47/A11	**6**	3.79%
Connectivity	Option D - Improves access to amenities/the town	**7**	4.43%
Connectivity	Option C - Better links to other roads/A47/A11	**2**	1.14%
Connectivity	Option A - Option is too far out/not good links/will not reduce traffic	**3**	1.89%
Connectivity	Option B - Both Too far out/not good links	**2**	1.14%
Cost	Option D - Most cost effective option	**3**	1.89%
Cost	Option A - Most cost effective option	**2**	1.14%
Cost	Option C - Most cost effective option	**3**	1.89%
Cost	Option A -Too expensive/not costs effective	**3**	1.89%
Cost	Option B - Too expensive/not cost effective (both variants)	**1**	0.75%
Environment	Option C - Minimum impact on environment	**7**	5.26%
Environment	All options will have negative effect on environment	**8**	5.06%
Environment	Option B - Negative effect on environment (both variants)	**8**	5.06%
Environment	Option C - Negative effect on environment	**6**	3.79%
Environment	Option D - Negative effect on environment	**7**	4.43%
Environment	Option D - Minimum impact on environment	**6**	3.79%
Environment	Option A - Minimum impact on environment	**4**	2.53%
Environment	Option A - Negative effect on environment	**3**	1.89%
Environment	Option D - Negative impact on historic sites	**2**	1.14%

Theme	Comment	N° of times mentioned	% of comments
Environment	Option A - Negative impact on historic sites	**1**	1.00%
Environment	Option B - Negative impact on historic sites (both variants)	**1**	1.00%
Local communities	Option D - Improves/will reduce rat-running	**9**	5.69%
Local communities	Option B - Will impact on local communities (both variants)	**7**	4.43%
Local communities	Option A - will not improve rat-running	**6**	3.79%
Local communities	Option C - Improves/will reduce rat-running	**3**	1.89%
Local communities	Option B1 - existing bridge - minimum inpact on community	**3**	1.89%
Local communities	Option B - will not improve rat-running (both variants)	**2**	1.14%
Local communities	Option C - will not improve rat-running	**2**	1.14%
Local communities	Local communities - general impact all	**2**	1.14%
Local communities	Option A - Will impact on local communities	**2**	1.14%
Local communities	All - impact businesses/estates	**2**	1.14%
Local communities	Option D - negativeimpact on businesses	**2**	1.14%
Local communities	Option B2 - Improves/will reduce rat-running	**1**	0.75%
Local communities	Rat Running - all options	**1**	0.75%
Local communities	Option C - Will impact on local communities	**2**	1.14%
Local communities	Option D - Will impact on local communities	**2**	1.14%
Local communities	B - Impact on businesses/estates	**1**	0.75%
Local communities	C - Impact on businesses/estates	**1**	0.75%
Other	Other comments and suggestions	**7**	4.43%
Other	Not enough information presented	**3**	1.89%
Other	Concern about loss of existing ped/cycle routes	**2**	1.14%
Other	More info is needed	**5**	3.16%
Other	Provide facilities for/ encourage sustainable transport nodes	**4**	2.53%
Other	Other negative comment - general	**4**	2.53%
	Total	**158**	100.4%

Annex F – Social media response to consultation

An analysis of the comments received on Facebook and Twitter in relation to the Norwich Western Link Options Consultation was undertaken. Over 500 comments were received on Facebook and Twitter.
A variety of issues and comments were raised, mirroring many of the comments raised as part of the consultation feedback analysed in this report. The top 20 comments have been outlined in Table F1.

Table F1: Top 20 most frequently raised comments on social media

Support for options	N° of comments on Facebook	N° of comments on Twitter	Total n° of comments on social media
Support for Option D	198	0	198
Support for Option C	85	0	85
General opposition to the scheme	17	0	17
Do not want any more roundabouts	14	1	15
Alternative route suggestions given	14	0	14
All options will have negative effect on environment	12	1	13
Need more road management such as road signs, cameras/speed reductions, better lane management and junction improvements	13	0	13
Support all options / scheme is needed	12	0	12
Support for Option B WEST	11	0	11
Support for Option B EAST	11	0	11
Option are too expensive/not cost effective	10	0	10
Oppose Option A	10	0	10
Oppose Option C	9	0	9
Scheme would reduce journey times	8	0	8
Not enough information presented / people do not feel their views are being heard	7	1	8
Support for Option A	8	0	8
Oppose Option B WEST	7	0	7
Oppose Option B EAST	7	0	7
Oppose Option D	7	0	7

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