AECOM

A55 / A494 / A548 Deeside Corridor Improvement: Key Stage 2

WelTAG Key Stage 2 Report

Llywodraeth Cymru
Welsh Government

DRAFT

CONTENTS

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Introduction

1.0

1.0 Introduction

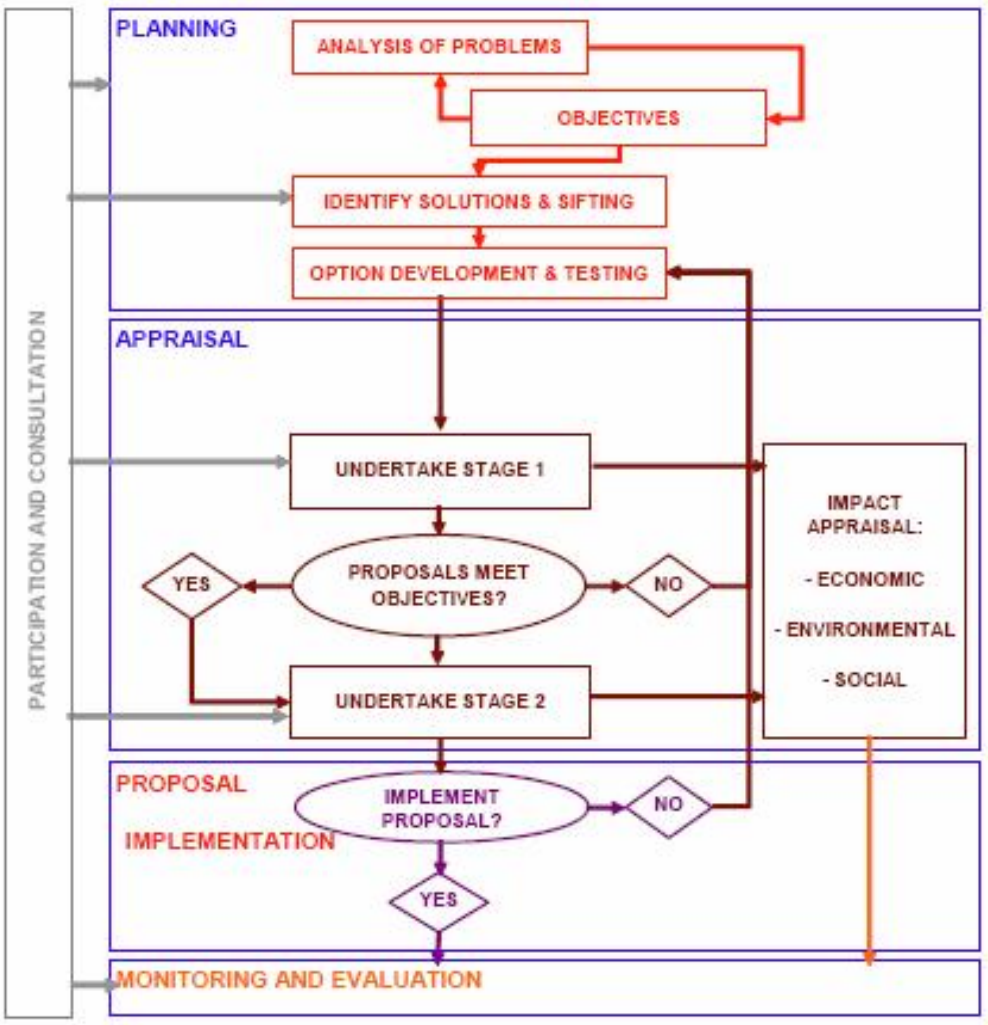
The following chapter describes the scheme background, scope and structure of this document.

1.1 Overview

1.1.1 This report outlines the findings of the appraisal of options for improvements to the A55/A494/A548 corridor. This section of the report provides an overview of the Welsh Transport Appraisal Guidance (WelTAG) process and how it has been applied to the A55/A494/A548 corridor as well as the findings from the previous stages of the study process which have led to the selection of the options appraised as part of this report.

1.1.2 "WelTAG…has been developed by the Welsh Government with the intention that it is applied to all transport strategies, plans and schemes being promoted or requiring funding from the Welsh Government." (source: Welsh Transport Planning and Appraisal Guidance, 2008) Figure 1.1 below outlines the WelTAG process at the scheme level.

Figure 1.1: The Structure of WelTAG at the Scheme Level (source: Welsh Transport Planning and Appraisal Guidance, 2008)



1.1.3 The key findings from the planning stage and Stage 1 appraisal for the A55/A494/A548 corridor are discussed below. This report summarises the findings of the appraisal undertaken as part of Stage 2 of the WelTAG appraisal process.

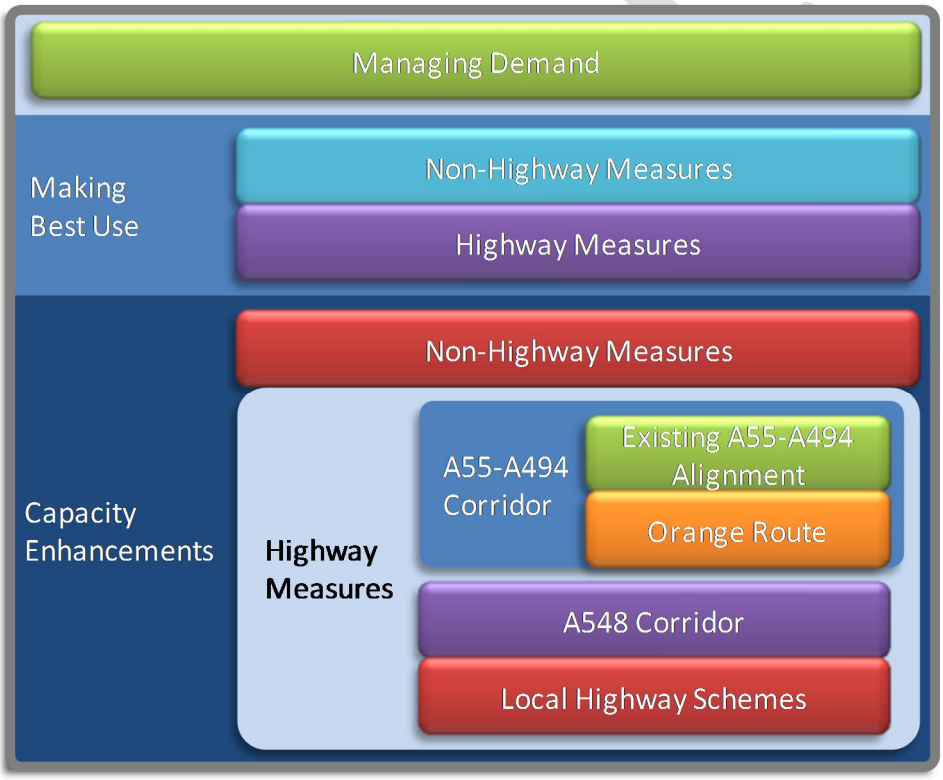
1.2 Previous Work

1.2.1 AECOM were commissioned by the Welsh Government in 2010 to undertake a transport study following the WelTAG process into options for improving the A55/A494 corridor in Northeast Wales. The first phase of this study, The Planning Stage, analysed the key existing problems on the strategic highway corridor and, through consultation, identified a set of transport planning objectives which seek to resolve these problems and address the future needs of the corridor. An initial long list of 82 potential options for the corridor which could contribute positively towards the study objectives were identified at this stage covering all relevant modes of transport and types of intervention. These were appraised against the identified Transport Planning Objectives (TPOs) and a shortlist of potential packages were identified for appraisal at WelTAG Stage 1 under the headings of:

- Managing Demand;
- Making Best Use; and
- Capacity Enhancements

1.2.2 A subsequent WelTAG Stage 1 appraisal was undertaken in 2011. This appraised the above packages, split into highway and non-highway measures to allow an assessment of what could be achieved with and without improvements to the highway. Figure 1.2 outlines the packages of measures appraised at WelTAG Stage 1.

Figure 1.2: WelTAG Stage 1 packages



1.2.3 Appraisal of these options was undertaken against detailed appraisal criteria stipulated by WelTAG under the Welsh Impact Areas of Economy, Environment and Society. The outcome from this initial appraisal was that two packages of measures, which were made up of elements of several of the above packages were identified for consideration at WelTAG Stage 2. These were:

- Package A: Demand Management, Making Best Use and Capacity Enhancements along the existing A55/A494 Corridor.
- Package B: Demand Management, Making Best Use and Capacity Enhancement utilising the A548 Corridor.

1.2.4 The highway capacity enhancement elements of the above packages for the existing A55/A494 corridor and A548 corridor form the basis of the options appraised as part of this WelTAG Stage 2 report. The other non-highway elements of the above packages are being taken forward separately by the Welsh Government.

1.3 Context and Purpose of this Report

1.3.1 This report contains the tertiary element of the WelTAG assessment process for the A554/A494/A548 Deeside Corridor Study; the Stage 2 Appraisal report. This takes the two highway options identified at WelTAG Stage 1 and appraises them in detail against the Welsh Impact Areas of economic, environmental and social concerns. The options are also assessed against the TPOs for the study which have been identified through the Planning Stage process (discussed in section 2 of this report).

1.3.2 The primary aim of this report is to outline the details of the appraisal of options against the Welsh Impact Areas of economy, environment and society, as well as the appraisal against to the TPOs to provide the evidence used to inform the establishment of a preferred option to be recommended to be taken forward to the implementation phase.

1.4 Structure

1.4.1 The remaining sections of this report are structured as follows:

- Section 2 outlines the transport planning objectives identified for the study
- Section 3 describes the current conditions on the existing highway network
- Section 4 describes the options for improving the network under consideration at this time
- Section 5 outlines the approach used to model the options and the traffic impacts of each option
- Section 6 outlines the findings from the economic appraisal of the options
- Section 7 describes the findings from the environmental appraisal of the options
- Section 8 discusses the findings from the social appraisal of the options
- Section 9 summarises the appraisal findings across all of the impact areas
- Section 10 outlines the proposed approach to monitoring and evaluation to be adopted
- Section 11 describes how the option appraisal aligns with the objectives of the Well-being of Future Generations Act
- Section 12 outlines the next steps in the development of the project

TRANSPORT PLANNING OBJECTIVES

2.0

2.0 TRANSPORT PLANNING OBJECTIVES

2.1 Overview

2.1.1 This section of the report discusses the key national and local policy objectives and how these have informed the Transport Planning Objectives (TPOs) for the study.

2.2 Planning Factors

2.2.1 Well-being of Future Generations Act

The TPOs for this study were produced in 2010 ahead of the Well-being of Future Generations (Wales) Act 2015 (WFGA) coming into force. We have therefore reviewed the objectives identified to confirm that they still comply with the requirements of the act.

The WFGA outlines the overarching aims of the Welsh Government, which aims to improve social, economic, environmental and cultural well-being across Wales for future generations. This aligns with the WelTAG process adopted as part of this project which appraises options against criteria under the headings of economy, environment and society.

The WFGA places a requirement on public bodies including Welsh Ministers and Local Authorities to act in a sustainable way considering the requirements of future generations. This document also puts a requirement on all public bodies to set and publish their own 'well-being objectives' that are designed to maximise its contribution to achieving each of the well-being goals.

This policy places a requirement on the WG to ensure that the preferred option design for the A55/A494 corridor meets the needs of future generations.

2.2.2 People, Places and Futures – The Wales Spatial Plan Update 2008

The Wales Spatial Plan Update (2008) is a 20 year plan for the sustainable development of Wales. This document identifies the area containing Wrexham, Broughton, Mold, Connah's Quay and Deeside as a key hub in the North East Wales area, with many key business sectors located in the area, but also containing areas in need of regeneration. It also recognises the importance of the strong national connectivity to Chester and Northwest England beyond this.

2.2.3 Wales Transport Strategy

The Welsh Government has a devolved responsibility for a number of policy areas for Wales, including of particular relevance to this project; transport, planning, and economic development. The 2008 Wales Transport Strategy outlines the strategic aims of the Welsh Government in relation to transport as:

- Reducing greenhouse gas emissions and other environmental impacts;
- Integrating local transport;
- Improving access between key settlements and sites;
- Enhancing international connectivity; and
- Increasing safety and security.

2.2.4 Wales National Transport Finance Plan

The National Transport Finance Plan, published in 2015 outlines, how the outcomes set in the Wales Transport Strategy will be delivered. The plan identifies the development of a scheme of improvements to the A494/A55/A548 Deeside Corridor as a priority road scheme for the period 2015 to 2020 and beyond.

2.2.5 Ministerial Task Force on North Wales Transport, 2014

This task force undertook a review of the transport issues in North Wales and made a series of recommendations regarding prioritised transport projects based on an appraisal process including:

- Benefit to the economy and jobs in north Wales
- Pinch points – congestion reduction
- Environmental impact
- Deliverability
- Value for money

The task force identified capacity enhancements/pinch point improvements on the strategic highway network, including the A55 and A494 as a strategic high level transport intervention following this appraisal process.

2.2.6 North Wales Joint Local Transport Plan 2015

This document pulls together the transportation aspirations for the six local authorities within North Wales. It provides a strategy for Anglesey, Conwy, Denbighshire, Flintshire, Gwynedd and Wrexham areas. The LTP provides the strategy for identifying and delivering improvements to the transport system within North Wales over the next 15 years. The key objectives of this document are:

- Efficiently meeting North Wales' diverse transport needs
- Raising the profile and performance of public transport services in North Wales
- Reducing congestion and journey times
- Supporting the development of towns and other key centres to increase their economic viability and to promote sustainable development and environmental improvement.
- Maintaining safe, efficient, more sustainable transport networks.
- Improving rail services for North Wales
- Environmentally-friendly and efficient freight movement
- Establishing an integrated North Wales traffic monitoring, information and control network and seeking to promote more sustainable travel behaviour
- Increasing current levels of cycling and walking by residents and visitors

The plan also identifies the A55/A494 route into Wales as a location where resilience improvements are required.

2.2.7 Wales Freight Strategy 2008

In 2007/8, a Freight Strategy for Wales was prepared and consulted on by the Welsh Government which set out the high-level aims and policies for freight transport and identified a series of 'steps' towards their delivery. A high priority was placed on freight transport in playing its part in ensuring a sustainable environment.

The key objectives of the Freight Strategy (One Wales Connecting the Nation: The Wales Freight Strategy 2008) were to minimise the need for transportation of freight by encouraging local sourcing and the development of distribution networks; minimise the environmental impact of freight by encouraging modal shift from road to rail, water, and air; and make the best use of the existing infrastructure in facilitating the needs of freight.

The WFS also identified a number of strategic issues including the following issues of specific relevance to the study area, including:

- The role of the A494 /A55 as connecting the Port of Holyhead and the North Wales Coast to the motorway network on Merseyside
- The number of freight vehicles using North Wales Ports was in the region of 172,000. In 2008, the figure accounted for 75% of the freight vehicles to / from Ireland. By 2014, the volume of freight vehicles that had gone through the Port of Holyhead had increased to approximately 360,000.

2.2.8 Report of the Wales Freight Working Group (2014)

Subsequently the Freight Task & Finish Group was set up in 2013 to advise the Welsh Government on strategic issues affecting freight with a focused on regions with high demand and capacity for freight. The group submitted its report to the Government in March 2014, which included 24 recommendations. The recommendations which are most relevant to freight and the Deeside Corridor are provided below:

- The Welsh Government delivers as quickly as possible all the commitments it has made to improving and enhancing the A55 expressway in North Wales.
- The Welsh Government delivers as quickly as possible the commitments it has made to improving the A494/A483

2.3 Transport Planning Objectives

2.3.1 The above policy documents, as well as the problems and opportunities identified for the study area through the analysis of evidence and stakeholder feedback as part of previous stages of the WelTAG process have informed and confirmed the identification of the below Transport Planning Objectives (TPOs) for the study. These objectives were also consulted on as part of the study Public Information Exhibition in 2015:

1. To reduce journey time variability and enhance the transport network resilience of the A55/A494 study corridor to periods of high demand, incidents and maintenance events.
2. To improve transport connections for businesses within the study area to key economic centres and employment sites.
3. To improve access between employment sites and workforce catchment areas.
4. To improve the actual and perceived safety and personal security of all transport users along the A55/A494 study corridor.
5. To improve the permeability across the A55/A494 corridor for non-motorised modes at key point of desire.
6. To ensure that the study area transport network facilitates necessary national and regional trip movements of people and freight.
7. To reduce carbon emissions from transport along the A55/A494 study corridor.
8. To minimise adverse impacts on the human environment including air, noise and light pollution, and landscape and townscape.
9. To minimise adverse impacts on the natural environment including local air quality, water and soil pollution, and biodiversity impacts.
10. To maintain and make more efficient use of the existing transport infrastructure along the A55/A494 study corridor.

2.3.2 These objectives have informed the selection of options for the A55/A494 corridor to date and in considering the relative merits and consultation responses the forthcoming identification of any preferred option to be taken forward.

EXISTING CONDITIONS

3.0

3.0 EXISTING CONDITIONS

3.1 Overview

3.1.1 This section of the report describes the current status of the A55/A494 corridor and the existing conditions present on the highway network within the study area.

3.2 Description of the Study Area

3.2.1 The study area extends from the west of Northop, Flintshire to the border with England just east of the Deeside Interchange (refer to Figures 1.1, 1.2 and 1.3). Undulating farmland with smaller settlements in the west and south contrasts with the urban and industrial landscape of the Dee Estuary and Deeside Industrial Park.

3.2.2 The two route corridors under consideration ('Blue' and 'Red') share a common line west of the existing Northop junction (A55 – A5119) before diverging to pass respectively to the south or north of Connah's Quay. The corridors meet again at the Deeside Interchange and lead north-eastwards on the existing A494 towards the A550 and M56.

3.2.3 West of Northop, inland settlements are mostly situated on undulating higher ground of ridges and plateaux in agricultural use. Northop lies at an elevation of around 100m AOD, and the existing A55 follows this elevation south-eastwards to Ewloe. To the south of this area of rolling landscape, the land rises further to 150m AOD around Buckley. To the north, the southern slopes of the Dee Valley descend quite steeply to around 5m AOD at the floodplain. On the southern bank of the River Dee the floodplain is relatively narrow and densely developed, but across the river it extends northwards for approximately 2km. The Deeside Industrial Park, containing various heavy and light industries, together with the settlement of Garden City and the proposed 'Airfields' development area, are all situated here.

3.2.4 Urban settlement dominates land use along much of the A494 from Queensferry as far as the Ewloe Interchange and on the A55 south of Northop Hall.

3.2.5 Garden City comprises mainly residential development on reclaimed land on the north bank of the River Dee. Garden City was originally developed to house workers of the Shotton Steelworks and comprises a mix of semi-detached and terraced housing.

3.2.6 Further south lies Queensferry main town centre located approximately 500 m to the south-west of the River Dee. Between the existing Dee Bridge and the town centre lie small business parks and isolated commercial premises such as car showrooms. The existing A494 runs close to the main street to the east, separating the town centre from the industrial estate. Immediately across from the Dee on the east side of the A494 is the Queensferry Pumping Station in an area of previously developed land where various informal light industrial commercial business are located.

3.2.7 Shotton lies to the west of Queensferry and comprises an extensive settlement of post-war housing and associated schools, a college and Deeside Community Hospital that lies on rising ground on the lower slopes of the Dee valley. The housing area is contained by the Wrexham - Bidston railway, which passes close to the historic small village of Higher Shotton.

3.2.8 Further south along the A494 at Aston Hill and towards Ewloe, an extensive area of modern housing occupies the land to the east of the A494. The housing stock is modern with extensive new estates contained by the route of the A55 in the south. The St David's Park business park lies within this area, acting as a buffer between much of the housing area and the A494. This includes modern office buildings, a hotel and a public house.

3.2.9 Between the interchange with the A55/A494 at St David's Park, Ewloe and the existing Junction 33 with the A5119 at Northop, the existing A55 road corridor is more rural and passes through a mixture of predominantly pasture land, some arable land and to a lesser extent woodland and plantation.

3.2.10 Along the Red Option from west to east, the settlement of Northop is positioned within a sheltered, relatively level area at the cusp of the Dee Valley side and Clywdian Hills and also has a significant historic core which is a conservation area.

3.2.11 On the northern edge of the study corridor, suburban Flint spreads up onto the lower slopes of the Dee Valley hillside above the historic core of the town which is located on the floor of the Dee Basin.

3.2.12 The small settlement of Kelsterton lies on the south bank of the River Dee separating the larger settlements of Flint and Connah's Quay.

3.2.13 North of the River Dee, residential development is largely absent other than the village of Shotwick which lies to the west of the existing A550/A494 junction in the unitary authority of Cheshire West and Chester.

3.2.14 The River Dee, tidal and canalised west of Chester, is the principal watercourse draining the study area. Minor tributaries include Northop Brook / Lead Brook, which forms a steep-sided, wooded valley leading to Oakenholt; Wepre Brook which also flows in a wooded valley that separates the urban area of Connah's Quay from Shotton; and Broughton Brook and its tributaries. Broughton Brook runs through Hawarden Park and descends the valley side before running parallel to the River Dee and into the Queensferry Drain. Land north of the River Dee is drained by a network of ditches and artificial balancing ponds within the industrial estate.

3.2.15 The underlying geology includes sandstone, gravels, clay and coal measures and the landscape has been influenced by a long history of mining and quarrying. Before the mines and quarries the land was farmed, and numerous farmsteads remain. These vary in age and size, as do the fields, with larger fields being located within the south-eastern part of the study area and smaller fields in the central and north western parts.

3.2.16 Outside the extensive built-up areas, a well-established agricultural landscape survives with hedgerows and specimen trees, particularly in the south east, around Hawarden Castle. The woodlands of Hawarden Park and Bilberry Wood beyond are the only major woodlands within the study area, although the woodland in the Wepre valley provides containment to the study area to the north and a ribbon of ancient woodland fills the steep-sided Leadbrook valley flowing north from Northop. Other trees are now grouped along transport routes such as the A494(T) and along disused railways, and around the remnants of former collieries.

3.2.17 The area contains a number of sites which have been designated in response to their nature conservation interest. These are the River Dee and its estuary (designated as the River Dee Special Area of Conservation (SAC), River Dee SSSI and the Dee Estuary Special Protection Area (SPA)), the Connah's Quay and Woodlands SSSI, Maes y Grug SSSI, the Deeside and Buckley Newt Sites SAC and Buckley Claypits and Commons SSSI.

3.2.18 The original system of roads developed between the historic settlements of Hawarden and Northop, and along the valley side between farming settlements such as Mancot and Higher Shotton. These roads survive and can be distinguished by their organic form and alignment that follows the grain of the landscape.

3.2.19 Later transport links have a greater impact on the landscape and were influenced by the industrial development of the area. The extraction of clay and of coal led to the development of the Dee as a waterway and to the industry along its southern bank. The railway follows the Dee on its way around the North Wales coast and this helped expand the industrialisation of the narrow southern Dee floodplain. A second railway was built linking Wrexham and Mold with the coastal route. A later, further link was extended across the Dee to serve the Wirral, passing close to Hawarden as it cuts through the study area.

3.2.20 The river crossing at Queensferry has had a significant influence on this landscape. The original ferry was replaced by a bridge, the town expanded and the roads were modernised, with links to Hawarden and Mold. The rapid rate of industrial development during the nineteenth and twentieth century saw the expansion of the mines, quarries and associated industries. The housing areas also expanded, the bridge allowing easy access for commuters to industrial areas to the north of the Dee and to the RAF camp at Sealand.

3.2.21 Ultimately, the construction of the A494 dual carriageway has been the defining influence on this landscape. This major transport link dominates the areas of housing and farmland to either side and is visible and audible over a much wider area. Remnants of the pre-industrial landscape remain and there is significant visual, cultural and ecological interest within it.

3.3 Existing Highway Network

3.3.1 The A55/A494 corridor section of the trunk road within the study area forms part of route E22 of the Trans European Road Network linking Ireland, the UK, Netherlands, Germany and Sweden. A map showing the existing highway network is shown in Figure 3.1.

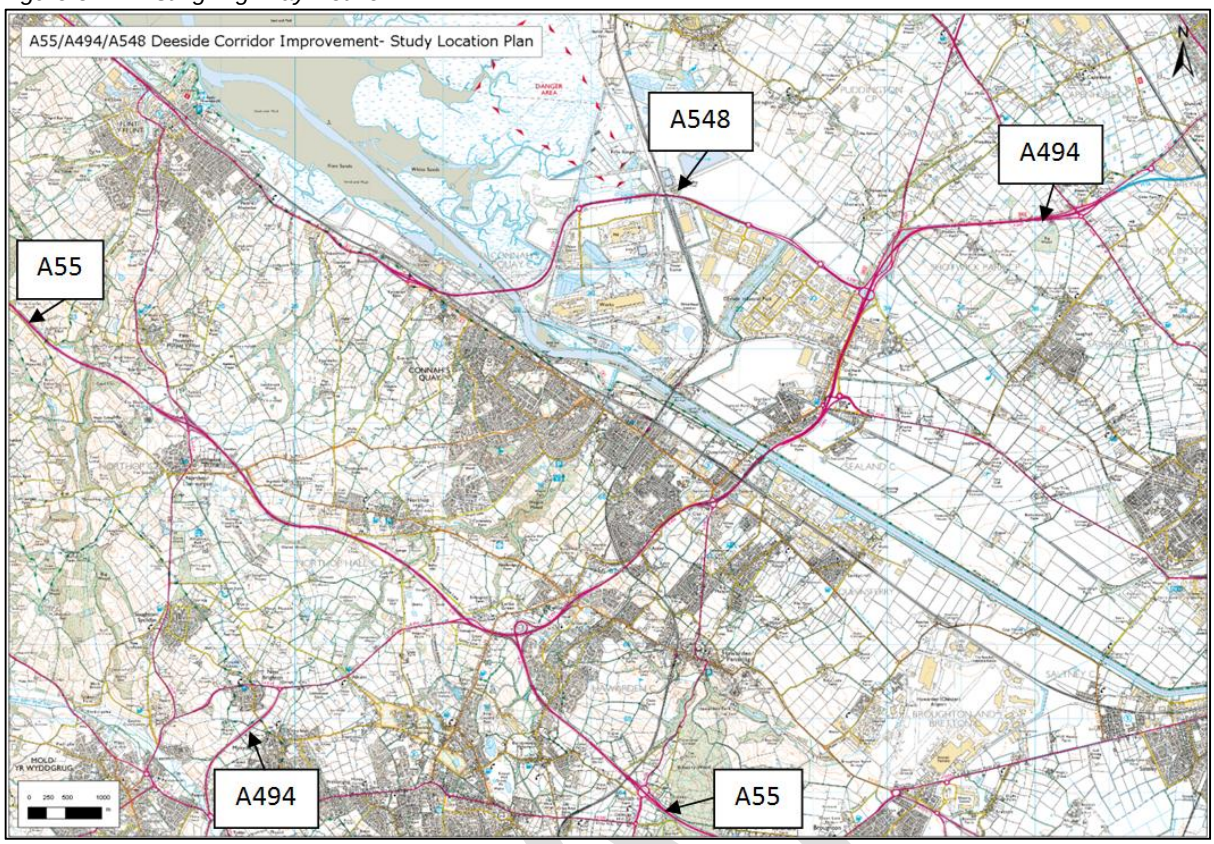
3.3.2 The section of A55 within the study area is a dual-carriageway link between the Ewloe grade-separated interchange with the A494 and the Northop grade-separated interchange with the A5119. This section of the trunk road also provides access to the A494 towards Mold, A55 Chester West services, Pinfold Lane (westbound), B5126 (westbound off-slip only), Northop Hall (eastbound) and Northop Hall services. Many of these on and off slips are below the current recommended highway design standard. To the east of the study area the A55 continues past Broughton to the south and west of Chester where it joins the M53. To the west of the study area the A55 provides a dual-carriageway link towards North-West Wales and Anglesey.

3.3.3 The A494 within the study area is a dual-carriageway link between the A550 / A5117 at the English / Welsh border and the Ewloe grade-separated interchange with the A55. This section of the A494 provides direct access from the trunk road to areas of Ewloe and Queensferry, many of these on and off slips are also below the current recommended highway design standard. The section between the English / Welsh border and the River Dee bridge has recently been improved and consists of 2 or 3 lane dual-carriageway, although a sub-standard alignment exists approaching the River Dee Bridge. The section between the River Dee Bridge and Ewloe interchange consists of 2 lane dual-carriageway via Aston Hill.

3.3.4 Other routes in the study area include:

- A548 Flint – Deeside Industrial Park - Chester
- Western section links Flint with the Deeside Industrial Park and the A494 / A550 via the Flintshire Bridge;
- Eastern section links the A494 at Deeside Industrial Park via Sealand with Chester
- A550 South Wirral – Queensferry – Hawarden - Penyffordd
- Northern section links south Wirral with the A494 near the English / Welsh Border
- Southern section links Queensferry via Hawarden with the A55 dual-carriageway and onwards towards Penymynydd and Penyffordd.
- B5129 Kelsterton – Queensferry - Saltney
- provides a link from the A548 through the communities of Connah's Quay, Shotton and Queensferry to the A494 and onwards via Sandycroft and Hawarden Airport (Airbus) to Saltney;
- B5126 between Northop and Connah's Quay via Wepre.
- B5125 between Northop and Ewloe via Northop Hall.

Figure 3.1: Existing Highway Network



3.4 Traffic and Public Transport

3.4.1 Traffic Flows

The A55/A494 corridor through Deeside provides a key part of the strategic trunk road network in north-east Wales providing the link between the M56 and the A55 north Wales corridor, it also serves local traffic accessing areas including Deeside Industrial Park, Queensferry, Connah's Quay, Ewloe and Northop. The Average Weekday Daily Traffic flows for a neutral month in 2015 are shown in Table 3.1, with heavy goods vehicles accounting for 8% of these vehicles.

Table 3.1: Average Weekday Daily Traffic and % HGVs on the A55/A494 corridor

Location	Direction	AWDT	% HGV
A494 (Queensferry – River Dee)	Eastbound	35,900	8%
	Westbound	36,600	8%
A55 (Ewloe – Northop)	Eastbound	28,000	8%
	Westbound	29,600	8%

Traffic flows along the A55/A494 corridor are highest in the morning and evening peak hours, peak hour traffic flows are shown in Figure 3.2 and 3.3.

Peak traffic flows are tidal, with higher flows eastbound in the morning peak and westbound in the evening peak. On the A494 in the morning peak hour eastbound flows are 39% higher than westbound flows, whilst in the evening peak hour westbound flows are higher than eastbound flows by 34%.

Figure 3.2: 24hr Traffic Flow Profile – A494 Queensferry

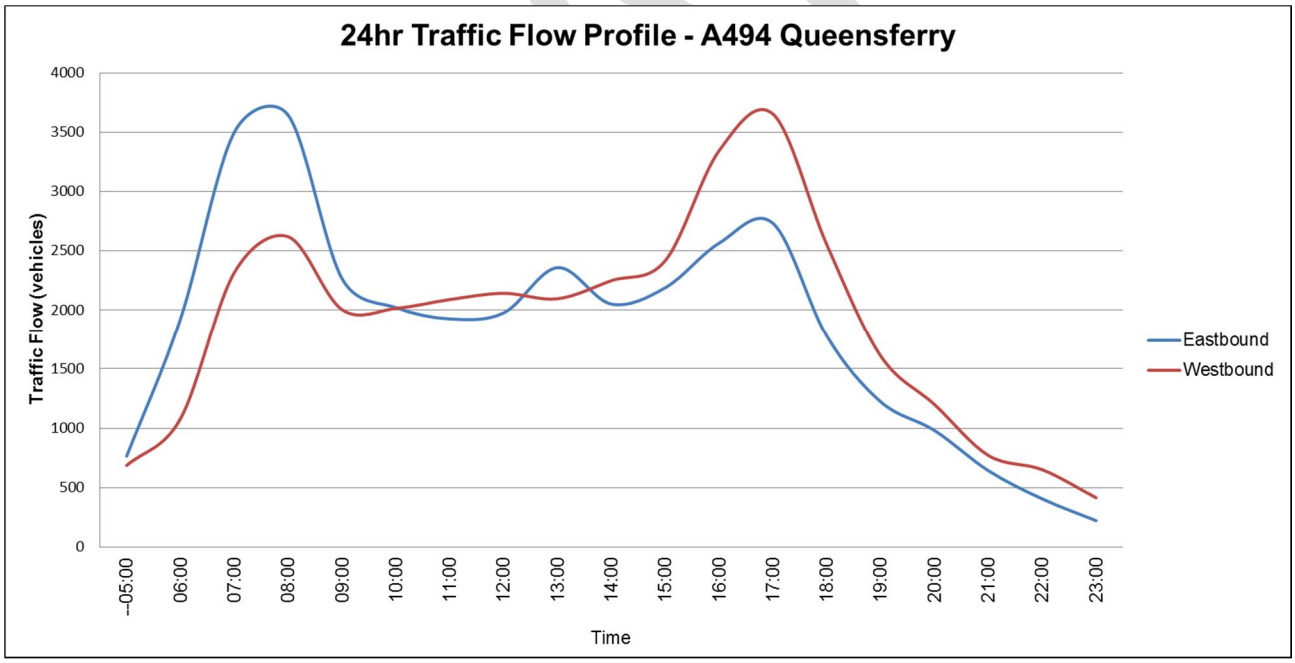
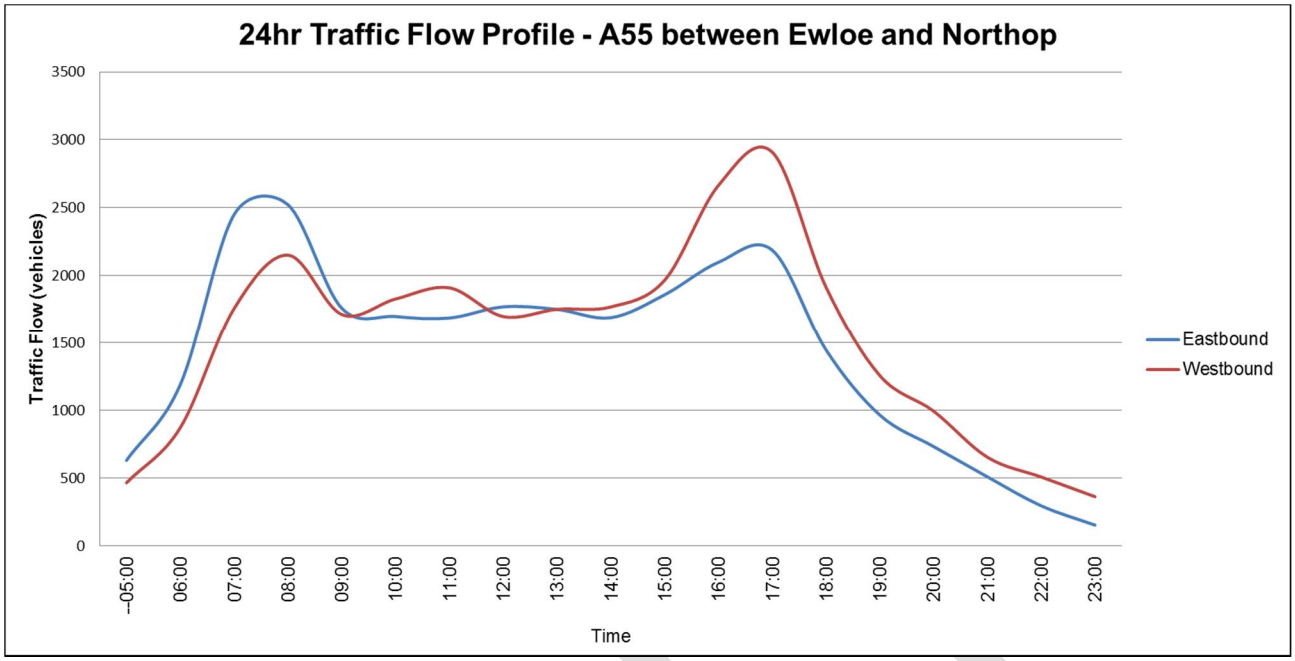


Figure 3.3: 24hr Traffic Flow Profile – A55 between Ewloe and Northop



Traffic flows on Fridays and eastbound flows on Sundays are often higher than Average Weekday Daily Traffic flows, as shown in Table 3.2. On the A494 traffic flows westbound on Fridays are 18% higher than average weekday flows, on the A55 between Ewloe and Northop this increases to over 28%. On Sundays, traffic flows on the A55 eastbound are 13% higher than average weekday flows.

Table 3.2: Average Daily Traffic Flow – Mon-Thurs, Friday, Saturday and Sunday

Location	Direction	Mon-Thurs	Friday	Saturday	Sunday
A494 Queensferry	Eastbound	35,000	37,000	28,600	34,500
	Westbound	35,600	43,300	32,200	26,500
A55 (Ewloe – Northop)	Eastbound	26,200	29,800	25,500	31,600
	Westbound	27,700	38,000	28,200	22,400

3.4.2 Congestion and Delays

There are often reduced speeds and congestion particularly in the evening peak hour in the south-westbound direction on the A494 where the road narrows to two lanes and crosses the River Dee. The A494 heading westbound along the corridor has a relatively steep gradient at Aston Hill which causes HGV speeds to reduce. HGVs overtaking other vehicles at this location effectively reduce capacity and can cause congestion at peak times In addition, there are sub-standard slip roads particularly on the A55 at Northop Hall and A494 at the Plough Lane junction and Old Aston Hill, which present a safety hazard for drivers using these junctions to access the strategic corridor.

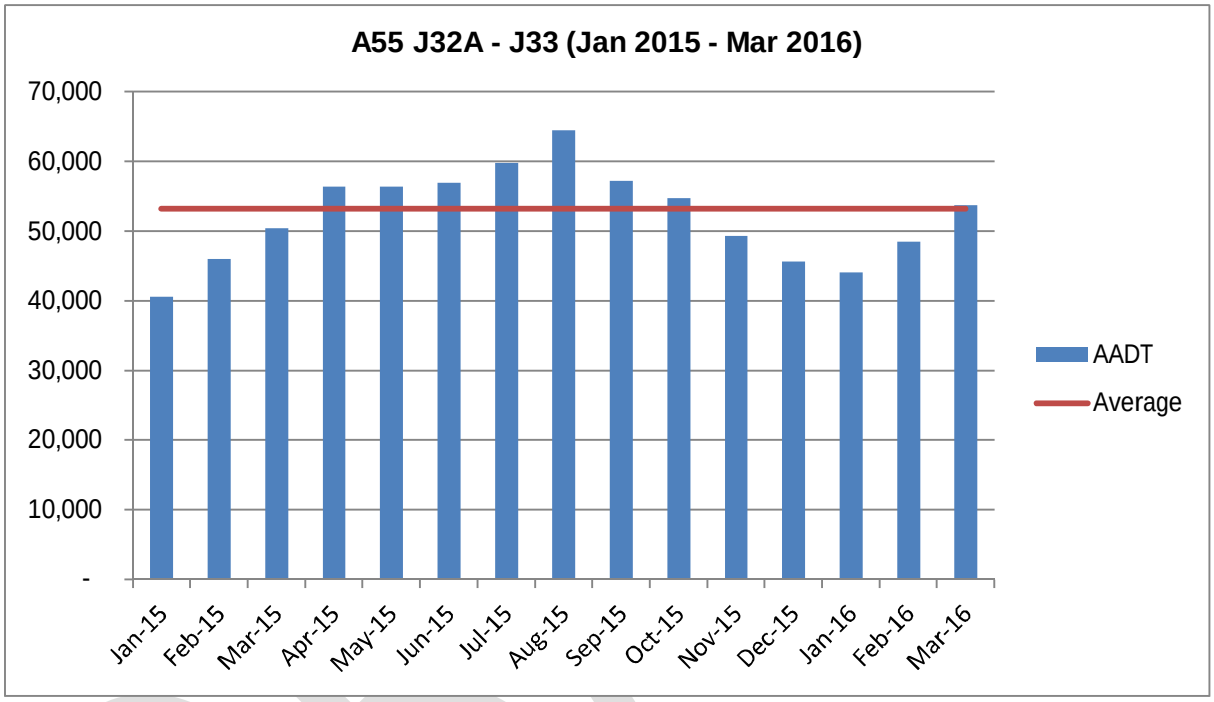
Distances between some of the junctions along the corridor such as between Ewloe Interchange and St David's Park junction are below modern design standards. This requires drivers of vehicles to make numerous lane changes and weaving movements, which is particularly evident at Ewloe Interchange and St David's Park junction. These short weaving sections reduce capacity which causes congestion.

Along the A494 between Ewloe Interchange and the English/Welsh border average travel times increase from just under 6 minutes in the off peak to nearly 8 minutes in the morning peak hour for the peak eastbound direction. In the peak westbound direction, travel times increase from 6 minutes in the off peak to 7 minutes and 30 seconds in the evening peak hour.

3.4.3 Seasonality: Analysis of traffic levels through the year

The Average Weekday Daily Traffic (AWDT) annual flow profile for the Traffic Wales permanent traffic counter site on the A55 between junction 32a and junction 33 is shown in Figure 3.4. Traffic flows peak during August, a consequence of holiday traffic heading to and from North Wales. Traffic flow is observed to be at its lowest between December and February, with higher than average traffic flows between April and September. High traffic flows affecting journey times are experienced along the corridor over the summer months particularly on Friday evenings and Sunday afternoons.

Figure 3.4: A55 (J32A-J33) Two-way AWDT Annual Profile



3.4.4 Resilience

There are resilience issues along the existing A55/A494 corridor with higher traffic flows and longer journey times on Friday afternoons. Traffic flows regularly exceed capacity in the morning and evening peak hours causing congestion and delays. Combinations of the traffic flow issues on the corridor, such as high peak hour tidal traffic flows, higher than average holiday and seasonal traffic flows and slow HGV speeds on Aston Hill can cause severe traffic delays. The lack of resilience along the corridor is particularly apparent when incidents such as vehicle breakdowns occur, causing an obstruction and resulting in severe delays to other road users.

3.4.5 Through Traffic

A significant proportion of traffic using the A55/A494 corridor is 'through traffic' (i.e travelling along the corridor between Northop and the English/Welsh border). On the A494 at Queensferry 'through traffic' accounts for 29% eastbound and 30% westbound, and on the A55 between Ewloe and Northop 'through traffic' accounts for 36% eastbound and 38% westbound. The lower percentages of through traffic on the A494 compared to the A55, are due to more local traffic using the strategic A494 corridor through Queensferry.

3.4.6 Local Road Network

There is traffic congestion on the surrounding local roads; it is likely that drivers choosing local routes to avoid delays on the strategic road network contribute to local congestion. Congestion on the local road network regularly occurs on the A550 through Hawarden, the A549 through Buckley, the B5125 between

Northop and Ewloe, and the B5129 through Shotton and Connah's Quay. Journey times along the B5129 between the A548 at Kelsterton and the A494 at Queensferry are shown in Table 3.3.

Table 3.3: Journey times along the B5129 through Shotton and Connah's Quay

Location	Direction	Morning Peak	Inter-peak	Evening Peak	Off Peak
B5129 between Kelsterton and Queensferry	Eastbound	11mins	11mins	13mins	8mins
	Westbound	10mins	11mins	11mins	8mins

This demonstrates that there is delay along the B5129 at most times during the day when compared to off peak uncongested journey times. For example, in the evening peak in the eastbound direction, journey times increase by 5 minutes (over 60%) when compared to uncongested journey times.

3.4.7 Public Transport

Public transport provision across the study area consists of rail services providing for commuters and longer distance journeys, and local bus services.

The rail lines in the study area are described below, typically there are 1-2 trains per hour on each of these lines:

- The Borderlands Line (Wrexham - Bidston), stations on this line within the study area include Buckley, Hawarden, Shotton High Level and Hawarden Bridge; this line also provides a link for longer distance services to Birkenhead and Liverpool.
- North Wales Coast Line (Rhyl - Chester), stations on this line within the study area include Flint and Shotton Low Level; this line also provides a link for longer distance services between Holyhead / Bangor / Llandudno.
- Chester to Shrewsbury Line (Chester - Wrexham), there are no intermediate stations on this line within the study area; this line also provides a link for longer distance services to Shrewsbury, Birmingham and mid Wales.

Local bus services link numerous locations throughout the study area, although frequencies on most routes are limited to 1-2 buses per hour. Key bus corridors include the B5129 through Connah's Quay and Shotton, with several services routeing via Mold, Buckley, Hawarden, Broughton and Chester.

The public transport mode share for motorised journeys (excluding walking and cycling) within the Deeside study area is typically 4%. The public transport mode share for journeys starting or finishing within the Deeside study area is also about 4%, increasing up to 8% for longer distance journeys to and from North Wales that travel through Deeside and follow a rail corridor, such as Llandudno to Manchester.

3.4.8 Freight

- **Localised Vehicle Routing Choices**

There is an 8-mile difference in route length between the route south of Chester (A55-M53-M56) and the northern route (A55/A494/A5117/M56). As such, the northern route, which utilises the A494, is the route of choice for the majority of cross-border freight traffic . This routing also is preferred for freight traffic approaching from the North West of England to access Deeside Industrial Estate. Traffic for the other nearby main freight generator at Wrexham Industrial Estate will typically use the M56 / A55 / A483 routing.

For traffic flows to / from the Deeside Corridor which is travelling to / from the West Midlands and beyond the preferred routing will be via the A494 / A55 / A483 / A41 routes. This routing includes both domestic traffic and transit traffic bound to / from Ireland via the Port of Holyhead and would be unaffected by any alternative route.

- **Lorry Parking**

Within the area, there is limited provision of dedicated overnight lorry parking on the Deeside Corridor, which is the preferred route for the majority of cross-border freight traffic. Dedicated lorry parking provision in the area includes 8 spaces at the BP Service Station, A548 Ringway.

- **Journey Time Reliability**

  The study area road network is unable to cope with traffic volumes in peak hours, which leads to poor journey time reliability for freight deliveries. The absence of hard shoulders, on key routes such as the A55/A494 means that the roads are increasingly susceptible to incidents such as vehicle breakdowns or tyre incidents.

  HGVs overtaking each other on a dual carriageway where top end speed difference is marginal can take a considerable amount of time and lead to localised congestion.

- **Platooning of Traffic**

  The route is heavily used by HGV traffic to and from the Port of Holyhead and port traffic may account for 16% of all freight at certain times. Platooning of traffic on the A55 is caused when large Roll-On Roll-Off ships unload in a relatively short period; in practice around 200 HGVs plus additional cars can leave the Port of Holyhead within a 15 minute period. 98% of freight traffic through the Port of Holyhead is Roll-On Roll-Off1.

- **Freight Trip Generators**

  The study area forms part of the preferred cross-border route for freight traffic. The top industry sector category of vehicles using the A55/A494 was general haulage followed by the building sector, then waste5.

  The area houses a significant number of key freight trip generators and attractors including Holyhead Port, Airbus UK and Deeside Industrial Estate, which is home to the following organisations:

  1. Chemistry Lane – Knauf Works, Great Bear, SP Energy, Veolia Environment, Allen Morris, Promins, Parcelforce,
  2. Princes West Avenue – Topmix, Go parx, Recycling, Tasties Sandwiches, Crump
  3. Glendale Business Units – small units, parking issue
  4. Queensferry Industrial Estate
  5. Pentre Retail Site – Makro, Red Moose
  6. Spencer Industrial Estate – A.D. Waste
  7. Drury Lane Industrial Estate – Jewson, Linde, Paul Bentley
  8. Sandycroft – Grampian Country Foods, Hewdens
  9. Deeside Industrial Estate, Tata Steel, UPM Keymenne, Toyota, Morrison's Manufacturing Centre, Great Bear Distribution

  There also are a number of quarries along the A494 resulting in a higher proportion of aggregates traffic than the surrounding areas.

- **International hauliers**

  Within the project area, a previous study5 has shown that approximately 6% of traffic on the A55/A494 is international, twice the national average of 3%. Statistics show that international drivers of which the majority are left hand drive have higher accident rates and a higher tendency for vehicles not reaching the UK HGV standards.

- **Lack of Rail Freight Terminals**

  Within the study area there is minimal use of the network for rail freight and a lack of freight terminals. The only existing site is located at within the Tata Steel Site at Shotton accessed through the Dee Marsh Sidings off the Wrexham – Bidston Line which is used for the reception of steel coils from South Wales. Rail Freight has a significantly lower mode market share in North Wales estimated at less than 1% as compared to a UK average of in the region of 10%.

[1] Report of Freight Task and Finish Group 2014 (Annex B)

3.5 Accidents

3.5.1 STATS 19 accident data has been obtained from www.data.gov.uk to determine the baseline data for the transport safety appraisal. Road traffic accident and casualty data have been obtained for the 5 year period from 2011 to 2015 for the A55/A494/A548 Deeside corridor study area. A comparison of accidents by road type is shown in Table 3.4, this shows a broadly similar picture between local and national statistics.

Table 3.4: Comparison of Local and National Accident Proportions by Road Type

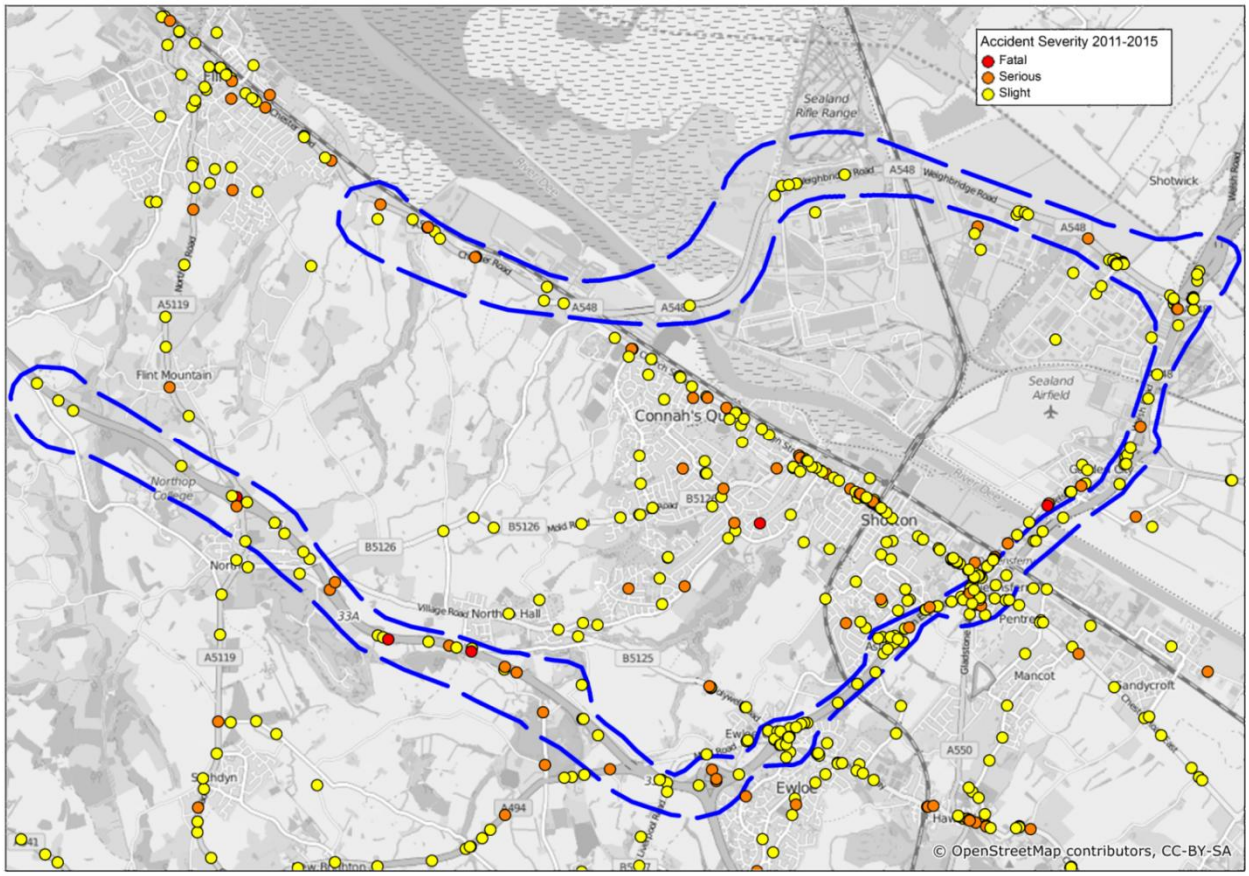
	Deeside Study Area		National Averages[2]
Road Type	Number	Percentage	Percentage
Motorway	0	0%	4%
A Roads	500	51%	46%
Other Roads	569	49%	50%

3.5.2 Accident proportions by casualty type are shown in Table 3.5, the accident locations are shown on Figure 3.5.

Table 3.5: Road Traffic Accident Proportions by Casualty Type (2011 – 2015)

Accident Type	Number	Percentage
Fatal	14	1%
Serious	191	18%
Slight	864	81%
Total	1069	100%

Figure 3.5: STATS 19 Accident Data Plot (2011 – 2015)



3.5.3 51% of all accidents within Flintshire occurred on A-roads, 20% on B-roads and 29% on unclassified roads. Noticeable accident clusters occur at the A548/Parkway Roundabout near Deeside Industrial Estate. Similarly, accident clusters are also observed at the A494 Queensferry Interchange and A55/A494 Ewloe Green Interchange. The A55 near Northop Hall exhibits a higher proportion of 'serious' and 'fatal' accidents as a result of higher vehicle speeds.

3.5.4 On the local road network, a significant number of accidents are also located on the B5129 High Street as a result of a high density of potential hazards (e.g. large number of junctions, on-street parking and pedestrians). There is also a cluster of accidents in Hawarden on the A550 and B5125.

3.5.5 In some locations, such as Ewloe Interchange, the current highway layout is perceived as unsafe, it is likely that drivers make allowance for the perception of risk by reducing speed, with a resultant impact on the accident rates at this location; the accident rate observed along the A55/A494 corridor is not significantly different from the rate observed on dual carriageways.

3.6 Key Environmental Issues

3.6.1 The environmental appraisal of the two options follows the nine environmental topic headings based on WelTAG and DMRB guidance:

- Noise, particularly the effect where traffic is or would be close to residential property and schools;
- Local Air Quality in the form of nitrogen dioxide and small particles emitted by vehicles, which are recognised concerns for human health;
- Greenhouse Gas Emissions derived from transport, as these contribute to the overall influence on climate change and could work against policies to reduce greenhouse gas emissions;
- Landscape and Townscape effects such as the loss of open spaces, countryside and urban areas which are valued by people;
- Biodiversity, including species and habitats with special designations and protections in law such as Special Areas of Conservation and Sites of Special Scientific Interest;
- Soils and Geology effects on any designated sites, the use of soils currently in agricultural production, and possible contaminated land that could affect the construction of a scheme;
- Heritage features which could be affected directly by construction or indirectly by the alteration of the highway network in the vicinity. Features include Listed Buildings and other recorded sites, as well as the potential for new finds;
- Water Environment effects such as discharges from new or extended carriageways, the pollutants that could be discharged, and modification to watercourses through culverting; and
- Communities and Land Use, including severance of connections between communities, loss of or alteration to footpaths and other routes used by pedestrians, cyclists and others, and the effect of taking land from businesses and agriculture.

OPTIONS FOR SCHEME APPRAISAL

4.0

4.0 OPTIONS FOR SCHEME APPRAISAL

4.1 Overview

4.1.1 This section of the report outlines the contents of the options under consideration at WelTAG Stage 2 and how these options have been derived.

4.2 4.2 General

4.2.1 The main outcome of the Stage 1 Appraisal for the A55 / A494 WelTAG Study was the development of transport infrastructure packages, as described below:

- Package A – Demand Management, Making Best Use and Capacity Enhancements along the existing A55/A494 Corridor.
- Package B - Demand Management, Making Best Use and Capacity Enhancement utilising the A548 Corridor.

4.2.2 Both of these proposals are major highway schemes, supported by a package of public transport, walking, cycling and freight schemes.

4.2.3 The decision to recommend which options and packages are taken forward was been based on the outcomes from the Stage 1 assessment which assessed the packages against the environmental, social and economic appraisal criteria as well as the studies transport planning objectives.

4.3 Alternative Scheme A and Associated Measures

See Appendix B - Table 4.3: Engineering Description of Alternative Scheme A (Blue Option)

4.3.1 The stage 2 appraisal has focussed on the capacity enhancements along the existing A55/A494 Corridor, the Blue Option:

- Improvement of existing dual carriageway between A55-A5119 Northop Junction and A494 north of Queensferry Roundabout, via remodelled Ewloe Interchange (A55 – A494) and renewed River Dee Bridge. This option would provide three lanes in each direction. Approximate length 9.8km.

4.3.2 Additional measures to support the Blue option ‘capacity enhancement’ have not been assessed as part of the Stage 2 appraisal. The stage 1 appraisal identified a number of demand management, walking and cycling, freight, public transport measures that could form part of a package.

4.4 Alternative Scheme B and Associated Measures

See Appendix C - Table 4.4: Engineering Description of Alternative Scheme B (Red Option)

4.4.1 The stage 2 appraisal has focussed on the capacity enhancements along the existing A55/A494 Corridor, the Red Option:

- Two-lane dual carriageway linking A55-A5119 Northop Junction with A494 and A550 north of Deeside Parkway Junction, via Kelsterton Interchange and Flintshire Bridge. This option is partly online improvement and partly new alignment. Approximate length 13.0km.

4.4.2 Additional measures to support the Red option ‘capacity enhancement’ have not been assessed as part of the Stage 2 appraisal. The stage 1 appraisal identified a number of demand management, walking and cycling, freight, public transport measures that could form part of a package.

4.5 Other Alternatives and Associated Measures

4.5.1 Public Transport

Based on the findings of the North Wales Route Study, no major public transport schemes have been identified which were considered 'more than likely' to be constructed.

However, 'Moving North Wales Forward' published in March 2017, sets out the Welsh Government's vision for an integrated transport network across North Wales and the development of a North East Wales Metro. This will include the development of integrated transport hubs and improved rail access to Deeside.

The impact of reducing public transport generalised costs across the study area has been undertaken to explore how potential public transport improvements may influence or interact with the proposed options. Additional information is provided within the traffic Forecasting and Economic Assessment Report.

TRANSPORT ANALYSIS

5.0

5.0 TRANSPORT ANALYSIS

5.1 Overview

5.1.1 This section of the report outlines the transport impacts of the proposed options and the methodologies adopted to determine these impacts.

5.2 Transport Data and Analysis

Introduction

5.2.1 The methodology and approach used to assess the Red and Blue options is in line with the following guidance documents:

- Welsh Transport Planning and Appraisal Guidance, WelTAG
- Design Manual for Roads and Bridges (DMRB), Volume 12.1.1
- Transport Analysis Guidance Website, WebTAG
- Design Manual for Roads and Bridges (DMRB), Volume 13 – COBA Manual

5.2.2 The 2015 Deeside Transport Model has been developed to assess the impacts of proposed schemes on the transport network in Deeside and the surrounding area. The model development and validation is documented in the Model Development and Validation Report, whilst the Traffic Forecasting & Economic Assessment Report describes the methodology for the traffic forecasting and economic appraisal. It also documents the analysis of the modelled impacts of the proposed schemes and presents analysis of the introduction of the proposed schemes on traffic volumes, journey times and accidents and presents the results of the economic appraisal.

Do Minimum Scenario

5.2.3 The 'Do Minimum' provides a description of the scenario that would exist if the 'Do Something' scheme is not built. This section defines the infrastructure schemes and developments included in the Deeside Transport Model Do Minimum scenario. The overarching principle of WebTAG unit M4 is to ensure that the scenarios tested represent a consistent and coherent vision in respect of supply and demand assumptions. A number of forecast years have been assessed including a potential scheme opening year (2022) and a scheme design year (2037).

5.2.4

5.2.5 Table *5.1* and Table 5.2 show the total household and employment changes for all forecast years. Household and employment data has been obtained from TEMPro v7.0.2

Table 5.1 – Household Totals (TEMPro v7.0)

	2015	2022	2032	2037	2042
Total Households					
Flintshire	65,556	68,112	70,508	71,240	72,283
Cheshire West and Chester	145,313	150,902	158,185	161,751	167,663

[2] An interim dataset (NTEMv7.1 Interim for Wales) was released in December 2016 which incorporates revised assumptions on housing growth. There are no changes that materially affect the Deeside Study area. A programme of work to review and update the dataset is ongoing with estimated publication date of February 2017. An updated version 7.2 was released after this report was drafted.

Table 5.2 - Employment Totals (TEMPro v7.0)

	2015	2022	2032	2037	2042
Total Jobs					
Flintshire	76,766	78,679	80,838	82,064	83,338
Cheshire West and Chester	170,930	176,040	180,868	183,608	186,461

5.2.6 The number of households in Flintshire and Cheshire West and Chester are expected to increase by 9% and 11% respectively between 2015 and 2037. Levels of employment are also expected to increase by 7%. Highway trips are forecast to increase by 14%-18% during the same period, while in absolute terms, a modest decrease is predicted for public transport trips (equating to 8%-10%).

5.2.7 Utilising the Flintshire Unitary Development Plan and Cheshire West and Chester Local Plan, a number of major developments have been identified as travel demand generators. A significant growth in trips is expected as a result of major development proposals at:

Site Description	UDP / LDP Assumptions
Deeside Industrial Park	B1, B2 and B8 employment uses Deeside Industrial Park, Phase II (11.6 hectares); Land to North of Shotton Paper (24.0 hectares); Land to East of Shotton Paper (32.0 hectares)
Land North West of Garden City	Strategic Mixed Use Development (HSG2A) 20-25 hectares of housing land (at least 650 dwellings), 98 hectares of employment land (B1, B2 and B8), school facilities, health facilities, a community building, convenience retail provision, civic space and other related community requirements
Sealand (DARA Site)	The DARA site offers an opportunity to provide a high quality business environment (B1) at the Gateway entrance to the County (18.5 hectares)

5.2.8 The most common cause of changes in travel supply, typically consists of the implementation of new transport schemes. Highway improvement schemes expected to be operational by 2022 and therefore included in all future year scenarios include:

- A55 / A483 Junction Improvements – completed October 2015 and included within the base year transport model;
- Queensferry Roundabout and adjacent signalised junction (Asda) – completed Summer 2016;
- Mersey Gateway River Crossing – under construction, opening autumn 2017;
- Development access roads for Land North West of Garden City (Airfields); and
- River Dee Bridge widening, aiming for opening in 2022. The scheme will consist of widening the A494 carriageway to four lanes in both directions across the River Dee between Drome Corner Interchange and south of River Dee, before dropping to two lanes prior to the existing rail bridge in Queensferry.

5.2.9 The findings of the North Wales Route Study was used to identify any major public transport schemes which were considered being 'more than likely' to be constructed. No major public transport schemes were identified as part of the review, therefore current train service and bus service patterns have been assumed for all future years.

5.2.10 Economic factors such as car ownership, fuel price, income and value of time have an impact on travel costs. The WebTAG data book, latest version (July 2016) has been used to provide the required economic parameters and transport modelling inputs for these factors.

5.2.11 The changes in population, employment, development proposals and transport network infrastructure combined with economic factors result in significant traffic growth in the corridor between 2015 and 2037.

5.2.12 Figure 6.1 presents the 24 hour Average Weekday Daily Traffic (AWDT) flows on key links for the Do Minimum forecast scenario (Design year 2037). Do Minimum forecast flows are compared against 2015 base year flows to show the expected change in traffic flows, taking into account background network and cost changes over time.

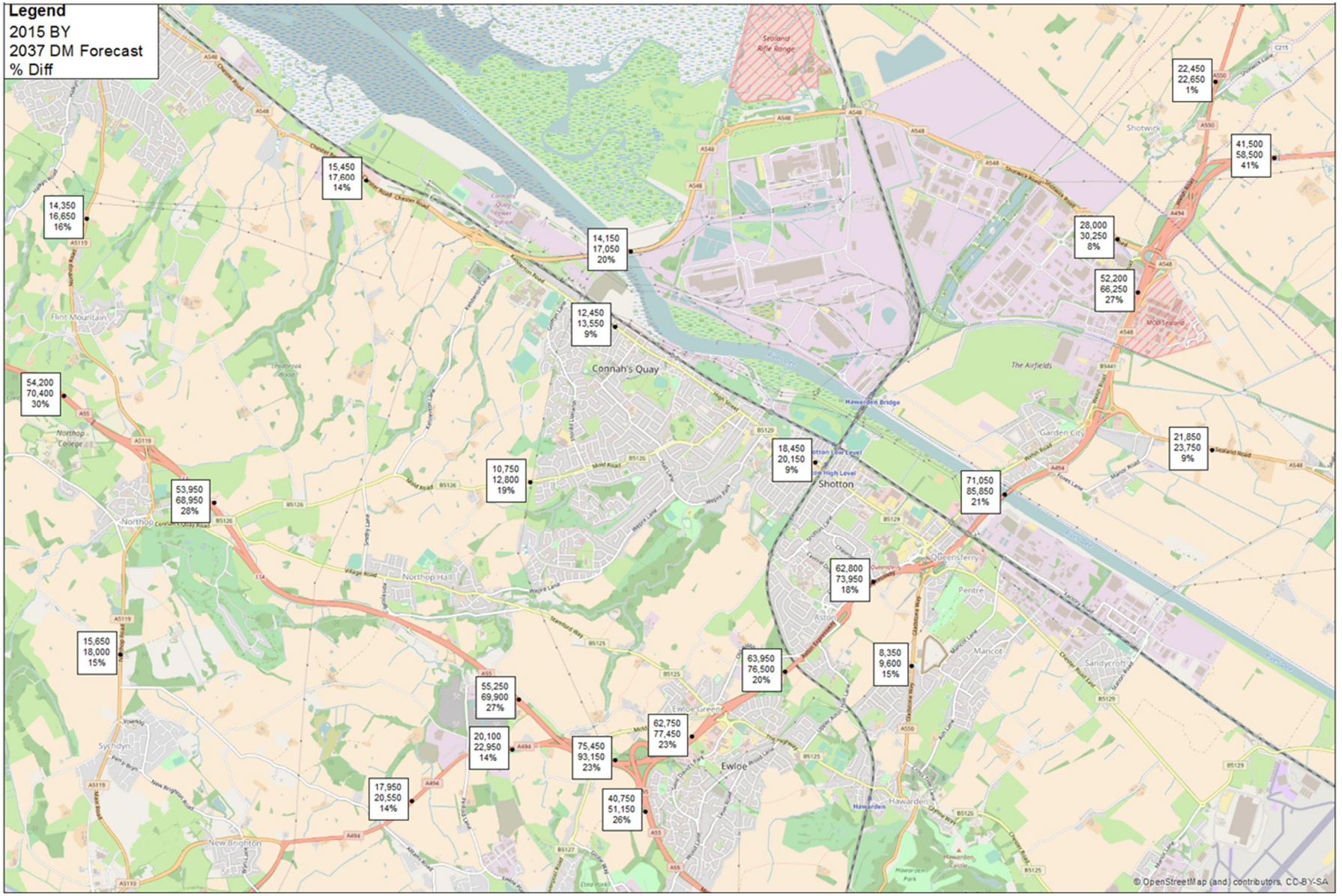
5.2.13 Traffic flows (AWDT) on the A55/A494 corridor are expected to increase by up to 30% between 2015 and 2037. Traffic on minor roads is expected to increase at a more modest rate (maximum of 20%).

5.2.14 Traffic flows (AWDT) on the A55 between Ewloe and Northop are predicted to increase by 27-28% between 2015 and 2037, on the A494 at Queensferry the corresponding traffic growth is 18-21%.

5.2.15 The growth in traffic along the corridor is predicted to increase congestion and journey times throughout Deeside. The transport model has been used to compare journey times between 2037 (design year) and 2015 (base year) on two key routes through Deeside:

- Along the A55 and A494 between Northop and the A5117: For the tidal flow directions, eastbound journey times in the morning peak will increase by 18% to 19 minutes and westbound journey times in the evening peak will increase by 22% to 19 minutes. Journey times in the peak hours in the opposite directions and during the inter-peak are predicted to increase by 5-8%.
- Along the A494 between Mold and Deeside Industrial Park: For the tidal flow directions, north-eastbound journey times in the morning peak will increase by 12% to 22 minutes and south-westbound journey times in the evening peak will increase by 15% to 19 minutes. Journey times in the peak hours in the opposite directions and during the inter-peak are predicted to increase by 5-10%.

Figure 5.1 - 2037 Do Minimum Forecasts and 2015 Base Year Modelled Flows – Two-way AWDT Flow



Do Something Scenario

5.2.16 Two Options have been tested and appraised:

- Blue Option: Improvement of existing dual carriageway between A55-A5119 Northop Junction and A494 north of Queensferry Roundabout, via remodelled Ewloe Interchange (A55 – A494). This option would provide three lanes in each direction.
- Red Option: Two-lane dual carriageway linking A55-A5119 Northop Junction with A494 and A550 north of Deeside Parkway Junction, via Kelsterton Interchange and Flintshire Bridge. This option is partly online improvement and partly new alignment.

5.2.17 The changes in transport network infrastructure associated with the Red and Blue options are forecast to induce some traffic growth on the strategic road network in the corridor.

Blue Option

Figure 6.2 presents the 24 hour Average Weekday Daily Traffic (AWDT) flows on key links for the Do Something Blue option (Design year 2037). Do Something forecast flows are compared against Do Minimum forecast flows to show the expected change in traffic flows, taking into account the changes in transport network infrastructure.

Traffic flows (AWDT) on the A55 corridor between Ewloe and Northop are predicted to increase by 11% west of Northop Hall and 36% east of Northop Hall (this includes traffic using the parallel distributor roads). The significant change in traffic flow east of Northop Hall is due to the re-routeing of traffic between Mold and Ewloe interchange via a new junction at Northop Hall.

On the A494 at Queensferry traffic flows are predicted to increase by 10-11%, traffic flows on the A548 Flintshire Bridge are predicted to decrease by 17%.

On the local road network, traffic flows (AWDT) on the A550 between Hawarden and Queensferry are predicted to decrease by 21%, on the B5129 at Shotton traffic flows are predicted to increase by 1%.

The changes in transport infrastructure and re-routeing of traffic are predicted to reduce congestion and journey times along the A55/A494 corridor throughout Deeside. The transport model has been used to compare the Do Minimum and Do Something journey times for 2037.

Along the A55 and A494 between Northop and the A5117: For the tidal flow directions, eastbound journey times in the morning peak will decrease from 19 minutes to 15 minutes and westbound journey times in the evening peak will decrease from 19 minutes to 15 minutes. More modest reductions in journey times of 1-2 minutes are predicted in the peak hours in the opposite directions and during the inter-peak.

Red Option

Figure 6.3 presents the 24 hour Average Weekday Daily Traffic (AWDT) flows on key links for the Do Something Red option (Design year 2037). Do Something forecast flows are compared against Do Minimum forecast flows to show the expected change in traffic flows, taking into account the changes in transport network infrastructure.

Traffic flows (AWDT) on the A55 between Ewloe and Northop are predicted to decrease by 33-34%, on the A494 at Queensferry traffic flows are predicted to decrease by 24-26%.

On the A548 Flintshire Bridge, traffic flows (AWDT) are predicted to increase by over 100% to 47,950 vehicles.

On the local road network, traffic flows (AWDT) on the A550 between Hawarden and Queensferry are predicted to decrease by 21%, on the B5129 at Shotton traffic flows are predicted to decrease by 4%.

The changes in transport infrastructure and re-routeing of traffic are predicted to reduce congestion and journey times along the A55/A494 corridor throughout Deeside. The transport model has been used to compare the Do Minimum and Do Something journey times for 2037 on two key routes through Deeside:

On the A548 / A494 dual carriageway between Northop and the A5117 (via the red option): For the tidal flow directions, eastbound journey times in the morning peak are predicted to be 13 minutes and westbound journey times in the evening peak are predicted to be 12 minutes. Journey times in the peak hours in the opposite directions and during the inter-peak are predicted to be approximately 11 minutes. This route is approximately 2kms shorter than the A55/A494 route, and hence provides additional journey time savings.

In addition there will be journey time decreases along the existing A55 and A494 between Northop and the M56: For the tidal flow directions, eastbound journey times in the morning peak will decrease from 19 minutes to 16 minutes and westbound journey times in the evening peak will decrease from 19 minutes to 15 minutes. Minor reductions in journey times are predicted in the peak hours in the opposite directions and during the inter-peak.

Figure 5.2 - 2037 Do Minimum and 2037 Do Something Forecasts Blue Option – Two-way AWDT Flow

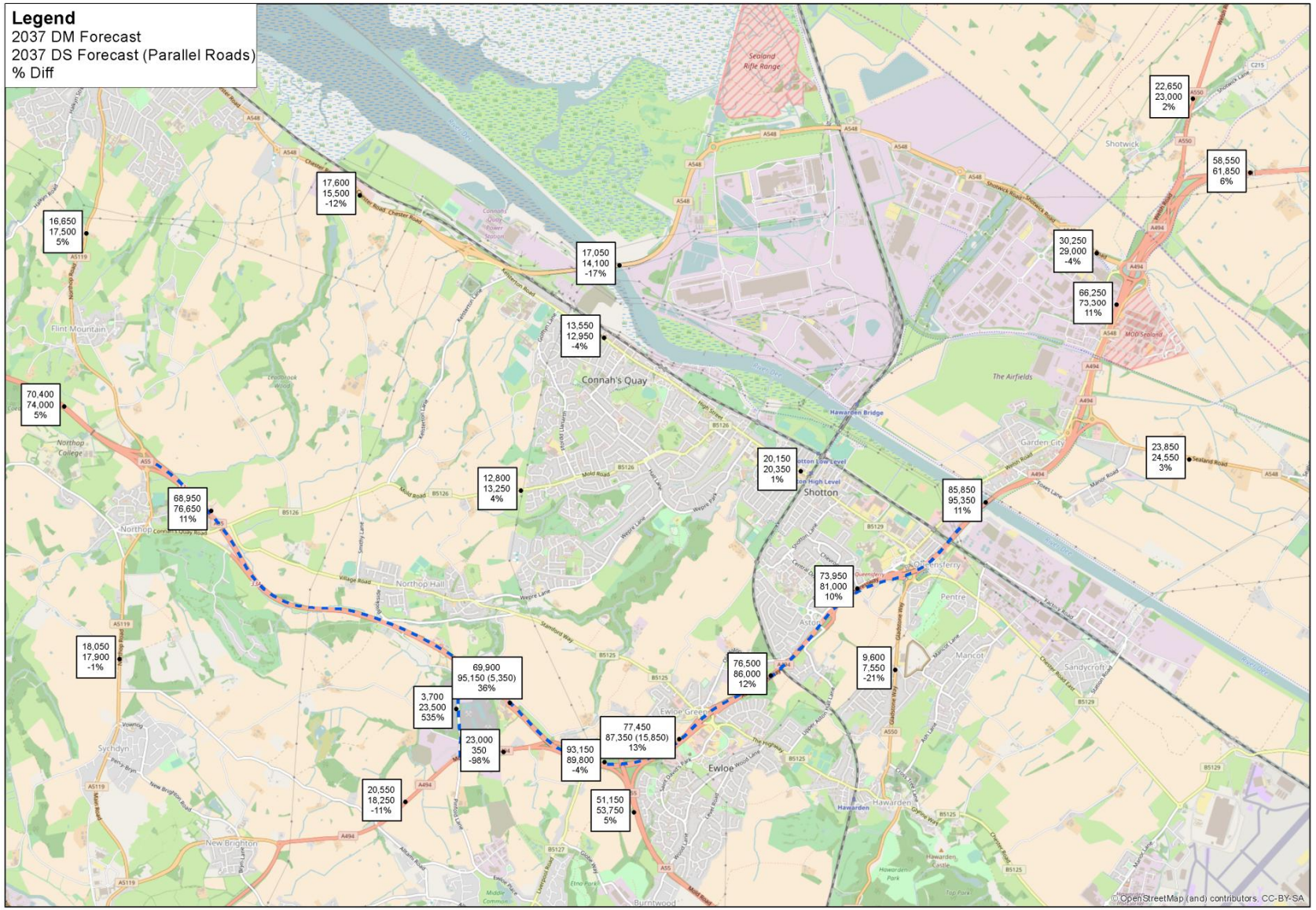


Figure 5.3 – 2037 Do Minimum and 2037 Do Something Forecasts Red Option – Two-way AWDT Flow

Strategic Corridor Traffic

5.2.18 For the Blue option, strategic through traffic will continue to use the A55/A494 corridor, the increased highway capacity will result in reduced congestion leading to journey times savings, with the largest changes in the peak hours.

5.2.19 For the Red option, strategic through traffic will follow the two-lane dual carriageway linking A55-A5119 Northop Junction with A494 and A550 north of Deeside Parkway Junction, via Kelsterton Interchange and Flintshire Bridge. The increased highway capacity and shorter journey distance will result in journey times savings, with the largest changes in the peak hours.

Local Road Network

5.2.20 Both options provide additional capacity along the strategic road network, with a resultant reduction in traffic flows at numerous locations on the local road network.

5.2.21 The Blue option would require the closure of some accesses onto the A55/A494, parallel distributor roads would be provided to provide access, although this would result in an increase in journey distance and journey times for some movements.

5.2.22 The Red option would result in a reduction in traffic flows on the existing A55/A494, overall this option creates the largest decreases in traffic on local roads, due to traffic re-roueting to use the A55/A494 dual-carriageway.

5.2.23 Resilience

5.2.24 The additional highway capacity provided by the red or blue options will increase resilience and journey time reliability, thus contributing positively towards the 'Journey Times & Network Resilience' transport planning objective.

5.2.25 The three-lane dual carriageway between Northop and Queensferry, provided by the Blue Option will provide additional highway capacity along the corridor.

5.2.26 The A548 Flintshire Bridge occasionally closes to all traffic, mostly due to adverse weather conditions (high winds). Between 2010 and 2014 there were a total of 19 bridge closures, an average of less than 4 closures per year. The majority of adverse weather closures are for several hours, e.g. until wind speeds have reduced to safe levels.

5.2.27 The dual carriageway between Northop and Deeside Industrial Park, provided by the Red option, in addition to the existing A55/A494 will provide significant additional highway capacity along the corridor. On the few occasions per year when the Flintshire Bridge is closed due to adverse weather conditions the existing A55/A494 will be the diversion route.

5.3 Conclusions

5.3.1 Both options will result in a re-distribution of traffic and a reduction in congestion on the strategic route network.

5.3.2 Blue option - Strategic through traffic will continue to use the A55/A494 corridor, the increased highway capacity will result in reduced congestion leading to journey times savings, with the largest changes in the peak hours. On the A494 at Queensferry traffic flows are predicted to increase by 10-11%, traffic flows on the A548 Flintshire Bridge are predicted to decrease by 17%.

5.3.3 Red option - Strategic through traffic will follow the two-lane dual carriageway linking A55-A5119 Northop Junction with A494 and A550 north of Deeside Parkway Junction, via Kelsterton Interchange and Flintshire Bridge. The increased highway capacity and shorter journey distance will result in journey times savings, with the largest changes in the peak hours. Traffic flows (AWDT) on the A55 between Ewloe and Northop are predicted to decrease by 33-34%, on the A494 at Queensferry traffic flows are predicted to decrease by 24-26%. On the A548 Flintshire Bridge, traffic flows (AWDT) are predicted to increase by over 100% to 47,950 vehicles.

5.3.4 Both options provide additional capacity along the strategic road network, with a resultant reduction in traffic flows at numerous locations on the local road network.

5.3.5 The additional highway capacity provided by the red or blue options will increase resilience and journey time reliability, thus contributing positively towards the 'Journey Times & Network Resilience' transport planning objective.

ECONOMIC ASSESSMENT

6.0

6.0 ECONOMIC ASSESSMENT

6.1 Overview

6.1.1 This section summarises the findings of the economic assessment of the two options for the A55/A494/A548 corridor currently under consideration. This includes an overview of the methodology adopted and the key findings.

6.2 Methodology

6.2.1 The economic performance of the scheme has been assessed using TUBA (Transport User Benefit Appraisal). The assessment applies standard economics parameters for the growth in values of time and vehicle operating costs. The assessment assumes a 60 year appraisal period, starting from the proposed opening year of 2022.

6.2.2 Additional work has been undertaken to quantify the impact of the Red and Blue options in terms of safety, i.e. the number and severity of accidents. The assessment of accident benefits was based on the methodology and parameters prescribed by COBALT, which calculates accident analysis for major transport schemes according to Department of Transport guidance.

6.2.3 In addition the wider economic impacts of the Red and Blue options have been assessed, this is described in section 6.4.

6.3 Network and Printouts

6.3.1 TUBA results files are shown in the Traffic Forecasting & Economic Appraisal Report (Appendix K), this includes full sets of tables for the 60 year appraisal period for the Red and Blue Options.

6.4 Economic Appraisal Discussion (TUBA & COBALT)

6.4.1 The forecast travel time benefits and vehicle operating costs for the Red and Blue options are summarised in Table 6.1. The Red Option provides greater travel time benefits for both business and non-business (commuting) and non-business (other) when compared to the Blue Option. There is comparatively little change forecast in vehicle operating costs although user benefits attributed to business vehicle operating costs are positive for the Red Option and negative for the Blue Option.

6.4.2 Both the Red Option and Blue Option provide travel time benefits during the AM and PM peaks. Both local and through traffic receive travel time benefits as a result of the schemes, with the largest benefits typically seen for through traffic with origins or destinations to the east or west of the study area.

6.4.3 The Red Option will return significant travel time benefits for traffic with an origin or destination (or both) outside of the study area, showing strong regional benefits for through traffic as well as improved connectivity between the study area and the rest of North Wales and the Northwest of England. Strong local benefits are also observed for areas within the study area as a result of the congestion relief at 'pinch-points' and improved connectivity to the strategic road network.

6.4.4 For the Blue Option, the benefits for external through trips is in part offset by dis-benefits to more local trips, particularly in Northop and Mold. This is primarily as a result of local junction closure implemented as part of the scheme, resulting in greater trip distances and thus greater travel times. The redesign of the Ewloe Interchange means traffic travelling to and from Mold will have further to travel to access the A55/A494 corridor. Conversely, trips to and from Mynydd Isa and Buckley are likely to benefit from improved accessibility to the A55/A494 corridor.

Table 6.1 - Economic Efficiency of the Transport System (Values in £millions)

	Red Option	Blue Option
Non-business: Commuting	£80m	£40m
Non-business: Other	£129m	£51m
Business	£233m	£100m
Total		
Present Value of Transport Economic Efficiency Benefits	**£442m**	**£191m**

** Note: Benefits during construction and maintenance are not assessed as part of a Stage 2 appraisal*

Accident Benefit Analysis

6.4.5 Accident analysis has been undertaken in COBALT for a 60 year appraisal period. COBALT assesses the potential number of accidents on each given link in the road network. The process is mechanistic using national evidence on accident rates to calculate a notional number of accidents based on link type (i.e. number of lanes/speed) and traffic volume.

6.4.6 Notwithstanding the close proximity of junctions and relatively poor standard of the existing route our analysis does not indicate a statistically significant difference in the local accident rate; it may be that driver perceptions reflecting the road layout affect their behaviour. It should also be noted that due to the limitation of available evidence, the improvement in the standard of road (i.e. whether a road is modern or older) that the scheme would deliver does not impact on the assessed number of potential accidents calculated in the COBALT process. These considerations are however discussed qualitatively.

6.4.7 Table 6.2 below shows the impact of the two appraised options in terms of the change in accident and casualty numbers over a 60 year appraisal period and the economic cost or benefit of these changes.

Table 6.2 – Accident Costs and Benefits

	Do Minimum	Red Option	Blue Option
Accidents			
Total Accidents	**15,930**	**15,848**	**16,234**
Total Accidents Saved by Scheme	**-**	***82***	***-304***
Casualties			
Total Casualties (Fatal)	**177**	**179**	**182**
(Serious)	**2,119**	**2,115**	**2,161**
(Slight)	**19,274**	**19,192**	**19,654**
Total Casualties Saved by Scheme (Fatal)	**-**	***-2***	***-5***
(Serious)	**-**	***5***	***-42***
(Slight)	**-**	***82***	***-380***
Accident Benefits			
Total Accident Costs (£000's)	**845,128**	**843,628**	**862,711**
Total Accident Benefits Saved by Scheme(£000's)	**-**	***£1,500***	***-£17,583***

6.4.8 Accident analysis shows that the Red Option is forecast to reduce the total number of accidents and casualties over the sixty year appraisal period, resulting in a reduction in accident costs of £1.5m. However, an increase in accident severity is predicted, with a slight increase in fatal accidents. This is predominantly a result of the Red Option alignment being shorter and thus reducing the number of vehicle kilometres travelled, thereby reducing the potential for accidents.

6.4.9 Both options are forecast to induce additional traffic, however, as the Blue Option alignment distance is the same length as the current alignment, the net effect is forecast to increase the number of accidents; thereby increasing the overall accessed economic cost of accidents by £17.5m. The Blue Option also

results in an increase in vehicle kilometres travelled due to local accesses being closed causing traffic to reroute via longer routes. The speed limit along the existing A55/A494 alignment between Ewloe and Queensferry is also assumed to increase compared to the Do Minimum, thereby increasing the assessed severity of potential accidents.

Scheme Costs

6.4.10 Scheme costs in 2015 Q4 prices are shown below. Scheme costs include an optimism bias of 44%.

- The total scheme cost for the Red Option is £255.4m.
- The total scheme cost for the Blue Option is £283.0m.

6.4.11 Scheme costs have been estimated using Q4 2015 construction prices. No allowance has been made for potential real construction cost prices at this stage of the study and costs have been deflated to 2010 prices using GDP deflator values from the WebTAG databook. Costs have then been discounted reflecting the assumed opening year and expressed in 2010 market prices.

6.4.12 The total discounted scheme cost for the Red Option is £192.4m. The total discounted scheme cost for the Blue Option is £212.5m.

6.4.13 An allowance of 12% has been made for scheme preparation costs and 5% for supervision costs. Maintenance[3] and operating costs have not been determined and are not included in the total scheme costs at this stage of the study.

Transport Economic Efficiency

Table 6.3 summarises the total scheme benefits and costs across the full 60 year appraisal period.

Table 6.3 – Scheme Benefits and Costs over 60 Year Appraisal Period (£millions)

	Red Option	Blue Option
PVB-Consumers	£208.5m	£91.7m
PVB-Business	£233.0m	£99.6m
Carbon Benefits	-£19.5m	-£21.8m
Reliability	-	-
Construction Impacts	-	-
Noise	-	-
Accidents	£1.5m	-£17.6m
PVB Total	£423.5m	£151.9m
Discounted Costs	£192.4m	£212.5m
Indirect Tax Revenue	-£39.5m	-£44.0m
PVC Total	£152.9m	£168.5m
Net Present Value	£270.6m	-£16.6m
Benefit Cost Ratio (BCR)	2.77	0.90

6.4.14 Economic benefits relating to reliability, construction impacts and noise have not been assessed at this stage, however it is likely that they will be of a scale that will not materially impact on the overall economic appraisal.

6.4.15 Present Value Benefits (PVB) taking into account consumer benefits, business benefits, carbon and accident benefits are significantly higher for the Red Option than the Blue Option:

- Red Option PVB = £423.5m
- Blue Option PVB = £151.9m

[3] **Investment in new transport infrastructure may provide savings in replacing or maintaining existing infrastructure. These avoided renewals can be treated as a maintenance cost saving in the 'with scheme' case.**

6.4.16 Present Value Costs (PVC) taking into account scheme costs and indirect tax revenue are:

- Red Option PVC = £152.9m
- Blue Option PVC = £168.5m

6.4.17 The resultant Benefit Cost Ratio (BCR) for the Red Option is 2.77, whilst the BCR for the Blue option is 0.90.

6.5 Wider Economic Impacts

6.5.1 Overview

The report 'A55 A494 A548 Wider Economic Impacts' forms part of the WelTAG Stage 2 study and examines the Economic Activity and Location Impacts of the Red and Blue options. These impacts arise when transport changes induce changes in the pattern, type or scale of economic activity. The assessment has been carried out in line with EALI principles described within the WelTAG section 6.3 and supporting Technical Guidance Annex D.

The approach to this EALI assessment has been tailored to the A55 A494 A548 Stage 2 study, concentrating on the likely impacts on employment and GVA within the core study area, while also describing likely impacts at a wider geographic scale. The assessment also briefly examines the possibility that monetised Wider Economic Impacts may arise due to the proposed transport interventions. The Wider Economic Benefits (WEBs) have not been formally quantified using WelTAG guidance, but an indication of their scale and nature has been provided based on available evidence from the transport modelling.

6.5.2 Baseline Economic Conditions

The current economic characteristics of the study area have been examined and compared against the wider national picture. This forms an economic baseline for the study area from which future economic growth and the potential economic impacts of transport interventions have been examined.

Overall the area is characterised by high levels of labour market participation and relatively low levels of unemployment compared to the national average. The area is divided by the river Dee with primarily residential areas to the south (except for Broughton) and manufacturing and industrial centres north of the Dee. High technology manufacturing provides skilled jobs in these industrial areas and in Broughton, while the commercial centre of Chester provides service sector and public sector jobs. Further West, the employment mix changes to favour activities like distribution, construction and manufacturing.

6.5.3 Monetised Wider Economic Benefits

WEBs can arise when non-transport markets do not behave perfectly competitively. WelTAG follows WebTAG in identifying four areas where these impacts are both well evidenced and where there are established methodologies for calculating their monetary value. For this analysis we have assessed agglomeration and imperfect competition benefits, we have not assessed competition effects and labour market impacts.

For the Red option, agglomeration impacts are estimated to be around £5.2 million per annum in 2032, or around 19% of total user benefits. For the Blue option, these impacts are estimated at around £2.7 million which reflects around 22% of user benefits. Agglomeration benefits have not been estimated for any areas outside of the study area which may benefit from improvements in longer distance journeys to/from or through the study area.

The results are summarised in Table 6.4.

Table 6.4: Net present value of user benefits and WEBs, £m 2015 prices

	User Benefits	Agglomeration	Imperfect Competition	Total
Red option	471	71 - 118	22	564 - 611
Blue option	260	39 - 65	11	310 - 337

Source: Transport model outputs, Connected Economics calculations

Additional employment within the study area could support a further increase in Gross Value Added. There are large uncertainties about the level of induced employment, but the evidence points to an around an additional 200 jobs under the Red option as a reasonable central estimate. If these were skewed towards the manufacturing sector, then a reasonable assumption is that the GVA per job in 2032 would be around

£65,000 per annum, generating around an additional £13m of economic activity per annum in 2032. This is similar to the value of the productivity benefits that are expected to be generated by the Blue Route.

6.5.4 Conclusions

The analysis suggests that both the Red option and Blue option will have very significant economic impacts on communities in Flintshire, with the Red option providing a little more than twice as many economic benefits to residents and businesses within the study area.

ENVIRONMENT ASSESSMENT

7.0

7.0 ENVIRONMENT ASSESSMENT

7.1 Overview

7.2 DMRB Stage 2 Environmental Assessment

7.2.1 A formal Environmental Assessment was conducted to consider the predicted effects of the two options and to contribute to the selection of an option package. The approach and structure of the Assessment was broadly consistent with that of a statutory EIA, but the content and level of assessment are appropriate to the level of scheme detail which is available at this WelTAG Stage 2. Both options within the study involve significant highway works for which a formal EIA would typically be required at Key Stage 3.

7.2.2 The appraisal consisted of baseline study, using published and unpublished data sources supplemented by some fieldwork, and an appraisal of the initial designs for each option. At this Key Stage 2 the designs are in outline only and so many assumptions have to be made: these are stated in the Environmental Assessment together with detailed descriptions of the assessment methods, which are not repeated here.

7.2.3 The need for formal EIA has been considered within a Screening Report and Record of Determination conducted in accordance with DMRB (2008) Volume 11 Environmental Assessment Section 2 Environmental Impact Assessment Part 3 (HD47/08) 'Screening a Project' and Interim Advice Note 126/09(W).

7.2.4 The requirements of the Habitats Regulations (Assessment of Implications for European Sites) have been considered in accordance with DMRB (2008) Volume 11 Environmental Assessment Section 4 Part 1 (HD44/09) by conducting a Screening Assessment.

7.3 WelTAG Stage 2 Environmental Appraisals

7.3.1 The environmental effects of each option, assessed under the Environmental Assessment, have been appraised against the 'Environment' topics of the Welsh Impact Areas set out in 'Welsh Transport Planning and Appraisal Guidance v7.1 (2008) which is the version current during the present study.

7.3.2 The findings of the appraisal for each topic are described qualitatively and (where possible) quantitatively and then summarised in Appraisal Summary Tables, presented in Section 9.0. The results of the assessment of impact significance for each topic are summarised on a seven-point scale:

- Large beneficial (+++)
- Moderate beneficial (++)
- Slight beneficial (+)
- Neutral (0)
- Slight adverse (-)
- Moderate adverse (- -) and
- Large adverse (- - -)

7.3.3 Criteria for these scale points are recorded in each topic. In many cases they have been derived by aligning significance criteria in the relevant section of DMRB with this seven point scale.

7.4 Noise

7.4.1 As part of this Stage 2 Noise and Vibration Assessment a Stage 2 WelTAG appraisal has been undertaken, following the methods described in WelTAG guidance section 7.4 and documents referred to therein. The WelTAG noise appraisal and AST summary table only considers the potential operational noise impacts as WelTAG states:

> *"The introduction of transport proposals may generate additional noise, both during construction and system operation. This guidance focuses on the operational noise impacts, since any construction impacts will be temporary and will be unlikely to matter in the overall decision making process."*

7.4.2 WelTAG requires the overall effect of a proposed Scheme to be summarised using a seven –point scale measure of significance. Appendix E of WelTAG provides some guidance on the criteria to be applied for each of these significance scores using landscape effects as an example. However, WelTAG does not provide specific criteria for noise. Therefore, the WelTAG seven-point scale has been aligned with the five-point scale in HD213/11 to determine the overall WelTAG significance for noise effects. In doing so, the minor and negligible impacts from HD213/11 have been combined and aligned with the 'Slight' score in WelTAG. Table 7.1 summarises the appraisal scoring criteria used in this appraisal:

Table 7.1 Seven Point Appraisal Impact Significance Scale

WelTAG Scale	Symbol	HD213/11Score	Examples
Large beneficial	+++	Major Beneficial	Beneficial (i.e. reduced noise) and in line with a significant proportion of the population in the WelTAG study area. Quantitatively ≤-10dB in long term and ≤-5 dB in the short term
Moderate beneficial	++	Moderate Beneficial	Beneficial (i.e. reduced noise) and in line with the proportion of the population in the WelTAG study area. Quantitatively -5.0 to -9.9 dB in tong term and -3.0 to -4.9 dB in the short term
Slight beneficial	+	Minor/ Negligible Beneficial	Beneficial (i.e. reduced noise) and only a small proportion of population in the WelTAG study area. Quantitatively -0.1 to -4.9 dB in long term and -0.1 to -2.9 dB in the short term
No / Neutral effect	0	No change	There are no Noise Benefits or Disbenefits
Slight adverse	-	Minor/ Negligible Adverse	Adverse (i.e. increased noise) and only a small proportion of proportion of population in the WelTAG study area. Quantitatively +0.1 to +4.9 dB in long term and +0.1 to +2.9 dB in the short term
Moderate adverse	--	Moderate Adverse	Adverse (i.e. increased noise) and in line with the proportion of the population in the WelTAG study area. Quantitatively +5.0 to +9.9 dB in long term and +3.0 to +4.9 dB in the short term
Large adverse	---	Major Adverse	Adverse (i.e. increased noise) and in line with a significant proportion of the population in the WelTAG study area. Quantitatively ≥+10dB in long term and ≥+5 dB in the short term

7.4.3 Given the close proximity of receptors to the proposed construction works as shown in Figure 4.2, there would be the potential for major adverse impacts at some receptors due to construction noise. Therefore, without mitigation the significance of the effect would be classed as large adverse. The control of noise during construction would be an important target for the Construction Environmental Management Plan, as with good attention to noise management practices it is possible that noise impacts could be substantially reduced. There are fewer sensitive receptors close to the Red Option than the Blue Option and so the number of people potentially exposed to construction noise in this Option is correspondingly fewer.

7.4.4 Figures 4.4 – 4.7 present the forecast conditions in 2022 and 2037 along the Blue Option. Traffic noise levels would continue to rise if neither option was constructed ('Do Minimum'). Implementing the Blue Option would expose 568 households to a higher 3dB noise band than in the Do Minimum, in the Forecast Year (2037). Three of these would move up by two bands and one by three bands. 118 households would be exposed to a lower 3dB noise band. Two of these would move down by two bands, one by three bands and three by four bands. 3073 households would remain in the same 3dB noise band. The 19 households in the highest (69 – 71.9dB and 72 – 74.9dB bands) would be exposed to the same band in the Do Minimum or with the Blue Option.

7.4.5 Overall the impact of noise from the Blue Option is 'Slight Adverse'.

7.4.6 Figures 4.8 – 4.11 present the forecast conditions in 2022 and 2037 along the Red Option. Implementing the Red Option would bring a new trunk road through a rural area not currently exposed to traffic noise in close proximity, and add traffic to the existing A548 route. Some shift in traffic away from the Blue Option route would occur, reducing congestion but increasing speeds, and so there would be noise effects for households on both options if the Red Option was implemented.

7.4.7 This option would expose 73 households to a higher 3dB noise band than in the Do Minimum, in the Forecast Year (2037). Eight of these would move up by two bands, nine by three bands, three by four bands and one by five bands (<45dB in Do Minimum, 57-59.9dB with Red Option). 1041 households would be exposed to a lower 3dB noise band, one band lower in each case. 2790 households would remain in the same 3dB noise band. All households predicted in the 63 – 65.9dB band or higher in the Do Minimum would be exposed to the same band or lower with the Red Option.

7.4.8 Overall the impact of noise from the Red Option is 'Slight Positive'.

7.4.9 Additional mitigation in the form of noise barriers where sensitive receptors are most exposed to trunk road traffic may achieve a reduction in the effects of noise predicted here. This objective would form part of the Key Stage 3 design objectives.

7.5 Local Air Quality

7.5.1 The effects associated with the construction phase of the proposed scheme have been qualitatively assessed with reference to the Institute of Air Quality Management (IAQM) published 'Guidance on the Assessment of Dust from Demolition and Construction'. There are residential and some industrial receptors, sensitive to dust, in proximity to the proposed construction works. Effective control of dust in construction is possible, by implementing a Construction Environmental Management Plan, and so there should be no significant residual effects of construction dust from either Option.

7.5.2 Nitrogen Dioxide (NO2) and particulate matter (PM10) are the two pollutants of concern in relation to road transport sources and air quality objectives. There are no AQMAs declared in the FCC administrative area, although concentrations of NO2 close to and above the annual average air quality objective value of 40 µg/m3 have previously been identified in the study area. Modelling of baseline conditions was supplemented by additional monitoring during the study period. Forecasts for the year of opening (2022) were conducted using 2015 emission factors, a 'conservative' assumption, as the predicted substantial improvement (29 – 39% reduction) in vehicle emissions by 2022 is not certain to occur. The results of this modelling are shown in Figure 5.2 – 5.4.

7.5.3 WelTAG requires the overall effect of a proposed Scheme to be summarised using a seven point scale measure of significance. However, WelTAG does not provide specific criteria for air quality. Therefore, the WelTAG seven point scale has been aligned with the five point scale derived from Interim Advice Note IAN 174/13 (Highways Agency June 2013) shown in Table 7.2 to determine the overall WelTAG significance for local air quality effects. In doing so, the minor and negligible impact has been combined and aligned with the slight score in WelTAG.

Table 7.2 Seven Point Appraisal Impact Significance Scale

WelTAG Scale	Air Quality Significance	Examples
Large Beneficial	Large Beneficial	These are benefits or positive impacts which, depending on the scale of benefit or severity of impact, the practitioner feels should be a principal consideration when assessing a option's eligibility for funding;
Moderate Beneficial	Medium Beneficial	The option is anticipated to have only a moderate benefit or positive impact. Moderate benefits and impacts are those which taken in isolation may not determine an option's eligibility for funding, but taken together do so;
Slight Beneficial	Small Beneficial	The option is anticipated to have only a small benefit or positive impact. Small benefits or impacts are those which are worth noting, but the practitioner believes are not likely to contribute materially to determining whether an option is funded or otherwise.
No effect or neutral effect	No change	The option is anticipated to have no, or negligible, benefit or negative impact.
Slight Adverse	Small Adverse	The option is anticipated to have only a moderate cost or negative impact. Moderate negative impacts are those which taken in isolation may not determine an option's eligibility for funding, but taken together could do so.
Moderate Adverse	Medium Adverse	The option is anticipated to have only a moderate cost or negative impact. Moderate negative impacts are those which taken in isolation may not determine an option's eligibility for

		funding, but taken together could do so;
Large Adverse	Large Adverse	These are costs or negative impacts which, depending on the scale of cost or severity of impact, the practitioner should take into consideration when assessing an option's eligibility for funding.

7.5.4 The model predicted that in the Do-Minimum (DM) case, 3 properties would be exposed to pollutant concentrations exceeding the annual mean NO2 air quality objective by the 2022 opening year, with a further 6 properties within 10% of the annual mean NO2 air quality objective (i.e. >36 µg/m3). These exceedances are all adjacent to the existing A494/A55 carriageways where traffic flows would continue to grow.

7.5.5 The Blue Option may have beneficial local air quality effects where the road alignment is further from residential properties, although detrimental effects may occur where it is closer. Implementing the Red Option would bring a new trunk road through a rural area not currently exposed to traffic in close proximity, and add traffic to the existing A548 route. Some shift in traffic away from the Blue Option route would occur, reducing congestion but increasing speeds, and so there would be emissions effects for households on both options if the Red Option was implemented.

7.5.6 The Blue Option would lead to 3 properties exceeding the annual mean NO2 air quality objective in the 2022 opening year. Two of these properties in Queensferry would exceed the objective in the Do Minimum case. The other is a predicted new exceedance adjacent to the widened A55, where additional mitigation would be considered to reduce the exposure. No location is predicted to exceed 60 µg/m3 and so it is considered unlikely that the short-term hourly objective for NO2 would be breached.

7.5.7 If the Red Option is implemented it is predicted that no properties would continue to be exposed to pollutant concentrations exceeding the annual mean NO2 air quality objective in the 2022 opening year. The redistribution of traffic to the Red Option would reduce pollutant concentrations near the existing roads and would not introduce any additional exceedances. With this Option, no location is predicted to exceed 60 µg/m3 and so it is considered unlikely that the short-term hourly objective for NO2 would be breached.

7.5.8 For both Options, the annual mean concentration of PM10 was predicted at relevant receptor locations within 100 m of the affected carriageways where the highest pollutant concentrations and most significant effects were anticipated to occur. No exceedances of the daily objective for PM10 were identified, and the annual mean PM10 air quality objective was not predicted to be exceeded for any location.

7.5.9 Using the criteria presented in Table 7.2 the overall effect on local air quality from the Blue Option is Neutral because this option is not expected to increase the small number of sensitive receptor locations exceeding annual mean air quality objectives (NO2) in the opening year (2022), using conservative predictions for vehicles, and no receptor locations are predicted to exceed the objectives for PM10.

7.5.10 Using the criteria presented in Table 7.2 the overall effect on local air quality from the Red Route is Neutral because, using conservative predictions for vehicles, no locations are expected to exceed the objective values for NO2 or particulates (PM10) in the Opening Year.

7.5.11 Refining the alignment, and future improvements in vehicle emissions are predicted to reduce exposure to both NO2 and PM10 in either Option.

7.6 Greenhouse Gas Emissions

7.6.1 In accordance with WelTAG guidance section 7.6 the changes in greenhouse gas emissions associated with the two options have been appraised by calculating the total change in tonnes of carbon emitted between the 'with scheme' and 'without scheme' scenarios for the whole appraisal period. The assessment used outputs from the TUBA (Transport Users Benefit Appraisal) transport economic appraisal software, which was designed on behalf of the Department for Transport (DfT) in accordance with Unit 7.6 of the WelTAG guidance for economic appraisal for multi-modal schemes with fixed or variable demand. The data for the proposed Options were provided by the AECOM Transportation team.

7.6.2 No significance criteria for the predicted impacts are given in the guidance. The Net Present Value in monetary terms is calculated and presented as part of the monetised costs and benefits table.

7.6.3 Implementing the Blue Option is predicted to generate an increase in CO2 emissions of 472,576 tonnes (+0.83%) over the 60-year appraisal period, compared with the Do Minimum. The Option would encourage

an increased number of journeys which outweighs the emission benefits of improvement to traffic flow. The negative effect is not considered large enough to affect the achievement of overall national policies and commitments. Therefore, the overall significance of the Blue Option is considered to be Neutral.

7.6.4 Implementing the Red Option is predicted to generate an increase in CO2 emissions of 422,624 tonnes (+0.74%) over the 60-year appraisal period, compared with the Do Minimum. The Option would encourage an increased number of journeys which outweighs the emission benefits of improvement to traffic flow. The negative effect is not considered large enough to affect the achievement of overall national policies and commitments. Therefore, the overall significance of the Red Option is considered to be Neutral.

7.7 Landscape and Townscape

7.7.1 The assessment of impacts on landscape and townscape has been carried out following the guidance in DMRB Volume II, Section 3, Part 5 also taking account of the 'Guidelines for Landscape and Visual Impact Assessment' Third Edition (GLVIA), published in 2013 by Landscape Institute and Institute for Environmental Management and Assessment. The baseline condition, the existing landscape and townscape of a corridor either side of the indicative centrelines for each Option, was assessed using a combination of published sources such as LANDMAP and field observation carried out in winter (leafless) and summer conditions.

7.7.2 The Blue and Red Options were then considered in turn, to establish the likely impacts on their surroundings. This was followed by an assessment of the effects of the options on the existing landscape, townscape, key views and affected properties.

7.7.3 Landscape and visual impact assessment criteria are normally used to make a reasoned judgement about the value and sensitivity of landscape and visual resources, and the magnitude of change and significance of any impacts this causes. DMRB does not provide any detailed guidance on the criteria to be adopted. Instead, landscape practitioners rely on the current edition of GLVIA which contains the necessary criteria and provides examples of good practice.

7.7.4 Figure 7.1 shows the landscape designations within the study area. There are no statutorily designated landscapes (eg AONB or National Park) within the study area. There is one registered historic landscape, Holywell Common and Halkyn Mountain mining landscape, that is predicted to experience an indirect impact, i.e. it would experience a change in view but would not experience a change to the landscape fabric.

7.7.5 Of the 10 Registered Parks and Gardens of Historic Interest in the study area, 8 are predicted to experience an indirect impact.

7.7.6 Landscape character areas, Townscape character areas and Transport character areas are based on LANDMAP Visual and Sensory aspect areas and the Cheshire Landscape Character Assessment areas, further refined through desk study and site survey. They are representative of type and character and are of a scale appropriate to the study area. Figure 7.5 shows these LCAs and their quality assessment. 54 LCAs, 64 TCAs and 16 Transport character areas within the study area were identified from desk study, and those most likely to be affected by each Option were considered further.

7.7.7 The effects of vegetation loss, additional road surface area, elevation of junctions, additional lighting and similar changes would lead to impacts on 28 character areas if the Blue Option was implemented, and 19 character areas if the Red Option was implemented.

7.7.8 Blue Option impacts

- Significant detrimental impact is predicted for 1 character area (LCA 002 - Aston Hall Agriculture). Road improvement would result in loss of farmsteads and dwellings and severance of public footpaths.
- Moderate detrimental impact is predicted for 9 character areas. With mitigation, receptors would benefit from reinstatement of landscape features lost to proposed improvement.
- Slight detrimental impact is predicted for 17 character areas.
- Slight beneficial impact is predicted for 1 character area (LCA 115 – Higher Shotton Residential Area, this character area is predicted to suffer a range of impacts from slight adverse to slight beneficial).

7.7.9 Red Option impacts

- Significant detrimental impact is predicted for 3 character areas (LCA 036 – Kelsterton Brook, LCA 037 – Leadbrook Valley, LCA 044 Shotwick Lake Agriculture). Road improvement would result in loss of agricultural land and ancient woodland.
- Moderate detrimental impact is predicted for 4 character areas. With mitigation, receptors would benefit from reinstatement of landscape features lost to proposed improvement.
- Slight detrimental impact is predicted for 12 character areas.

7.7.10 Mitigation would include substantial, targeted areas of new woodland planting to replace or improve screening, but this planting would not fully achieve its objective by the time of the Design Year (2037).

7.8 Biodiversity

7.8.1 WelTAG guidance directs that the assessment of the potential effects on biodiversity should follow the approach of describing biodiversity features including an assessment of their importance, then describing how the proposals affect those features and their distinctive quality, before producing an overall assessment of the significance of the impact based on the seven point scale. The assessment of anticipated environmental effects has been based on guidance provided within the CIEEM guidelines and the Design Manual for Roads and Bridges with particular reference to Volume 10: Environmental Design and Volume 11: Environmental Assessment.

7.8.2 Desk study and collation of published data was combined with an Extended Phase 1 habitat survey of the study area conducted as part of the assessment. The constraints and habitat surveys are shown in Figures 8.1, 8.2 and 8.3.

7.8.3 The Blue Option could cause slight direct, permanent habitat loss at the northern edge of Buckley Claypits and Commons SSSI (part of Deeside and Buckley Newt Sites SAC) due to the creation of an off slip road from the A55 westbound at Ewloe interchange. No waterbody will be lost, but surrounding terrestrial habitat will be lost within 250 m – 500 m of great crested newt (GCN) breeding ponds. The road may also introduce an additional risk to the species by way of incidental capture in gully pots and kerbs unless isolated by a wildlife barrier. Increases in traffic flows could lead to increased dust and nitrogen deposition on this area. The Blue Option works could therefore cause significant effects on the two designations and their GCN populations locally. However, it is unlikely to introduce any new barriers to movement between currently connected populations..

7.8.4 The Blue Option does not extend far beyond the existing A55/A494 and so no significant impacts on wintering birds are considered to be likely.

7.8.5 Works as part of the Blue Option are unlikely to have significant effects on bats.

7.8.6 The overall assessment for the Blue Option is: Construction stage - moderate adverse and Operational stage - moderate adverse to large adverse.

7.8.7 The Red Option crosses the River Dee SAC, SSSI and the Dee Estuary Ramsar, SPA, SAC and SSSI via the existing Flintshire Bridge. Upstream of the crossing point (but connected by tidal flow) the River Dee is further designated as the River Dee and Bala Lake SAC. Shotton Lagoons and Reedbeds SSSI is also present approximately 70 m from the Red Option.

7.8.8 The proposals for Weighbridge Road Junction include the creation of a grade-separated junction to remove the on-line roundabout. The proposals extend the road northwards into part of the Dee Estuary Ramsar, SAC and SSSI. Such works would have a likely significant effect on the integrity of the designated site and the species and habitats included as qualifying features. The existing A548 runs adjacent to this designated area, crossing it at Flintshire Bridge as well as being within 70 m of Shotton Lagoons and Reedbeds. Works to this road would potentially have an impact on the qualifying features of these designated sites, through pollution and disturbance from construction works. In the vicinity of the Dee Estuary, the areas of habitat to the north and west of the Red Option are likely to support wintering birds, with birds either foraging or roosting within the fields. These fields may be considered to provide supporting habitat for the birds which are qualifying features of the SPA. Construction works will result in disturbance to foraging birds as well as the temporary and permanent loss of foraging and roosting habitat.

7.8.9 46 ponds were observed within the Red Option corridor. In addition to these ponds a number of larger lakes and lagoons that could not be accessed are present to the north of the Survey Area. Many ponds within the Red Option are likely either to be lost as part of the construction works, or to suffer from changes in hydrology and potential pollution and sediment run-off from adjacent construction areas.

7.8.10 The creation of a new road within the western extent of the Red Option, and the associated loss of ponds and terrestrial habitat, is likely to have a significant and permanent impact on amphibian populations including GCN present within and immediately adjacent to the Red Option. This Option also introduces new barriers to movement, and so would sever existing connectivity between populations and 'meta-populations' which in the long term can have significant negative effects. The effectiveness of wildlife underpasses and similar mitigation for GCN is not well established and so a precautionary assessment is required at this stage. Revisions at Parkway Junction and Shotwick Interchange to the east are also likely to result in the loss of ponds and terrestrial habitat which may support GCN.

7.8.11 Badger setts are present throughout the Red Option and the creation of a new road is likely to result in the severance of populations and the temporary and permanent loss of foraging habitat. During the operational phase of the proposed scheme there is also a high likelihood that badgers will be killed when they attempt to cross the road. Badgers on the carriageway could contribute to road traffic incidents.

7.8.12 There are two designated sites within 10 km of the Red Option that support significant numbers of bats. The Red Option is likely to support roosting and foraging by bats, as well as bats commuting through the Red Option area to other roosts and foraging habitat. The construction of the proposed scheme may result in the loss of roosts as well as the temporary and permanent loss of foraging habitat.

7.8.13 The overall assessment for the Red Option is: Construction stage - moderate adverse and Operational stage - moderate adverse to large adverse.

7.9 Soil

7.9.1 WelTAG guidance directs the assessment of the potential effects on geology and soils to appraisal guidance in DMRB. The significance of the potential effects of constructing either option on groundwater has been assessed in a qualitative manner. No intrusive investigation has been undertaken for this Stage 2 appraisal, which is based on desk study. The agricultural assessment has provided further information on soil use and Agricultural Land Classification, shown in Figure 12.2.

7.9.2 Both Options pass through potential coal mining areas, cross the River Dee, include areas of potential ground contamination, and pass over the most sensitive receptors identified.

7.9.3 Both Options would take land which is currently in agricultural use. The effect of this in land use, food production and in agricultural business terms is assessed as a social and an economic effect and so not reported here. The soils throughout the works, whichever Option is taken forward, would be carefully stripped, stored and re-used either within the works landscape areas or on nearby areas of land requiring additional soil, eg. for land restoration. For this reason the soils are not 'lost' as a resource and so the effect on soils is considered to be neutral or slight adverse.

7.9.4 The effects on soils and geological receptors for both construction and operation phases, with mitigation in place, are considered to be neutral because there are no predicted changes in quality and/ or usability of soils, geological features or aquifers, and no measurable effect on humans, soils, buildings, or other ecosystems from ground contamination.

7.9.5 The Blue Option is likely to affect some 12.5 ha of agricultural land of sub-grade 3a. As agricultural land is a receptor of high sensitivity, the significance of impact is moderate – major adverse significance. The Red Option is likely to affect some 56 ha of agricultural land of grade 2 and sub-grade 3a permanently, a magnitude of change which is major adverse. This is considered to be a social and economic impact.

7.9.6 These assessments are based on desk study, but would be refined following confirmation of the final alignment and intrusive ground investigation along selected sections of that route.

7.10 Heritage

7.10.1 The assessment has been prepared in accordance with Welsh Transport Planning and Appraisal Guidance for Stage 2 projects. The assessment of impacts on cultural heritage assets was undertaken through the analysis of data obtained from the Royal Commission on the Ancient and Historic Monuments of Wales and the online database, Coflein. Lists of Scheduled Ancient Monuments and Listed Buildings were accessed from Cadw databases. Lists of sites contained in the Welsh archaeological trusts' online database Archwilio and previous work undertaken in this area were added to the database.

7.10.2 The Options being assessed have only been developed to a Key Stage 2 and thus the reasonable worst-case basis of assessment for heritage receptors has been set out. A study corridor, a minimum of 1 km wide on either side of each option, was assessed. The assessment sought to identify sites within the corridor, assign a comparative value to each site, gain an understanding of the nature of the surrounding archaeological landscape and place sites within their wider context. The study corridors overlap in part and so some site locations fall into both options.

7.10.3 To bring the assessment of potential effects to a graded conclusion using the standardised 7-point scale of significance required by the WelTAG Stage 2 assessment process, the DMRB significance categories were grouped as shown in Table 7.3.

Table 7.3 Seven Point Appraisal Impact Significance Scale

DMRB	WelTAG Scale
Very Large	Large Positive
Large	
Moderate/Large	Moderate Positive
Moderate	
Moderate/Slight	
Slight	Slight Positive
Neutral/Slight	
Neutral	No effect or neutral effect
Neutral/Slight	Slight Adverse
Slight	
Moderate/Slight	Moderate Adverse
Moderate	
Moderate/Large	
Large	Large Adverse
Very Large	

7.10.4 No large-scale impact is predicted for any site along the Blue Option. Detailed engineering design, ancillary elements such as landscaping and temporary components such as storage areas and access tracks may create an impact. This can be mitigated or avoided by consideration of the presence of heritage features during the design stage, appropriate investigations and the recording of features before or during the works.

7.10.5 The Blue Option has the potential for 11 instances of an impact of 'Neutral/Slight' significance; two instances of 'Slight' significance. There are five sites of 'negligible' value (because the site is recorded as previously damaged or no visible trace remains) but the magnitude of impact is unknown. In these cases a precautionary assessment of 'Slight' significance is given to the impact. Further fieldwork and investigation would be considered during Key Stage 3.

7.10.6 Due to the on-line nature of this option, the impact on most sites along the Option will be 'neutral'.

7.10.7 The Red Option has the potential for 3 instances of an impact of 'Neutral/Slight' significance; 4 instances of 'Slight' significance; 1 of 'Slight / Moderate' significance and 2 where the site value and unknown magnitude of impact leads to precautionary assessment of 'Slight' significance. Further fieldwork and investigation would be considered during Key Stage 3.

7.10.8 No large-scale impact is predicted for any site along the Red Option corridor. The western end of the corridor crosses farmland rising up from the Dee Estuary. This area will require a full impact assessment to supplement reported work on early mapping for place-name evidence and features that are no longer visible. At present, no large-scale features, or assets of 'medium' or 'high' value have been identified that could not be mitigated by careful assessment and design. Three boundary stones, classified as being of 'Medium' value, could be avoided by design or fully recorded if necessary. The eastern portion of the Red Option corridor follows the line of an existing modern road across the post-medieval reclaimed marshes.

7.11 Water Environment

7.11.1 The Stage 2 assessment presented in this chapter has been prepared in accordance with the Welsh Transport Planning and Appraisal Guidance (WelTAG, 2008). It also takes into consideration the technical assessment methods and criteria for determining the significance of potential effects described in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 10 Road Drainage and the Water Environment (otherwise referred to as HD45/09).

7.11.2 Surface water receptors and flood risk have been considered for a study area extending approximately 1 km from each of the two options (from the centreline). This study area ensures that all water bodies that could be affected by the proposed development are identified. Desk study was supplemented by a walkover survey carried out on the 9th December 2015. Figure 11.1 shows these surface water bodies.

7.11.3 Potential flood risk constraints have been identified based on an appreciation of the study area and experience of other highway developments. Fluvial and tidal flood risk zones are shown in Figure 11.2.

7.11.4 The DMRB's HD45/09 provides a method to assess pollution impacts from routine runoff. The assessment takes into account the traffic flow, impermeable contributing area, and the Q95 flow within the river (that which is exceeded 95% of the time). The Highways Agency Water Risk Assessment Tool (HAWRAT) assessment output indicates whether the outflow discharge passes soluble copper and zinc EQS concentrations, and whether the annual average copper and zinc concentrations are met. Additionally it provides an assessment of any chronic impact from sediment-associated contaminants.

7.11.5 The calculations take into account various catchment specific factors, including the traffic using the site, the climatic region of the UK, road area draining to the outfall, as well as the potential low flow conditions in the receiving watercourse, water hardness and receiving watercourse width.

7.11.6 The overall significance of effects of a development on the water environment are determined under WelTAG using a seven point scale. As WelTAG does not provide specific criteria for the water environment, the seven points have been aligned with the eight points in WebTAG Unit A3 Chapter 10 to determine the overall significance of all effects on the water environment. In doing so, the 'very large' and 'large' adverse summary scores from WebTAG have been combined and aligned with the 'large adverse' score in WelTAG. Table 7.4 summarises the appraisal scoring criteria used in this assessment:

Table 7.4 Seven Point Appraisal Impact Significance Scale

WelTAG Scale	Symbol	WebTAG	Examples
Large Positive	+++	Large Beneficial	It is extremely unlikely that any scheme incorporating the construction of a new transport route (road or rail) would fit into this category. However, a scheme could have a large positive impact if it is predicted that it will result in a 'very' or 'highly' significant improvement to a water feature(s), with insignificant adverse impacts on other water features.
Moderate Positive	++	Moderate Beneficial	Where the scheme provides an opportunity to enhance the water environment, because it results in predicted: · Significant improvements for at least one water feature, with insignificant adverse impacts on other features; and · Very or highly significant improvements, but with some adverse impacts of a much lower significance. The predicted improvements achieved by the scheme should greatly outweigh any potential negative impacts.
Slight Positive	+	Slight Beneficial	Where the scheme provides an opportunity to enhance the water environment, because it provides improvements in water features which are of greater significance than the adverse effects.
No effect of neutral effect	0	Neutral	Where the net impact of the scheme is neutral, because: · It has no appreciable effect, either positive or negative, on the identified features; · The scheme would result in a combination of effects, some positive and some negative, which balance to give an overall neutral impact. In most cases these will be slight or moderate positive and negative impacts. It may be possible to balance impacts of greater significance. However, in these cases great care will be required to ensure that the impacts are comparable in terms of their potential environmental impacts and the perception of these impacts.
Slight Adverse	-	Slight Adverse	Where the scheme may result in a degradation of the water environment, because the predicted adverse impacts are of greater significance than the predicted improvements.
Moderate Adverse	--	Moderate Adverse	Where the scheme may result in a degradation of the water environment, because it results in predicted: · Significant adverse impacts on at least one feature, with insignificant predicted improvements to other features; · Very or highly significant adverse impacts, but with some improvements which are of a much lower significance; and · Are insufficient positive impacts to offset the negative impacts of the scheme.
Large Adverse	---	Very Large and Large Adverse	Where the scheme may result in a degradation of the water environment, because it results in predicted: · Highly to very significant adverse impacts on a water feature (s); and · Highly to significant adverse impacts on several water features.

7.11.7 The proposed Blue Option may also require a diversion of Queensferry Drain and works to the existing culverts that convey Daisybank Drain, and in particular Alltami Brook across the A55, which is predicted to have moderate adverse effects resulting in permanent Moderate/Large to Slight Adverse effects. Appropriate mitigation will need to be embedded in the design to minimise any adverse effects.

7.11.8 It is anticipated that the risk of a chemical spillage leading to a serious pollution incident could be mitigated by appropriate drainage design to ensure that adequate containment measures are achieved. Therefore, a neutral effect is predicted for all water bodies as a consequence of the Blue Option.

7.11.9 The Red Option will require a new crossing of Lead Brook, Shotwick Brook and an unnamed drain, and an extension to the existing crossing structure for Northop Brook due to the addition of new slip roads. No works are expected to the existing structure that conveys Kelsterton Brook beneath the existing A548. As Lead Brook flows at the bottom of a wooded ravine it is expected that the road will cross on a viaduct and will not have any impact on the hydromorphology of the channel. The works affecting Shotwick Brook, Northop Brook and the un-named drain could be moderate adverse resulting in permanent Moderate/Large to Slight Adverse effects, depending on importance. Careful design and implementation would be required, to minimise any adverse effects.

7.11.10 It is anticipated that the risk of a chemical spillage leading to a serious pollution incident could be mitigated by appropriate drainage design to ensure that the adequate number of containment measures are proposed. Therefore, a neutral effect is predicted for all water bodies as a consequence of the Red Option.

SOCIAL ASSESSMENT

8.0

8.0 SOCIAL ASSESSMENT

8.1 Overview

8.1.1 Transport interventions have an important role to play in improving quality of life as well as ensuring that indirect negative social impacts are minimised and mitigated where possible. Social objectives, such as improving quality of life, health and well-being are central to policy in Wales.

8.1.2 The topics appraised as part of the Social Impact Assessment, as stipulated within the 2008 WelTAG guidance are as follows:

- Transport Safety
- Personal Security
- Permeability
- Physical Fitness
- Social Inclusion
- Equality, Diversity and Human Rights

8.1.3 The findings from the social impacts appraisal undertaken for each of these headings are discussed in turn below.

8.2 Transport Safety

8.2.1 A description of accidents and accident analysis along the corridor and study area is provided in section 3.4. COBALT has been used to appraise the accident benefits of the Red and Blue Options, the approach is described in section 7.4.

8.2.2 Transport safety for road users is anticipated to improve as part of the Blue Route due to improved/widened sections of highway and junctions built to modern safety standards. Analysis of these impacts within COBALT utilising outputs from the transport model however indicates that an additional 5 fatal, 42 serious and 380 slight casualty accidents could occur over a 60 year appraisal period due to the additional induced traffic on the corridor and additional vehicle kilometres travelled due to the closure of some local accesses onto the A494. The current arrangements are perceived as unsafe and therefore drivers are extra cautious when negotiating the existing corridor, particularly at Ewloe interchange. This may limit the benefits achieved as existing caution is helping to reduce accidents. Some changes to access arrangements will occur with this option and the proximity of the scheme to Ewloe Green County Primary School at Ewloe will need to be given special consideration in the finalisation of the design. Overall the impact of this proposal on transport safety is assessed as neutral.

8.2.3 The Red Route option would redirect a proportion of existing traffic from the substandard A494/A55 route to a new route built to current design standards and away from local population centres. This would improve transport safety for users of the existing route, although the substandard design of the existing route would remain a problem. Analysis of these accident benefits in COBALT utilising outputs from the traffic model indicate that an additional 2 fatal accidents could occur, but 5 serious and 82 slight casualty accidents could be saved as a result of this over a 60 year appraisal threshold. This is due to the red route being shorter than the existing route. This option would also help to separate strategic and local traffic, reducing conflicts between different movements. It would also reduce traffic levels near to the populations of Shotton/Queensferry/Ewloe by ca.25%, reducing the potential for accidents involving pedestrians crossing the A494/A55 at none-designated crossing points. This option also reduces the potential for accidents involving freight transport due to a reduction in the disparity between the speeds of HGVs and general traffic experienced on the existing corridor at Aston Hill in the southbound direction. Overall the impact of this proposal on transport safety is assessed as slight beneficial.

8.3 Personal Security

8.3.1 The term ‘Personal Security’ as appraised through the WelTAG process relates to the relative freedom from risk or fear of attack or robbery and includes the personal possessions of transport users, such as bicycles. In the assessment of impacts consideration is given to both the actual incidence of such events as well as

their perceived frequency as perceptions can have just as significant an impact upon a person's behaviour as the actual risk of such an event happening. Consideration of the personal security impacts of the proposed options for the A55/A494 corridor has considered the below factors in relation to the proposed designs:

- • Site perimeters, entrances and exits (how well they are marked, design, whether there are physical barriers and the use of materials);
- • Formal surveillance (CCTV, their number and location, facilities design affecting staff surveillance);
- • Informal surveillance (materials, design, visibility, proximity to other activities);
- • Landscaping (features contributing to visibility and sense of security);
- • Lighting and visibility (quality and sufficiency of lighting, obstructions hindering visibility and CCTV coverage); and
- • Provision of emergency call, help points and public telephones.

8.3.2 As both options under consideration relate to major roads for use only by motorised modes, where the personal security risks are low, the impacts of the options are primarily limited to the impacts for pedestrians and cyclists wishing to cross the proposed routes.

8.3.3 Detailed design of the pedestrian/cycle crossing arrangements proposed for the blue route have not yet been undertaken, however it is assumed that all existing crossings and crossing types will be maintained or improved. The proposed improvements are therefore not anticipated to impact upon current levels of personal security. Particular consideration should be given to the needs of vulnerable groups and those with particular access requirements in the design of these crossings. Based upon the information currently available this is assessed as a neutral impact.

8.3.4 For the red route all pedestrian crossings on the new route will be lit and allow passive surveillance from passing traffic to ensure personal security is perceived as high for users of these crossings. Based upon the information currently available this is assessed as a neutral impact.

8.4 Permeability

8.4.1 Permeability, sometimes referred to as 'severance' relates to the impacts of a proposal on the movement of people in its vicinity on foot, by bicycle and on horseback. A piece of infrastructure, such as a major road, can act as a barrier to free movement across it for those utilising non-motorised modes. It is therefore important to appraise these impacts and identify any necessary mitigation measures required.

8.4.2 The Blue Route would maintain the existing A55/A494 route, which does act as a severance barrier between communities on either side of it, such as Aston and Shotton, with a number of desirable destinations located on either side of this route.

8.4.3 Existing crossing points of this route would be maintained, therefore no additional negative severance impacts are anticipated as a result of this option.

8.4.4 Consideration will be given to opportunities to improve the permeability of the corridor through new or improved crossings, however the designs of these are yet to be finalised. Due to this the currently anticipated impacts are considered neutral.

8.4.5 The construction of new highway as part of the red route option would be undertaken in a sparsely populated part of the study area, limiting the permeability impacts of the road.

8.4.6 New crossings of the red route will be provided for all existing roads, lanes and public rights of way that would be severed by the proposed route, therefore existing permeability for the populations surrounding the red route will be maintained. The route would however divide some existing farmers' fields into two and separate fields from the remainder of the farm, with associated impacts for the individuals affected.

8.4.7 Existing at-grade junctions on the A548 will be converted to grade-separated junctions, which could impact upon pedestrian permeability, although no specific pedestrian or cycle facilities are currently provided at these junctions and none motorised mode demand at these locations are likely to be very low.

8.4.8 This option has the potential to improve permeability for those living on the existing A55/A494 corridor due to reduced traffic levels here, although no additional formal crossings are proposed at this time and at-

grade crossing of the route would continue to be actively discouraged. The red route is currently assessed as a neutral impact in terms of permeability impacts.

8.5 Physical Fitness

8.5.1 Proposals which can impact upon levels of physical activity, through the provision or promotion of walking, cycling or on horseback can have a beneficial impact on levels of physical fitness and general well-being, which can have a beneficial impact on health. Conversely proposals which limit the potential for undertaking physical activity may have a negative impact upon health.

8.5.2 Physical fitness impacts are complex and relate to the length, intensity and frequency of exercise taken. Broadly speaking, the more the better, provided intensity is within safe limits. Different people may find different types of physical exercise more or less strenuous.

8.5.3 As the proposals under consideration relate to the provision of a major highway, which would not be open to active travel modes the beneficial physical fitness impacts of these proposals are likely to be limited. The key impact of these proposals therefore relates to the impacts of the proposals on adjacent walking and cycling routes and the propensity to travel by these modes.

8.5.4 For the blue route existing pedestrian bridges and underpasses will be maintained, with aspirations to improve upon these existing crossing arrangements. Improvements to crossing facilities could encourage additional walking and cycling trips to be made, with a slight beneficial impact on physical fitness. Improved car journey times may increase car mode share, potentially reducing levels of walking and cycling, with associated physical fitness dis-benefits. The overall impacts of this option on physical fitness are therefore assessed as neutral.

8.5.5 The red route will ensure that suitable crossings are provided for all public rights of way severed by the new road link. No positive or negative impacts on physical fitness levels predicted as no new pedestrian or cycle routes will be provided as part of this option and existing routes will be no more or less desirable. Improved car journey times may increase car mode share, potentially reducing levels of walking and cycling, with associated physical fitness dis-benefits, but this impact is likely to be negligible. The overall impacts of this option on physical fitness are therefore considered neutral.

8.6 Social Inclusion

8.6.1 Social inclusion is the act of making all groups of people within society feel valued and important. A number of factors can lead to social exclusion, such as poverty or low educational attainment. In transport terms the key facet of the transport system which can help to facilitate social inclusion is accessibility, the ease with which people can get to the destinations and obtain the services that are important to them, be it education, employment, healthcare or shopping.

8.6.2 The appraisal of Social inclusion is particularly focused on those whose options in life are limited by not having the transport they would wish. Whilst it is true that those with access to a car may have difficulty in reaching important destinations (due to money constraints for example), those without access to a car are much more likely to find it hard to make important journeys. The distance may be too great for walking or cycling and the public transport network may not offer services that are affordable, accessible, reliable and timely.

8.6.3 The consideration of pedestrian and cycle accessibility has been separately covered under the heading of ‘permeability’. The appraisal of social inclusion impacts therefore focuses on the public transport accessibility impacts of the options under consideration.

8.6.4 The blue option would improve accessibility for public transport routes using the strategic highway due to improved journey times through the corridor for all traffic. This will only have a slight beneficial impact upon deprived groups within the study area as only longer distance trips utilising the A55/A494 corridor are likely to benefit.

8.6.5 The red option would offer improved accessibility to opportunities in North Wales and England for those living in the study area and easier travel along the existing A55/A494 for local bus users. The new route could be utilised by public transport providers to provide access to work opportunities at Deeside Park from villages such as Northop and Flint Mountain, although no specific plans for this are proposed as part of the options presented. This is therefore considered a neutral impact.

8.7 Equality, Diversity and Human Rights

8.7.1 The Welsh Government is committed to delivering services that meet the needs of all citizens in Wales and are compatible with human rights legislation. This includes ensuring that all demographic groups, particularly under-represented groups, can take advantage of transport services. Therefore all transport proposals seeking public funding and/or approval from the Welsh Government must take account of differing needs and their equality impacts.

8.7.2 WelTAG requires that all positive and negative impacts of a proposal, particularly any disproportionate impacts should be assessed qualitatively for the following equality impact groups:

- Race, ethnicity, colour or nationality;
- Sex or marital status;
- Disability: physical, sensory or mental;
- Age;
- Religion or belief;
- Sexual orientation;
- Welsh language;
- Other; Lone parent, economic inactivity, social and multiple deprivation.

8.7.3 As part of the 2012 North East Wales Area Based Transport Strategy, which identified the need for capacity improvements to the A55/A494 corridor, a full Equalities Impact Assessment was undertaken. This considered the baseline conditions of the study area in relation to the spatial characteristics of the above equality impact groups. A summary of the key findings from this study in relation to the A55/A494 corridor are outlined below:

- Race, ethnicity, colour or nationality;
  - Low numbers of ethnic minorities in the study area
- Sex or marital status;
  - Women were more likely to travel by bus, men were more likely to cycle to work
- Disability: physical, sensory or mental;
  - Urban parts of the study area, such as Connah's Quay and Shotton were more likely to have higher numbers of people with a limiting long term illness or disability.
- Age;
  - The age profile of the study area was close to the UK national average
  - Areas with higher numbers of people aged over 70 included Flint and Mold.
  - Connah's Quay and Sealand also had high numbers of young people (0-19 years old).
- Religion or belief;
  - Minority religions were under-represented in the study area compared to the UK average.
  - 77% of respondents in the study area reported their religion as Christian.
- Welsh language;
  - The majority of people in the study area (82%) had no knowledge of the Welsh language
- Other; Lone parent, economic inactivity, social and multiple deprivation.
  - Lone parent families were focused on the urban parts of the study area, including Flint, Connah's Quay and Queensferry.
  - Levels of economic inactivity were lower than the Welsh average.
  - The most deprived parts of the study area included Flint, Connah's Quay, Shotton and Queensferry.
  - The rural parts of the study area including Northop suffered worst in terms of access to services deprivation.

8.7.4 The assessment considered the likely transport issues that may be faced by the equalities impact groups identified. The key findings of relevance to the A55/A494 options currently under consideration are discussed below:

- **Race, ethnicity, colour or nationality**
  - Language can be a barrier to knowledge of services. Choice of language used in signage and literature is important to ensure adequate understanding amongst non-native English speakers.
  - High levels of fear of crime, abuse or attack when travelling are found amongst minority groups.

- Car ownership in the UK is lowest amongst Black ethnic groups households, therefore these groups are more likely to be reliant on public transport and non-motorised modes.

- **Sex or marital status**
  - There are higher levels of public transport use amongst women, partly due to lower levels of car availability and fewer drivers licences held by women.
  - Women are more likely to make trips with complex itineraries (e.g. a trip to work via school and shops).
  - Women are more likely to work part time – requiring sufficient public transport coverage at times other than the commuter peaks.
  - Men tend to be less familiar with public transport use and some perceive a certain amount of stigma around using these modes.
  - Men are more likely to cycle and women more likely to walk.
  - Public transport vehicles may not be suitable to shopping trips or accompanying children.

- **Disability; physical, sensory or mental**
  - Higher level of reliance on public transport and taxi use amongst those with disabilities.
  - Impacts of inaccessible transport on social inclusion and accessibility to key opportunities and services.
  - The quality of pedestrian routes to public transport interchanges can affect the ability of people with disabilities to access public transport.
  - Need for fully accessible public transport fleet (Disability Discrimination Act 2005).
  - Timetables and other written material need to be in large clear fonts and not displayed too high.
  - Current methods of presenting transport information can be difficult for some people with mental disabilities to understand.
  - There is currently widespread abuse and a lack of enforcement of parking facilities provided for disabled drivers and passengers.
  - Online transport information is not always provided in a format accessible to the blind and partially sighted.

- **Age - Elderly**
  - Impacts on mobility caused by the potential loss of drivers' license for those over 70.
  - Free off-peak bus travel is currently available for the over 60s – there is a potential lack of awareness of this opportunity amongst some groups.
  - Older people are less likely to be able to access internet resources – e.g. car sharing websites or online transport information.
  - Timetables and other written material need to be written in large clear fonts.

- **Age - Young**
  - Lack of car availability leads to higher levels of reliance upon lifts, public transport, walking and cycling.
  - Availability of concessionary fares for young people (limited for those over 16).
  - Public transport usage can broaden the horizons of young people.
  - Lack of knowledge about transport availability amongst the young.
  - Cost of travel is a significant barrier for young people.
  - Lack of access to leisure activities can lead to anti-social behaviour.

- **Religion or belief**
  - Fear of crime, abuse or attack when travelling could be a factor.
  - Issues of identification when using a bus pass for Muslim women wearing veils.
  - Difficulty in getting a driving licence – language barriers with driving test and also identification for Muslim women wearing veils.

- **Sexual orientation**
  - Lesbian, Gay, Bisexual and Transgender (LGBT) people fear abuse, attack and disorderly or threatening behaviour from other passengers and also from staff.
  - Lots of LGBT people may alter their mode or time of travel to avoid large groups and overcrowding, particularly around school leaving time.

- Cycling is often preferable to LGBT people to avoid confrontation and harassment as well as preserve a sense of privacy and anonymity.
- Safety and security on the route to/from public transport stops as well as lighting etc. at the stops is also a concern.
- LGBT people in rural areas may access social activities and support groups by public transport and as a result many of these services may be unavailable to them.

· **Welsh Language**
- Easy access to Welsh language translations is required for all signage and written material.
- The Traveline website is nearly entirely bilingual.
- Few officers and civilian staff in the British Transport Police are currently able to speak Welsh so in emergencies initial contact may be with a non-Welsh-speaking officer

· **Other: Lone parent, economic inactivity, social and multiple deprivation**
- Cost of transport provision is a significant barrier for low income households.
- Deprived groups tend to have lower car ownership so are more reliant on public transport.
- Less likely to have access to internet resources.
- Lone parents may struggle to access public transport with a pram/buggy, shopping etc.
- Personal safety and security are a concern in deprived areas where crime levels tend to be higher than average.
- Deprived areas are at greater risk of social exclusion resulting from a lack of suitable transport provision to access opportunities.
- People suffering multiple deprivation issues may be more likely to have limited travel horizons.

The above potential issues which may disproportionately affect certain Equality Impact groups will be given considered in relation to the final designs for the corridor.

The blue route is likely to have a slight beneficial impact on public transport journey times through improving journey times along the A55/A494 corridor, benefiting groups, such as the young, women and the elderly who are more reliant on public transport. This route would maintain high traffic volumes along the existing A55/A494, with associated impacts on local communities in terms of air quality and noise impacts. The young and old and those suffering multiple deprivation are most likely to be affected by these existing impacts. This options is considered a neutral impact overall.

The red route is also likely to have a slight beneficial impact on public transport journey times through the study are through the provision of a new route which would be available to public transport service providers to utilise, benefiting groups, such as the young, women and the elderly who are more reliant on public transport. This option would reduce traffic volumes along the existing A55/A494, with associated benefits for local communities in terms of air quality and noise impacts. The young and old and those suffering multiple deprivation within the existing communities on the A55/A494 corridor are most likely to benefit from this option. This is considered a slight beneficial impact overall.

8.7.5 Health Impact Assessment

A Health Impact Assessment (HIA) is a mandatory requirement of WelTAG. The HIA seeks to consider how policies and initiatives may affect people's health and wellbeing. It is defined with WelTAG as:

'A combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population. In other words it is a process that considers the wider effects of local and national policies or initiatives and how they, in turn, may affect people's health'

An initial desktop based HIA was undertaken in 2011 as part of the A55/A494 Study WelTAG Stage 1 appraisal process. This considered the baseline health conditions of the local population, as well as an initial assessment of the packages identified at WelTAG Stage 1 against the key determinants of health outlined below:

- **Individuals Lifestyle / capacities affecting health:**
  - Smoking, nutrition and healthy eating, physical activity, alcohol / drug misuse, sexual health
  - Propensity to use health and care services
  - Skills and knowledge, training and education
  - Social and Community influences affecting health:
  - Family: Structure and function, parenting
  - Community: social support mechanisms, social networks, neighbourliness, peer pressure, community divisions, degree of isolation, historical identity-, cultural and spiritual ethos.

- **Living Conditions:**
  - Built environment, civic design and planning, housing, noise, smell, air and water quality, physical view and outlook, public safety, waste disposal, road hazards, injury hazards, safe play spaces

- **Working Conditions:**
  - Employment, workplace conditions, occupation, income
  - Services: (access to and quality of)
  - Medical services, caring services, careers advice and counselling, shops and commercial services, public amenities, transport, education and other services, access to information technology
  - Socio-economic, cultural and environmental and sustainability factors
  - Biological diversity, efficient use of resources, pollution, diversity / local distinctiveness, climate.
  - Macro-economic factors
  - Political climate, GDP, economic development, policy climate

In relation to the packages taken forward to WelTAG Stage 2, the blue route option package utilising the existing A55/A494 corridor was considered to have an overall Slight Adverse impact on health. This was due to the adverse impacts on the environment with a potential loss of habitat and increases in greenhouses gasses. Furthermore, the increases in local air and noise pollution were considered likely to have an adverse impact on living conditions.

The red route option utilising the A548 was also considered to have a Slight Adverse impact on health. Whilst the improvements to working conditions through improved accessibility to key employment sites was considered likely to be of major benefits for health, this would be matched by a moderate adverse impact on the environment. It was predicted that the proposals would have detrimental impacts on both bio-diversity as well as levels of greenhouses gasses across the study area. Furthermore, it was predicted that there would be rises in noise and air pollution locally which would have a slight adverse impact on living conditions.

A WelTAG Stage 2 Health Impact Assessment incorporating consultation with local and national experts in the field of health impacts will be undertaken as part of this WelTAG Stage 2 appraisal process. This will be undertaken alongside the public consultation for the study and will be reported in a separate Health Impact Assessment Report. Air Quality and Noise impacts are considered to be key factors which may influence health conditions for people living and working near to the affected routes. The WelTAG Stage 2 HIA will make use of the latest assessments of these impacts in determining the likely health impacts of each of the WelTAG Stage 2 options.

8.7.6 Equalities Impact Assessment

The 2008 WelTAG Guidance indicates that an Equality Impact Assessment (EqIA) should be undertaken at WelTAG Stage 1 if any equalities impacts are identified. As part of the A55/A494 WelTAG Stage 1 report an Equalities Impact screening was undertaken. This identified no disproportionate impacts on any equalities impact groups as a result of the options taken forward at that point. A full Equalities Impact Assessment was therefore not required.

An EqIA was undertaken as part of the North East Wales Area Based Transport Strategy; the strategy document which initially identified the A55/A494 corridor scheme as a priority for Northeast Wales. This was assessed as part of Package 9 – Capacity Enhancements (Strategic Trips). This identified no

disproportionate discriminatory impacts affecting any equality impact groups as a result of the proposed package.

Equality, diversity and human rights issues have however been considered for the two routes currently under consideration as discussed under the heading ‘Equality, Diversity and Human Rights’.

APPRAISAL SUMMARY

9.0

9.0 APPRAISAL SUMMARY

9.1 Overview

9.1.1 This section provides a summary of the key appraisal findings for the two options appraised at this stage through the presentation of Appraisal Summary Tables for each option. A comparison table is also provided which summarises the key differences between each option in terms of the appraisal findings.

Appraisal Summary Tables

BLUE OPTION	Description	Improvement of existing dual carriageway between A55-A5119 Northop Junction and A494 north of Queensferry Roundabout, via remodelled Ewloe Interchange (A55 – A494). This option would provide three lanes in each direction. Approximate length 9.8km.		
Welsh Impact Areas		Assessment	Distribution	Significance
Economy				
Transport Economic Efficiency		Estimated Total Scheme Cost: £212.5m (2010 prices) The majority of this cost is associated with construction costs along the A55/A494. Modelling indicates increases to VOCs of £69m, split between fuel and non-fuel costs. Travel time savings for consumers and businesses equating to £260m benefit, with some localised dis-benefits from junction closures. Indirect tax revenues decrease by £44.0m.	Direct time savings to all road users on the A55/A494 corridor and across study area.	Neutral (0)
EALI		For the Blue Route, GVA impacts are estimated at between £15.0 and £16.3 million per year for Wales as a whole in 2032. Within the study area, around £8m of additional output could be driven by new employment, although this is likely to be abstracted from elsewhere.	Potential economic benefits will be experienced throughout the A55/A494 corridor.	Slight Beneficial (+)
Environment				
Noise		Noise impacts at residential properties range from negligible reductions and no change to minor increase and, for less than 1%, a moderate or major increase (of 3 – 5dB(A) or more) This option places 568 households into a higher 3dB noise band, and 118 households into a lower band, in the forecast year (2037) The use of noise barriers to mitigate the effect of additional traffic and speeds, where possible and effective, would be considered.	Moderate or major increases at Pinfold Lane / Services junction and S side of A494 Aston to Queensferry	Slight Adverse (-)
Local Air Quality		This option is not expected to increase the small number of sensitive receptor locations at which annual mean air quality objective value for NO_2 would be exceeded in Opening Year (2022), using conservative predictions for vehicles. In Do Minimum, 3 sensitive receptor locations exceed annual mean objective and 6 are within 10% of annual mean objective for NO_2 This option has large adverse effect on 1 sensitive receptor location, moderate beneficial effect on 2	2 properties adjacent to existing A494 carriageway near Queensferry; 1 adjacent to A55 near Northop	Neutral (0)

	sensitive receptor locations. No sensitive receptor locations are predicted to exceed the annual mean or daily objective for particulates (PM_{10}) in Do Minimum or with this option. Refining the alignment, and future improvements in vehicle emissions are predicted to reduce exposure to both NO_2 and PM_{10}.		
Greenhouse Gas Emissions	The total emission of greenhouse gases under this Option, for the 60-year appraisal period, would increase by 472,576 t compared with the Do Minimum (approx. 0.83% increase). The Option would encourage an increased number of journeys which outweighs the emission benefits of improvement to traffic flow. The negative effect is not considered large enough to affect the achievement of overall national policies and commitments	Global environment	(not classified)
Landscape and Townscape	Significant detrimental impact predicted for 1 character area (LCA 002 - Aston Hall Agriculture). Road improvement would result in loss of farmsteads and dwellings and severance of public footpaths. Moderate detrimental impact predicted for 9 character areas. With mitigation, receptors would benefit from reinstatement of landscape features lost to proposed improvement. Slight detrimental impact predicted for 17 character areas. Slight beneficial impact predicted for 1 character area (LCA 115 – Higher Shotton Residential Area).		Substantial adverse (- - -) to Slight Beneficial (+)
Biodiversity	Loss of habitat within the Deeside and Buckley Newt Sites SAC is likely. Mitigation to neutral (0) or slightly beneficial (+) effect will be essential. Loss of other lower-value habitat including woodland is a short-medium term slightly adverse (-) effect Increases in sediment run-off and pollution incident risk assessed as slight (-) to moderate adverse (- -) effect, depending on the feature affected. Increase in nitrogen and small particulate deposition on sensitive habitats are likely to be neutral (0) to slightly adverse (-) effects With mitigation, construction stage impacts and operational impacts on species including legally protected species are likely to be neutral (0) to moderately adverse (-).	1km wide corridor on either side of route option. Impacts on hydrologically connected features at a distance greater than 1 km have also been considered	Construction Moderate adverse (**- -**) Operational Neutral (0) to slight adverse (**-**)
Heritage	No large-scale impact is predicted for any site along the blue option corridor. The impact on most sites in the corridor will be 'neutral'. Impact can generally be mitigated or avoided by consideration of the presence of heritage features during the design stage. Blue option has the potential for 22 instances of an impact of 'Slight' significance; 1 instance of 'Moderate' significance and 5 where the unknown	1km wide corridor on either side of route option. The study corridors overlap in part and so some site locations fall into both	Slight Adverse (**-**)

	magnitude of impact leads to precautionary assessment of 'Slight' significance.	options.	
Water Environment	Blue option requires physical modification to watercourses of 'very high' to 'medium' and 'high' importance which would, after mitigation, have Moderate/Large Adverse to Slight Adverse Effects. Residual effects will depend on the future proposed designs and the application of available mitigation which may reduce the overall impact. In particular, the new junction across the Alltami Brook will require a number of new crossings close together. All other flood risks are considered to be Slight/Neutral subject to an appropriate FCA including hydraulic modelling and breach analysis. It is also assumed that a suitable drainage system can be designed, incorporating SuDS or proprietary treatment measures where space is limited, to control the rate of runoff and provide adequate treatment and spillage containment (which may be an improvement on the current situation).	Watercourses throughout	Moderate Adverse (- -)
Soils	The precautionary assessment is of a low risk to Principal Aquifers arising from the possible disturbance of contaminated ground during construction and/or dewatering (if required). Soils would be conserved and re-used as a resource. There is no predicted change in quality and/ or use of soils, geological features or aquifers, and no measurable effect on humans, soils, buildings, or other ecosystems from ground contamination	Localised within Kinnerton Sandstone aquifer	Slight Adverse (-)
Social			
Transport safety	Assessment indicates that an additional 5 fatal, 42 serious and 380 slight casualty accidents could occur over a 60 year appraisal period due to additional traffic. The assessment method does not reflect the sub-standard road layout and apparent exceptionally cautious driving behaviour to moderate risk. It is expected that improvements to the design standard will reduce accidents or the perception of risk for drivers.	Benefits at least in terms of risk perception especially for areas with high accident potential including Ewloe Interchange and the A494 between Drome Corner and Ewloe.	Neutral (0)
Personal security	Personal security impacts of this option likely to be limited to the impacts for pedestrians and cyclists seeking to cross the corridor. Detailed design of pedestrian crossings has not yet been undertaken, however it is assumed that all existing crossings and crossing types will be maintained. The proposed improvements will therefore not impact upon current levels of personal	No impacts anticipated.	Neutral (0)

	security.		
Permeability	This option would maintain the existing A55/A494 route, which does act as a severance barrier between communities on either side of it, such as Aston and Shotton, with a number of desirable destinations located on either side of this route. Existing pedestrian crossing points would be maintained, therefore no additional negative severance impacts are anticipated as a result of this option. Consideration will be given to opportunities to improve the permeability of the corridor through new or improved crossings, however the designs of these are yet to be finalised.	No impacts anticipated.	Neutral (0)
Physical fitness	Improvements to crossing facilities could encourage additional walking and cycling trips to be made, with a slight beneficial impact on physical fitness. Improved car journey times may increase car mode share, potentially reducing levels of walking and cycling, with associated physical fitness disbenefits.	Benefits for communities needing to cross the A55/A494 corridor including Ewloe, Aston and Shotton.	Neutral (0)
Social inclusion	Improved accessibility for public transport routes using the strategic highway due to improved journey times through the corridor. This will only have a negligible impact upon deprived groups as only longer distance trips utilising the A55/A494 corridor are likely to benefit.	Benefits for longer distance public transport trips using the strategic highway only.	Slight beneficial (+)
Equality, Diversity & Human Rights	No positive or negative discriminatory impact on any individual equality impact group		Neutral (0)
Transport Planning Objectives			
1. To reduce journey time variability and enhance the transport network resilience of the A55/A494 study corridor to periods of high demand, incidents and maintenance events.	Additional lanes would improve network resilience during periods of high demand and incidents. The provision of additional lanes would also offer the potential for lane closures to facilitate maintenance during less busy periods without impacting upon journey time variability.		
2. To improve transport connections for businesses within the study area to key economic centres and employment sites.	The improved A55/A494 route would offer improved end to end journey time savings of between 1 1/2 mins and 3 1/2 mins for businesses in the study area to economic centres and employment sites. This would include improved connections to and from the Deeside Industrial Park from locations to the south and west, as well as improved connections to economic centres in England from the study area and locations in North Wales.		
3. To improve access between employment sites and workforce catchment areas.	The additional capacity provided on the A55/A494 corridor would improve journey times along the corridor during commuter peak periods, improving access between workforces and employment sites.		
4. To improve the actual and perceived safety and personal security of all transport users along the A55/A494 study corridor.	Assessment indicates that an additional 5 fatal, 42 serious and 380 slight casualty accidents could occur over a 60 year appraisal period due to additional traffic. The assessment method does not reflect the sub-standard road layout and apparent exceptionally cautious driving behaviour to moderate risk. It is expected that improvements to the design standard will reduce accidents or the perception of risk for drivers. Personal security impacts of this option are likely to be limited to the impacts for		

	pedestrians and cyclists seeking to cross the corridor. Detailed design of pedestrian crossings has not yet been undertaken, however it is assumed that all existing crossings and crossing types will be maintained. The proposed improvements will therefore not impact upon current levels of personal security.
5. To improve the permeability across the A55/A494 corridor for non-motorised modes at key point of desire.	No improved permeability is offered by this option. Existing pedestrian bridge and underpass crossing locations would be maintained, but no additional crossings are currently proposed.
6. To ensure that the study area transport network facilitates necessary national and regional trip movements of people and freight.	The additional capacity provided on the A55/A494 corridor as part of this option would remove a key pinchpoint on the route which forms part of the TEN-T network and is important for regional trips as well as trips to/from Ireland. This will help to ensure that these necessary movements of people and freight are facilitated.
7. To reduce carbon emissions from transport along the A55/A494 study corridor.	This option would result in an increase in carbon emissions due to additional traffic induced onto the network resulting from the additional capacity created, as well as an increase in vehicle journey distances resulting from the closure of some local accessing onto the A494.
8. To minimise adverse impacts on the human environment including air, noise and light pollution, and landscape and townscape.	This option would lead to additional traffic on the route and would therefore have negative impacts on local air quality and noise which could not be fully mitigated. The additional highway width, loss of screening vegetation and additional lighting, particularly at remodelled junctions, would have an adverse impact on the landscape, townscape and visual receptors. Effects on heritage would be slight.
9. To minimise adverse impacts on the natural environment including local air quality, water and soil pollution, and biodiversity impacts.	This option would encourage additional journeys which would slightly increase the deposition of pollutants on protected habitats. Culverting and modifying watercourses would be moderate adverse effects. The risk of pollution of groundwater is low. There is the opportunity to improve protection of watercourses against the risk of accidental spillage. Works would encroach on protected biodiversity sites, for which careful mitigation would be needed to avoid negative effects. Other habitat loss would be unavoidable, but partly mitigated in the long term by new habitat creation.
10. To maintain and make more efficient use of the existing transport infrastructure along the A55/A494 study corridor.	This option would utilise the existing alignment of the A55/A494, making efficient use of the existing transport infrastructure on this corridor, although extensive works would be required to improve its design standard and capacity.
Other issues	
Public acceptability:	The Stage 1 assessment indicated that opposition was likely, particularly from those who opposed the previous Drome Corner to Ewloe scheme. Levels of public acceptability will be confirmed subsequent to the planned public consultation.
Acceptability to other stakeholders:	Stakeholder consultation indicates mixed levels of support, indicating that elements of other packages – e.g. demand management and reducing local access onto the A55/A494 could impact upon scheme requirements.
Technical and operational feasibility:	Would require significant land-take outside of the existing highway boundary, the Government already own some of the land, but additional land will be required. It is likely there will be disruption to traffic flow during construction, which will be mostly online along the A55 and A494. Significant construction related delays are likely, mitigation measures will be identified in the construction management plan.
Financial affordability and deliverability:	The high cost of this package means that funding will need to be sought from the delivery agencies that have been identified. This option will be subject to the successful completion of statutory procedures and the availability of funding from budgets approved by the WG.
Risks:	The main risks associated with this option are the availability of funding from the key delivery agencies and public acceptability.

RED OPTION	Description	Two-lane dual carriageway linking A55-A5119 Northop Junction with A494 and A550 north of Deeside Parkway Junction, via Kelsterton Interchange and Flintshire Bridge. This option is partly online improvement and partly new alignment. Approximate length 13.0km.		
Welsh Impact Areas		Assessment	Distribution	Significance
Economy				
Transport Economic Efficiency		Estimated Total Scheme Cost: £192.4m (2010 prices) The majority of this cost is associated with the enhancement of the A548 route between Flint and the A550, and a new road connecting the A55 and A548. Modelling indicates increases to VOCs of £29.5m, the increase is primarily due to non-fuel costs. Travel time savings for consumers and businesses equating to £471m benefit. Indirect tax revenues decrease by £39.5m.	All road users on the A55/A494/A548 corridor and across study area.	Significant Beneficial (+ + +)
EALI		For the Red Route, GVA impacts are estimated at around £33.5 and £36.3 million per year for Wales as a whole in 2032. Within the study area, around £13m of additional output could be driven by new employment, although this is likely to be abstracted from elsewhere.	The potential transfer of economic growth to the west of the study area within the A548 corridor is likely.	Moderate Beneficial (+ +)
Environment				
Noise		Noise impacts at residential properties range from a minor or negligible decrease for the majority, to a negligible, moderate or major increase for a small number. This option places 73 households into a higher 3dB noise band, and 1041 households into a lower band, in the forecast year (2037) Mitigation in the form of additional earthworks or other noise barriers in strategic locations may achieve a reduction in the noise effects at receptor locations most affected, principally along the offline section of this option.	Moderate or major increases between Northop Interchange and Kelsterton Interchange	Slight Beneficial (+)
Local Air Quality		No sensitive receptor locations are expected to exceed the annual mean air quality objective value for NO_2 in Opening Year (2022), using conservative predictions for vehicles. In Do Minimum, 3 sensitive receptor locations exceed annual mean objective and 6 are within 10% of annual mean objective for NO_2 Using conservative predictions for vehicles, no locations are expected to exceed the objective values for particulates (PM_{10}) in the Opening Year, and future improvements in vehicle emissions are predicted to reduce exposure to both NO_2 and PM_{10}.	Benefit for some properties adjacent to existing A494 and A55 carriageway	Neutral (0)
Greenhouse Gas Emissions		The total emission of greenhouse gases under this Option, for the 60-year appraisal period, would increase by 422,624 t compared with the Do Minimum (approx. 0.74% increase). The Option would encourage an increased number of journeys which outweighs the emission benefits of improvement to traffic flow. The negative effect is not considered large enough to affect the achievement of overall national policies and commitments	Global environment	(not classified)

Landscape and Townscape	Significant detrimental impact predicted for 3 character areas (LCA 036 – Kelsterton Brook, LCA 037 – Leadbrook Valley, LCA 044 Shotwick Lake Agriculture). Road improvement would result in loss of agricultural land and ancient woodland. Moderate detrimental impact predicted for 4 character areas. With mitigation, receptors would benefit from reinstatement of landscape features lost to proposed improvement. Slight detrimental impact predicted for 12 character areas.		Substantial Adverse (**- - -**) to Neutral (**0**)
Biodiversity	Loss of habitat within the Dee Estuary Ramsar, SPA, SAC, SSSI is likely. Mitigation to neutral (0) or slightly beneficial (+) effect will be essential. Loss of ponds, woodlands and other lower value habitat will cause severance of habitats at a landscape scale. Effectiveness of connectivity mitigation at specific locations targeting key species (e.g. GCN) is uncertain. Therefore effects at the wider scale are likely to be moderately adverse (- -) to large adverse (- - -). Increases in sediment run-off and pollution incident risk assessed as slight (-) to moderate adverse (- -) effect, depending on the feature affected. Increases of nitrogen and small particulate deposition, particularly on the new section of road, are likely to have a slightly adverse (-) to moderately adverse (- -) effect on sensitive habitats within proximity to the road. With mitigation, construction stage effects on species including legally protected species are likely to be neutral (0) to moderately adverse (-). Operational phase effects, particularly severance, on biodiversity in general are likely to be moderate (- -) to large (- - -) adverse	1km wide corridor on either side of route option. Impacts on hydrologically connected features at a distance greater than 1 km have also been considered	Construction Moderate adverse (**- -**) Operational Moderate adverse (**- -**) to large adverse (**- - -**)
Heritage	No large-scale impact is predicted for any site along the red option corridor. No large-scale features, or assets of 'medium' or 'high' value, have been identified that could not be mitigated by careful assessment and design. Red option has the potential for 7 instances of an impact of 'Neutral /Slight' and 'Slight' significance, 1 of 'Slight / Moderate' significance and 2 where the unknown site value or magnitude of impact leads to precautionary assessment of 'Slight' significance.	1km wide corridor on either side of route option The study corridors overlap in part and so some site locations fall into both options.	Slight Adverse (**-**)
Water Environment	Red option requires physical modification to watercourses of 'very high' to 'medium' importance which would, after mitigation, have Moderate/Large Adverse to Slight Adverse Effects. Residual effects will depend on the future proposed designs and the application of available mitigation which may reduce the overall impact. All other flood risks are considered to be Slight/Neutral subject to an appropriate FCA including	Watercourses throughout	Moderate Adverse (**- -**)

	hydraulic modelling and breach analysis. It is also assumed that a suitable drainage system can be designed, incorporating SuDS or proprietary treatment measures where space is limited, to control the rate of runoff and provide adequate treatment and spillage containment (which may be an improvement on the current situation).		
Soils	The precautionary assessment is of a low risk to Principal Aquifers arising from the possible disturbance of contaminated ground during construction and/or dewatering (if required). Soils would be conserved and re-used as a resource. There is no predicted change in quality and/ or use of soils, geological features or aquifers, and no measurable effect on humans, soils, buildings, or other ecosystems from ground contamination	Localised within Kinnerton Sandstone aquifer	Slight Adverse (-)
Social			
Transport safety	This option would redirect a proportion of existing traffic from the substandard A494/A55 route to a new route built to current design standards. This would improve transport safety for users of the existing route, although the substandard design of the existing route would remain a problem. Assessment of the impacts indicate that an additional 2 fatal accidents could occur, but 5 serious and 82 slight casualty accidents could be saved as a result of this over a 60 year appraisal threshold. This is due to the red route being shorter than the existing route. This option would also help to separate strategic and local traffic, reducing conflicts between different movements. It would also reduce traffic levels near to the populations of Shotton/Queensferry/Ewloe by ca.25%, reducing the potential for accidents involving pedestrians crossing the A494/A55 at none-designated crossing points. This option also reduces the potential for accidents involving freight transport due to a reduction in the disparity between the speeds of HGVs and general traffic experienced on the existing corridor at Aston Hill in the southbound direction.	Benefits for users of the A55/A494 corridor, particularly at Ewloe Interchange and Aston Hill and the communities adjacent to the A494.	Slight beneficial
Personal security	Personal security impacts of this option are likely to be limited to the impacts for pedestrians and cyclists seeking to cross the corridor. All pedestrian crossings on the new route will be lit and allow passive surveillance from passing traffic to ensure personal security is perceived as high for users of these crossings. This option is unlikely to change levels of personal security for users of the existing corridor.	Any impacts will be focused on the section of new road, which is sparsely populated.	Neutral
Permeability	The construction of new highway as part of the red route option would be undertaken in a sparsely populated part of the study area, limiting the permeability impacts of the road. New crossings of the red route will be provided for all	Benefits particularly for those living near to the existing A55/A494 route.	Neutral

	existing roads, lanes and public rights of way that would be severed by the proposed route, therefore existing permeability for the populations surrounding the red route will be maintained. Existing at-grade junctions on the A548 will be converted to grade-separated junctions, which could impact upon pedestrian permeability, although no specific pedestrian or cycle facilities are currently provided at these junctions and none motorised mode demand at these locations are likely to be very low.		
Physical fitness	No positive or negative impacts on physical fitness levels predicted as no new pedestrian or cycle routes will be provided as part of this option and existing routes will be no more or less desirable. Improved car journey times may increase car mode share, potentially reducing levels of walking and cycling, with associated physical fitness disbenefits, but this impact is likely to be negligible.		Neutral
Social inclusion	Improved accessibility to opportunities in North Wales and England and easier travel along the A55/A494 for local bus users. The new route could be utilised by public transport providers to provide access to work opportunities at Deeside Park for villages such as Northop and Flint Mountain, although no specific plans for this are proposed as part of the options presented.	Improvements for those making long distance journeys between North Wales and England and local movements within the Ewloe/Shotton area, which should benefit from a reduction in congestion.	Neutral
Equality, Diversity & Human Rights	Beneficial impacts resulting from improved air quality and noise impacts along the A55/A494 corridor will particularly benefit vulnerable groups including the young, old and those suffering multiple deprivation issues.	Benefits for residents living near to the existing A55/A494.	Slight beneficial
Transport Planning Objectives			
1. To reduce journey time variability and enhance the transport network resilience of the A55/A494 study corridor to periods of high demand, incidents and maintenance events.	The provision of the red route would reduce journey time variability and enhance network resilience by creating an alternative route to the A55/A494, helping to ensure that the network can cope with periods of high demand, as well as incidents and maintenance events.		
2. To improve transport connections for businesses within the study area to key economic centres and employment sites.	The provision of the red route would improve end to end journey times by 2 1/2 to 6 minutes and improve journey times for businesses in the study area to economic centres and employment sites. This would include improved connections to and from the Deeside Industrial Park from locations to the south and west, as well as improved connections to economic centres in England from the study area and locations in North Wales.		
3. To improve access	The additional capacity provided by the red route would improve journey times during		

between employment sites and workforce catchment areas.	commuter peak periods, improving access between workforces and employment sites.
4. To improve the actual and perceived safety and personal security of all transport users along the A55/A494 study corridor.	This option would redirect a proportion of existing traffic from the substandard A494/A55 route to a new route built to current design standards. This would improve transport safety for users of the existing route, although the substandard design of the existing route would remain a problem. Analysis of these accident benefits in COBALT utilising outputs from the traffic model indicate that an additional 2 fatal accidents could occur, but 5 serious and 82 slight casualty accidents could be saved as a result of this over a 60 year appraisal threshold. This is due to the red route being shorter than the existing route. This option would also help to separate strategic and local traffic, reducing conflicts between different movements. It would also reduce traffic levels near to the populations of Shotton/Queensferry/Ewloe by ca.25%, reducing the potential for accidents involving pedestrians crossing the A494/A55 at none-designated crossing points. This option also reduces the potential for accidents involving freight transport due to a reduction in the disparity between the speeds of HGVs and general traffic experienced on the existing corridor at Aston Hill in the southbound direction.
5. To improve the permeability across the A55/A494 corridor for non-motorised modes at key point of desire.	No improved permeability is offered by this option. Existing pedestrian bridge and underpass crossing locations would be maintained, but no additional crossings are currently proposed.
6. To ensure that the study area transport network facilitates necessary national and regional trip movements of people and freight.	The additional capacity provided by the red route option would overcome a key pinchpoint on the route which forms part of the TEN-T network and is important for regional trips as well as trips to/from Ireland. This will help to ensure that these necessary movements of people and freight are facilitated.
7. To reduce carbon emissions from transport along the A55/A494 study corridor.	This option would result in a slight increase in carbon emissions due to additional traffic induced onto the network resulting from the additional capacity created.
8. To minimise adverse impacts on the human environment including air, noise and light pollution, and landscape and townscape.	This option would transfer strategic trips away from the existing A55/A494 route, which passes through urban areas, and onto a new route away from urban areas. There would be slight reduction in noise for many residents along the Blue Option but larger increase for those not currently exposed. Option avoids exceedance of NO_2 and PM_{10} objectives at receptors. The new highway and elevated junctions, loss of screening vegetation and additional lighting, particularly at remodelled junctions, would have an adverse impact on the landscape and visual receptors. Effects on heritage would be slight.
9. To minimise adverse impacts on the natural environment including local air quality, water and soil pollution, and biodiversity impacts.	This option would transfer strategic onto a new route partly through rural areas, which would increase the deposition of pollutants on sensitive and protected habitats. Culverting and modifying watercourses would have moderate adverse effects. The risk of pollution of groundwater is low. Watercourses along the new section of highway would be exposed to a new, low, risk of accidental spillage and to highway pollutants. Works would encroach on protected biodiversity sites or disturb protected species, for which careful mitigation would be needed to avoid negative effects. Other habitat loss would be unavoidable, but partly mitigated in the long term by new habitat creation leaving a moderate to large adverse effect.
10. To maintain and make more efficient use of the existing transport infrastructure along the A55/A494 study corridor.	This option would utilise the alignment of the A548 for part of its route, although the existing roundabouts would need to be replaced. A new route would be required between Kelsterton and Northop which would not be based upon existing infrastructure.
Other issues	
Public acceptability:	The Stage 1 assessment indicated that support was likely from those living along the A55/A494 and opposition from those living along the A548 alignment. Levels of public acceptability will be confirmed subsequent to the planned public consultation.
Acceptability to other stakeholders:	Consultation indicated stakeholder support. Stakeholders questioned the A548 routes ability to replace the A55/A494 due to the capacity of the Flintshire bridge. Existing corridor

	would still require significant maintenance and to remain as trunk road.
Technical and operational feasibility:	Significant land purchase required as well as environmental mitigation. Significant maintenance still required on the A55/A494 corridor. It is likely there will be disruption to traffic flow during construction, which will be offline between Kelsterton and Northop, and online along the A548. Moderate construction related delays are likely, mitigation measures will be identified in the construction management plan.
Financial affordability and deliverability:	The high cost of this package means that funding will need to be sought from the delivery agencies that have been identified. This option will be subject to the successful completion of statutory procedures and the availability of funding from budgets approved by the WG.
Risks:	The main risks associated with this package are the availability of funding from the key delivery agencies and required environment mitigation measures.

Appraisal criteria	**Summary of significance / other qualitative finding**	**Summary of significance / other qualitative finding**
Welsh Impact Areas	**Blue option**	**Red option**
Economy		
Transport Economic Efficiency	Neutral (=) Scheme Cost = £283.0m (Q4 2015, Exc VAT and Inflation) Present Value Cost = £168.5m (2010 prices) Present Value Benefits £151.9m (2010 prices) Benefit Cost Ratio = 0.90	Significant Beneficial (+++) Cost = £255.4m (Q4 2015, Exc VAT and Inflation) Present Value Cost = £152.9m (2010 prices) Present Value Benefits £423.5m (2010 prices) Benefit Cost Ratio = 2.77
EALI (Wider economic impacts)	Slight Beneficial (+) GVA impacts are estimated at between £15.0 and £16.3 million per year for Wales as a whole in 2032.	Moderate Beneficial (++) GVA impacts are estimated at around £33.5 and £36.3 million per year for Wales as a whole in 2032.
Environment		
Noise	Slight Adverse (-)	Slight Beneficial (+)
Local Air Quality	Neutral (0)	Neutral (0)
Greenhouse Gas Emissions	(not classified)	(not classified)
Landscape and Townscape	Substantial adverse (- - -) to Slight Beneficial (+)	Substantial adverse (- - -) to Neutral (0)
Biodiversity	Construction - Moderate adverse (- -) Operational - Neutral(0) to slight adverse (-)	Construction - Moderate adverse (- -) Operational - Moderate adverse (- -) to large adverse (- - -)
Heritage	Slight adverse (-)	Slight adverse (-)
Water Environment	Moderate adverse (- -)	Moderate adverse (- -)
Soils	Slight adverse (-)	Slight adverse (-)
Society		
Transport safety	Neutral (0)	Slight Beneficial (+)
Personal security	Neutral (0)	Neutral (0)
Permeability	Neutral (0)	Neutral (0)
Physical fitness	Neutral (0)	Neutral (0)
Social inclusion	Slight Beneficial (+)	Neutral (0)

Appraisal criteria	Summary of significance / other qualitative finding	Summary of significance / other qualitative finding
Welsh Impact Areas	**Blue option**	**Red option**
Equality, Diversity & Human Rights	Neutral (0)	Slight Beneficial (+)

MONITORING AND EVALUATION PLAN

10.0

10.0 MONITORING AND EVALUATION PLAN

10.1 Overview

10.1.1 The 2008 WelTAG guidance, section 12, outlines the requirements for the monitoring and evaluation of major transport investment, in alignment with the core stages of the ROAMEF cycle[4]. The guidance outlines the need for a Monitoring and Evaluation Plan (MEP) to be prepared as part of a scheme or strategy appraisal process, which is also a condition for funding approval.

10.1.2 A robust yet proportionate A55/A494/A548 corridor MEP will assist the Welsh Government in determining the extent to which the delivered scheme has realised its objectives and forecast outcomes. Proportionate and regular monitoring and evaluation of the scheme delivery process and its outcomes is key to ensuring:

- The scheme is performing as intended and demonstrates value for money;
- Any problems and/or possible improvements are identified;
- Key performance indicators are monitored;
- Established objectives are being achieved; and
- The delivery body learn lessons for future major scheme delivery.

10.1.3 Monitoring of the outcomes of the scheme will aid in the valuation of the project as a whole. This will enable an understanding of the impacts of the scheme and determine whether the scheme has been successful in achieving its intended objectives. It will also assist in determining the contribution the scheme has made to achieving the Wales Transport Strategy objectives.

10.2 Scope of Monitoring and Evaluation

10.2.1 In preparing this MEP, considering has been given to the overarching scope and coverage of assessment activities required, given the scale and complexity of the scheme. This review has determined that the following scope should be adopted:

- Pre-implementation: A robust and comprehensive baseline of transport network conditions should be established prior to the scheme's implementation;
- Post construction: Immediately following scheme completion it is recommended that a high level review be undertaken of the efficiency and effectiveness of the various delivery agents;
- One year post scheme completion: An impact evaluation should be undertaken to assess the initial outcomes achieved. This will include a comparison of outturn traffic flows and journey times with those forecast as part of the appraisal modelling activities. An economic evaluation of the scheme's value or money should also be undertaken at this point; and
- Between three and five years post scheme completion: A follow up impact evaluation should be undertaken to consider the medium term outcomes and contribution of the scheme to wider economic impacts.

Each of these areas is covered in turn below.

10.3 Baseline Position

10.3.1 The first requirement will be to ensure that robust baseline data exists, for the period immediately prior to the start of scheme implementation. This will permit a direct comparison with ex-post data, thereby considering the gross change in core indicators. It is good practice to maximise the use of data collected as part of the ex-ante appraisal process in establishing a baseline. However, the data used to develop the appraisal transport model was collected at various times in 2015 and 2016; the former will therefore be at least two years prior to scheme implementation.

[4] Rationale, Objectives, Appraisal, Monitoring, Evaluation and Feedback, defined in HM Treasury Green Book: Appraisal and Evaluation in Central Government.

10.3.2 A review is recommended of the validity of the existing data, in the context of changes in background conditions since 2015. This should cover two areas of data: first, those data sources that were specifically collected or enhanced as part of the appraisal process; and secondly, those that are derived from readily available secondary sources. For surveys specifically undertaken for this study, such as traffic counts, any available permanent data sources should be used to understand change since 2015 e.g. the Traffic Wales permanent ATC on the A55 between junction 32a and junction 33. This review should determine whether there have been any substantive changes in data since 2015/2016 which would necessitate the collection and analysis of updated baseline data. Where data is readily available from secondary sources, such as TrafficMaster or STATS19, then data should be obtained for 2016/17 and a review undertaken of changes since 2015.

10.3.3 The review should determine the most appropriate baseline year, based on evidence from across the range of datasets. If it is considered necessary to define a baseline for 2017 then a baseline data collection plan should be prepared and any additional data collected prior to scheme implementation. The collection of an updated set of baseline data is highly recommended if the start of scheme construction is later than June 2018 i.e. three years after modelling data was collected.

10.3.4 A baseline data report should be prepared, presenting a comprehensive picture of the pre-implementation conditions across the range of outcome and impact indicators. This should include consideration of the following datasets.

10.3.5 Traffic Flows

Extensive traffic flow data has been collected as part of the transport modelling activities, including Automatic Traffic Counts (ATC) at 13 sites used to collect Roadside Interview Data. This is supplemented by 38 permanent ATC sites managed by Traffic Wales, Flintshire CC and Cheshire West and Chester Council (CW&CC). A detailed audit of the baseline data available from across these sites should be undertaken, identifying the core locations where robust data is available, and will continue to be available during and after scheme implementation.

10.3.6 Traffic Time Reliability

Journey times and variability data has been collated for the 12 routes (both directions) defined in the Data Collection and Transport Survey Report. This used TrafficMaster data provided by Welsh Government for a neutral month between March and June 2015. Journey times were analysed for the AM peak, inter-peak and PM peak periods. Additional data for 2016/17 should be obtained and reviewed as part of the baseline exercise.

10.3.7 Accidents and Casualties

As noted earlier, STATS 19 accident data has be obtained from www.data.gov.uk. Road traffic accident and casualty data have been obtained for the 5 year period from 2011 to 2015 for the A55/A494/A548 Deeside corridor. The data has been analysed to report accidents and casualties by road user type, to include pedestrians and cyclists. Additional data for 2016 and 2017 should be obtained and analysed to present an updated baseline from that included in the 2015 transport modelling.

10.3.8 Air Quality

Local air quality monitoring was also undertaken as part of the appraisal process. NO2 levels were monitored using passive diffusion tubes for 4 months, from 25 July 2016 to 24 November 2016 at 25 locations. NO2 and PM10 were also measured for 6 months using continuous reference monitoring methods at one location (South Bank, Shotton). This equipment was also used to calculate a local verification adjustment for the diffusion tube network. This equipment was installed on 25 July 2016 and is due to end monitoring in January 2017; it is strongly recommended that this site remain operational throughout scheme implementation and into the year one post implementation period. The monitoring data have been adjusted for laboratory bias and seasonal effects to provide annual average concentrations for 2016, which will form the baseline data for the scheme. In addition, Flintshire County Council has undertaken continuous monitoring of air quality at 25 locations near to the study area, with data available

back to 2012. Data from these sites will provide contextual evidence within which to consider scheme outcomes.

10.3.9 Bus Patronage

As outlined in the Data Collection and Transport Survey Report, extensive boarding and alighting counts were undertaken of bus services across the study area in November 2015; 16 sites including Chester, Wrexham and Mold bus stations. The review should determine any available data from operators on patronage that could be used to generate a more up to data and thereby robust baseline. Given the costs associated with these counts careful consideration needs to be given to undertaking any further pre-implementation surveys. However, counts should be repeated in the year one ex-post period for comparison with the baseline and forecast for the opening year generated by the transport model.

10.3.10 Rail Patronage

Rail patronage, and flows between individual stations, was derived for 2015 using Lennon ticket sales data applied through the MOIRA rail timetable software. In addition, a survey was undertaken at six stations in the study area in November 2015: Chester; Flint; Hawarden Bridge; Shotton High; Wrexham Central; and Wrexham General. These surveys were associated with a count of passengers boarding and alighting each service and collected information on passenger's origin and destination, access mode and trip purpose. As part of the baseline review, the 2016 and 2017 Lennon data should be obtained and an updated analysis of passenger flows generated. The Lennon data should be obtained for at least one full year post opening of the scheme to assess the year one ex-post patronage levels.

10.3.11 Contextual Conditions

As noted earlier, the Port of Holyhead generates up to 16% of HGV traffic on the A55/A494 as a result of the port traffic. The monitoring must also therefore include the recording of port activity levels up to the point prior to scheme implementation e.g. the number of roll-on roll-off ferries that arrive. Other contextual data that should be collated as part of the baseline exercise includes household numbers, employment by category and GVA.

10.4 Review of Scheme Implementation

10.4.1 It is good practice to review the efficiency and effectiveness of scheme implementation through a process evaluation. A commonly adopted and proportionate approach is to undertake a single retrospective review of delivery agent performance, within three months of scheme completion. Delivery teams are generally still available at this time, and issues encountered are readily recollected. However, it is critical that data and information be collated during construction on the following topics:

- Risk registers at least for every 6-month period, so that risk management and mitigation can be observed throughout scheme delivery;
- Health and Safety records;
- Financial returns and information on compensation events;
- Minutes of key meetings, particularly where keys decisions are made; and
- Stakeholder engagement activities.

A short report on the scheme delivery should be prepared within six months of scheme completion.

10.5 Year One Impact Evaluation

10.5.1 WelTAG 2008 does not prescribe an approach for monitoring and evaluation, stating that this should be determined in a proportionate way for each scheme or strategy. A requirement of WelTAG 2008 is that a year one ex-post impact evaluation should be undertaken. The precise timing of this is dependent on the specific scheme. This section presents an overview of the proposed year one ex-post approach for the A55/A494/A548 corridor.

10.5.2 Ex-Post Data Collection and Analysis

To enable the year one impact evaluation to be undertaken it will be necessary to collect an updated set of monitoring data. This should replicate, as far as possible, the full range of data presented in the baseline report. For the A55/A494/A548 scheme it is recommended that a full year of ex-post data be available prior to the evaluation being undertaken. This is particularly relevant for the use of Lennon data for example. This recommendation will delay the preparation of the year one evaluation report, as there are time lags with the availability of some secondary data sources. The data should be processed and used to:

- Compare the outturn indicator values with the baseline, to determine the gross changes; and
- Compare with the opening year forecasts, to consider variance.

A narrative should be prepared around the observed level of change in each of the key indicators, with particular exploration required around variance observed from the ex-ante forecasts.

10.5.3 Defining the Counterfactual

A central consideration within the evaluation approach should be how to attribute the observed changes in outcome and impact indicators to the A55/A494/A548 corridor i.e. to derive the net effects of the scheme. This will require the selection and design of an evaluation approach to define the counterfactual i.e. the situation that would have occurred in the absence of the scheme. This will need to include consideration of other changes to the area's transport network (e.g. the North Wales Metro), background economic conditions and any other factors that could influence travel patterns in the area.

The core counterfactual scenario is the modelling Do Minimum scenario, tested using the 2015 Deeside Transport Model. However, where variance is observed between forecast and observed ex-post data, further exploration and investigation would be recommended. Consideration should therefore be given to:

- The use of comparison corridors or areas adjacent to the A55//A494 that could assist in controlling for background contextual changes i.e. of background growth varied was the assumed levels this should influence the scheme and comparator areas equally; and
- The use of theory-based evaluation approaches. These are becoming increasing common for major transport investment and assisting in unpicking the observed outcomes and impacts. Depth interviews with stakeholders and the analysis of causal pathways should be undertaken. This will include the preparation of a logic map of the scheme, to define how the outputs are anticipated to lead to outcomes and impacts.

10.5.4 Economic Evaluation

The final element of the year one evaluation will be to undertake an updated economic evaluation of the scheme i.e. determine the outturn value for money. The outturn costs of scheme implementation obtained through the review of delivery will be required. The observed values for the benefits defined in the ex-ante business case should be obtained, including:

- Traffic journey time (and reliability);
- Road safety;
- Vehicle operating costs;
- Air quality (to feed into the review of the SEA); and
- Noise.

These indicators also cover the three pillars of sustainable development: economy; environment; and society. The precise methodology for updating the economic evaluation should be determined in consultation with the Welsh Government. Options include:

- Collecting sufficient ex-post data to update the Deeside Transport Model and re-run the various scenarios, through which to determine an updated BCR; and
- A lower cost option of using selected observed ex-post data to review the accuracy of the ex-ante forecasts, and derive an estimate of the outturn BCR.

It is recommended that a single year one ex-post evaluation report be prepared incorporating the impact and economic assessment outputs.

10.6 Five Year Impact Evaluation

10.6.1 The final element of the evaluation should be an updated ex-post impact assessment, undertaken between three and five years post implementation. This should not include a repeat of the economic evaluation and should focus on reviewing the changes in key outcome indicators e.g. traffic flows and journey times. Consideration should be given to the use of theory-based approaches to again determine the contribution of the scheme and the influence of contextual factors.

WELL-BEING OF FUTURE GENERATIONS ACT

11.0

11.0 Well-Being of Future Generations Act

11.1 Overview

11.1.1 The Well-being of Future Generations (Wales) Act 2015 (WFGA) outlines the overarching aims of the Welsh Government, and requires public bodies to:

'..do things in pursuit of the economic, social, environmental and cultural well-being of Wales in a way that accords with the sustainable development principle'

11.1.2 Although the 2008 WelTAG process pre-dates the WFGA it closely aligns with the requirements of the Act through its focus on the appraisal of the economic, environmental and social impacts of the transport strategies and interventions developed as part of the process and the aim of maximising the benefits and minimising any dis-benefits against these criteria as part of the strategy and scheme development process.

11.1.3 This section of the report focuses on how the options currently under consideration for the A55/A494/A548 corridor align with the aims of the WFGA. This focuses on how each option contributes to the following Well-Being goals:

- **A Prosperous Wales** - an innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work;
- **A Resilient Wales** - a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change);
- **A Healthier Wales** - a society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood;
- **A More Equal Wales** - a society that enables people to fulfil their potential no matter what their background or circumstances (including their socio-economic background and circumstances);
- **A Wales of Cohesive Communities** - Attractive, viable, safe and well-connected communities;
- **A Wales of Vibrant Culture and Thriving Welsh Language** - a society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts and sports and recreation; and
- **A Globally Responsible Wales** - a nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.

11.2 Scheme Impacts

11.2.1 Table 11.1 indicates how the two options under consideration for the A55/A494/A548 corridor have been developed to contribute towards the aims of the WFGA.

Figure 11.1: Scheme contribution towards the WFGA Goals

WFGA Goal	Red Route	Blue Route
A Prosperous Wales:		
Innovative, productive and low carbon society	This option will result travel time savings equating to £471m over a 60 year appraisal threshold and GVA benefits of between £33.5m and £36.5m per year across Wales by 2032, with £13m of additional output within the study area driven by new employment. Increases in travel are likely to result in additional carbon emissions however.	This option will result travel time savings equating to £260m over a 60 year appraisal threshold and GVA benefits of between £15m and £16.3m per year across Wales by 2032, with £8m of additional output within the study area driven by new employment. Increases in travel are likely to result in additional carbon emissions however.
Recognising the limits of the global environment, using resources efficiently and proportionately (including acting on climate change)	This option would require approximately 56 ha of grade 2 and 3 agricultural land. Greenhouse gas emissions would be increased by 0.74% over the Do Minimum.	This option would require approximately 12 ha of grade 3a agricultural land. Greenhouse gas emissions would be increased by 0.83% over the Do Minimum.
Developing a skilled and well-educated population	Both options would improve accessibility to opportunities for education and training through improved journey times along the strategic highway network.	
An economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work	This option would contribute GVA benefits of between £33.5m and £36.5m per year across Wales by 2032, with £13m of additional output within the study area driven by new employment.	This option would contribute GVA benefits of between £15m and £16.3m per year across Wales by 2032, with £8m of additional output within the study area driven by new employment.
A Resilient Wales:		
Maintains and enhances a biodiverse natural environment	Land take and indirect effects on designated sites near Dee Estuary, and on protected species, particularly in rural area where ancient woodland is crossed by viaduct. Mitigation is unlikely to provide full mitigation though some elements could be enhanced where existing habitat value is low.	Marginal land take from site designated for Great Crested Newts but mitigation is likely to be possible. Loss of habitats in the highway estate could be mitigated by replacement and enhancement planting if land is available.
Healthy functioning ecosystems that support social, economic and ecological resilience	Land take and severance of habitats, and loss of organic farmland will reduce the healthy functioning of ecosystems. Watercourses would be protected by drainage and pollution control features within the highway drainage system, which could enhance the current situation.	The functioning of roadside ecosystems would be disrupted in the short term but replacement and enhancement planting would gradually restore this function, if sufficient land is available.
The capacity to adapt to change (for example climate change)	Loss of farmland reduces potential for local food production.	Neutral
A Healthier Wales:		
People's physical and mental well-being is maximised	A Health Impact Assessment will be undertaken to assess the physical and mental well-being impacts of the proposed options. Existing walking and cycling opportunities will be maintained through the provision of new and improved pedestrian/cycle crossings to maintain	

WFGA Goal	Red Route	Blue Route
	opportunities for physical activity. The Impact Assessment will take account of a predicted increase in noise for some residents along the each Option and decrease for others. The change for the large majority of residents is slight, and mitigation by barriers and design would be adopted where possible. The air quality for almost all residents would remain within annual mean objective values, but the Red Option would generate an improvement in air quality for those nearest the A55 and A494.	
Choices and behaviours that benefit future health	Existing opportunities for physical activity will be maintained through the provision of new and improved pedestrian/cycle crossings. Improved journey times by motorised modes may lead to some shifting to car use from more sustainable transport choices however.	
A More Equal Wales:		
A society that enables people to fulfil their potential no matter what their background or circumstances	No positive or negative discriminatory impacts are anticipated on any equalities impact groups as a result of either option, therefore providing all within society with the same opportunities.	
A Wales of Cohesive Communities:		
Attractive, viable, safe and well-connected communities	This option would move a proportion of traffic away from established communities, helping to improve the attractiveness and safety of those communities. Footpaths connecting farms and scattered dwellings would require diversion and specific provision to cross the Red Option between Northop and Kelsterton.	This option would maintain and add traffic to the existing A55/A494 route, and so footbridges or underpasses would be required to maintain existing connections and improve historic severance.
A Wales of Vibrant Culture and Thriving Welsh Language:		
Promotes and protects culture, heritage and the Welsh language	Both options would improve accessibility to cultural and heritage assets within North Wales and England through the provision of improved transport connections through the Deeside area. These improved transport connections would help to support tourism and economic regeneration in Welsh speaking areas of North Wales, helping to promote and protect the Welsh language. The Welsh language will also be included in all promotional and consultation materials for the scheme during its development phase.	
Encourages people to participate in the arts, and sports and recreation	Both options would improve accessibility to arts, sports and recreation venues through the provision of improved transport connections through the Deeside area.	
A Globally Responsible Wales:		
When doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether such a thing may make a positive contribution to global well-being	The local and regional benefits of both options as discussed above would also contribute to wider beneficial impacts as the A55/A494 corridor forms part of the European TEN-T network and will therefore provide beneficial impacts for the free movement of people and goods throughout Europe.	

NEXT STEPS

12.0

12.0 NEXT STEPS

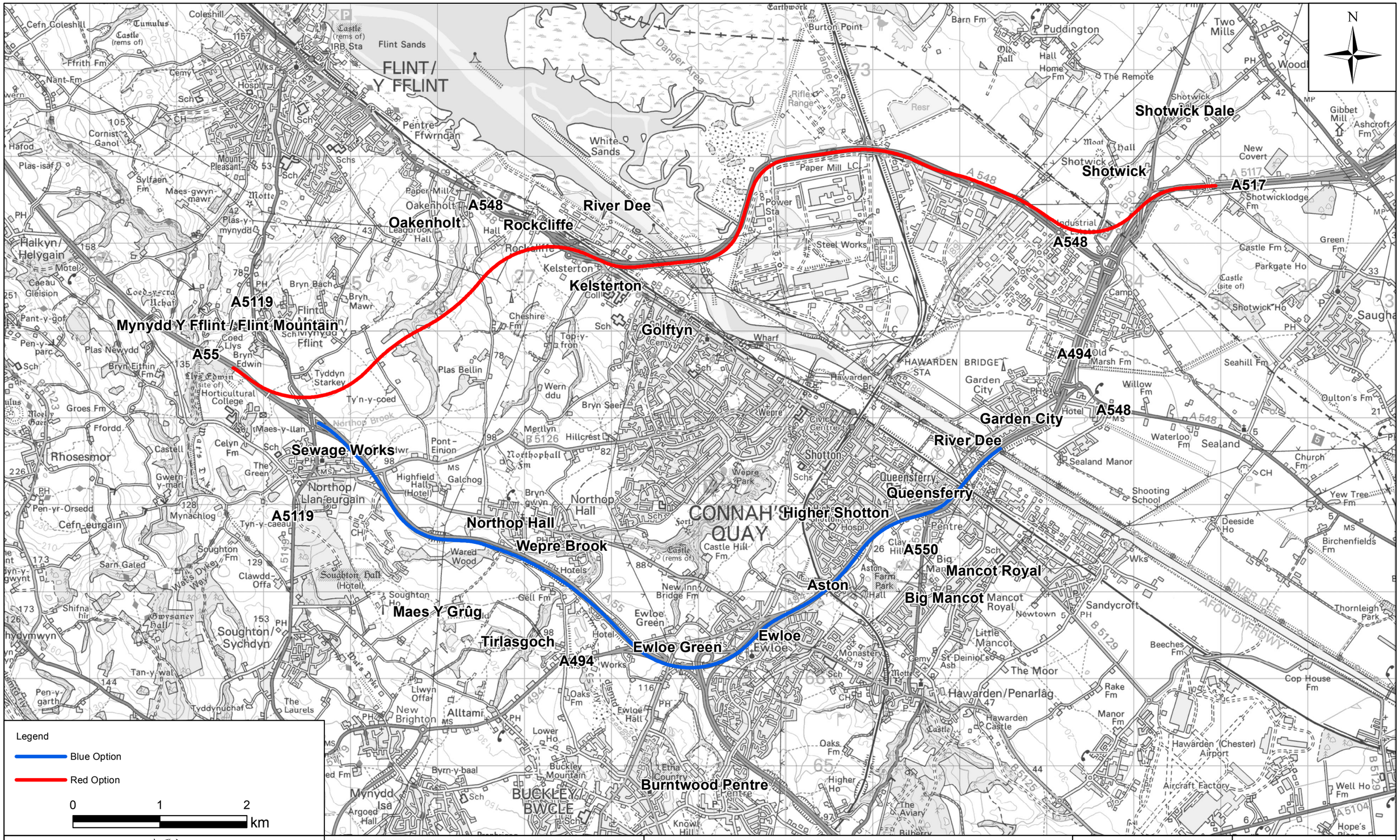
12.1 Overview

Appendices

A

Appendix A: Figures / Drawings

Contents



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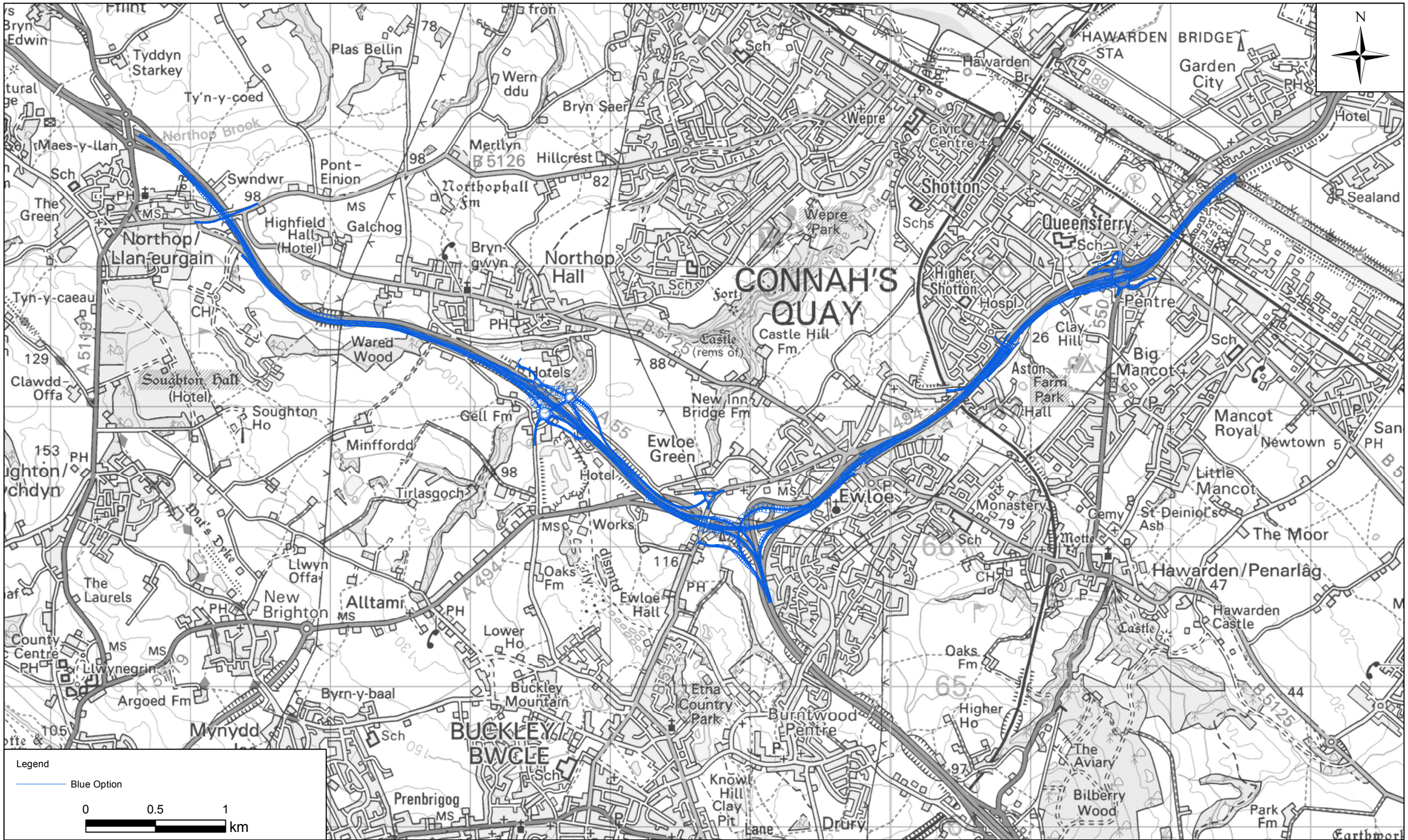

Legend

Blue Option

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government	Title: FIGURE 1.2 BLUE OPTION
Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2	

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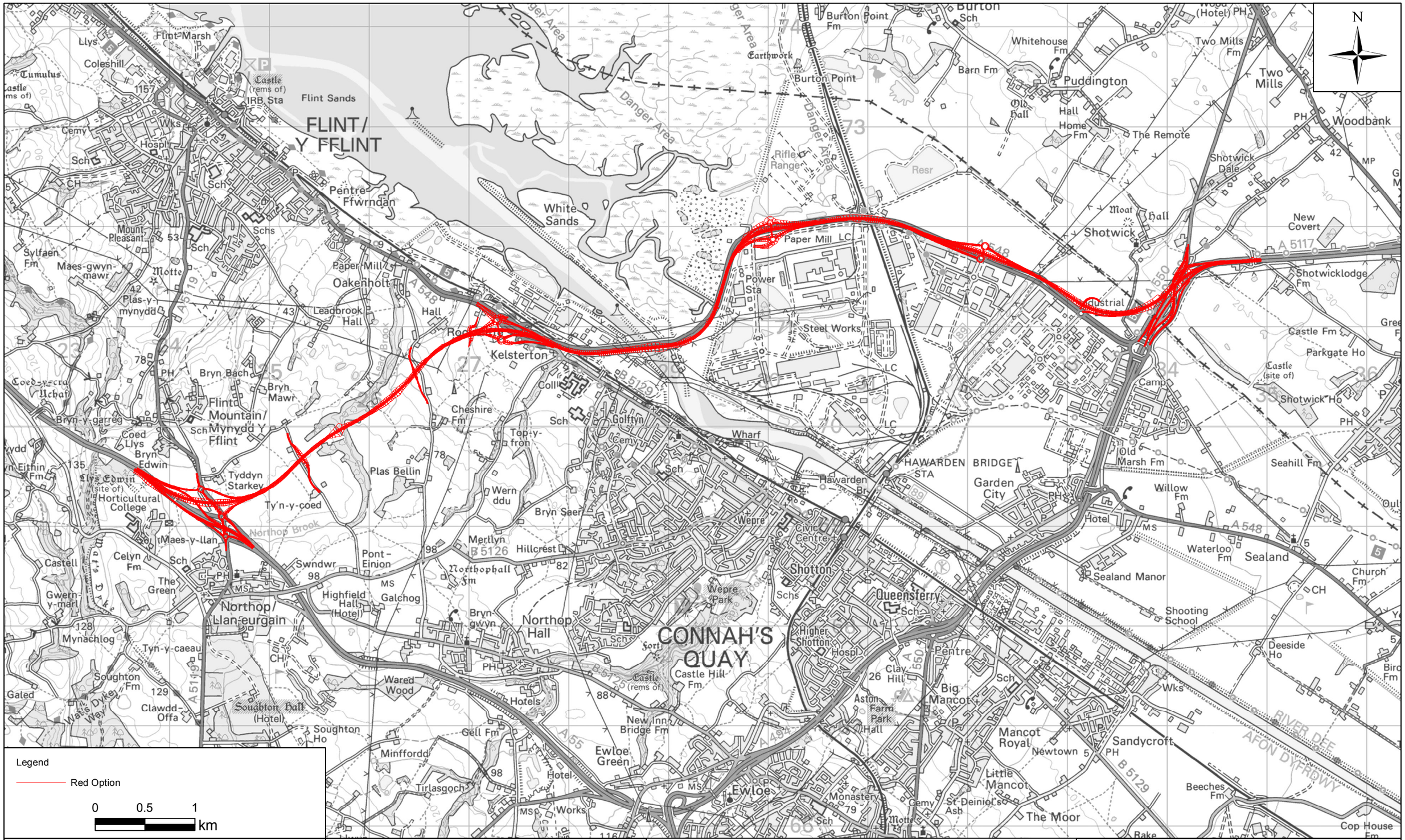

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Red Option

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government	Title: FIGURE 1.3 RED OPTION
Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2	

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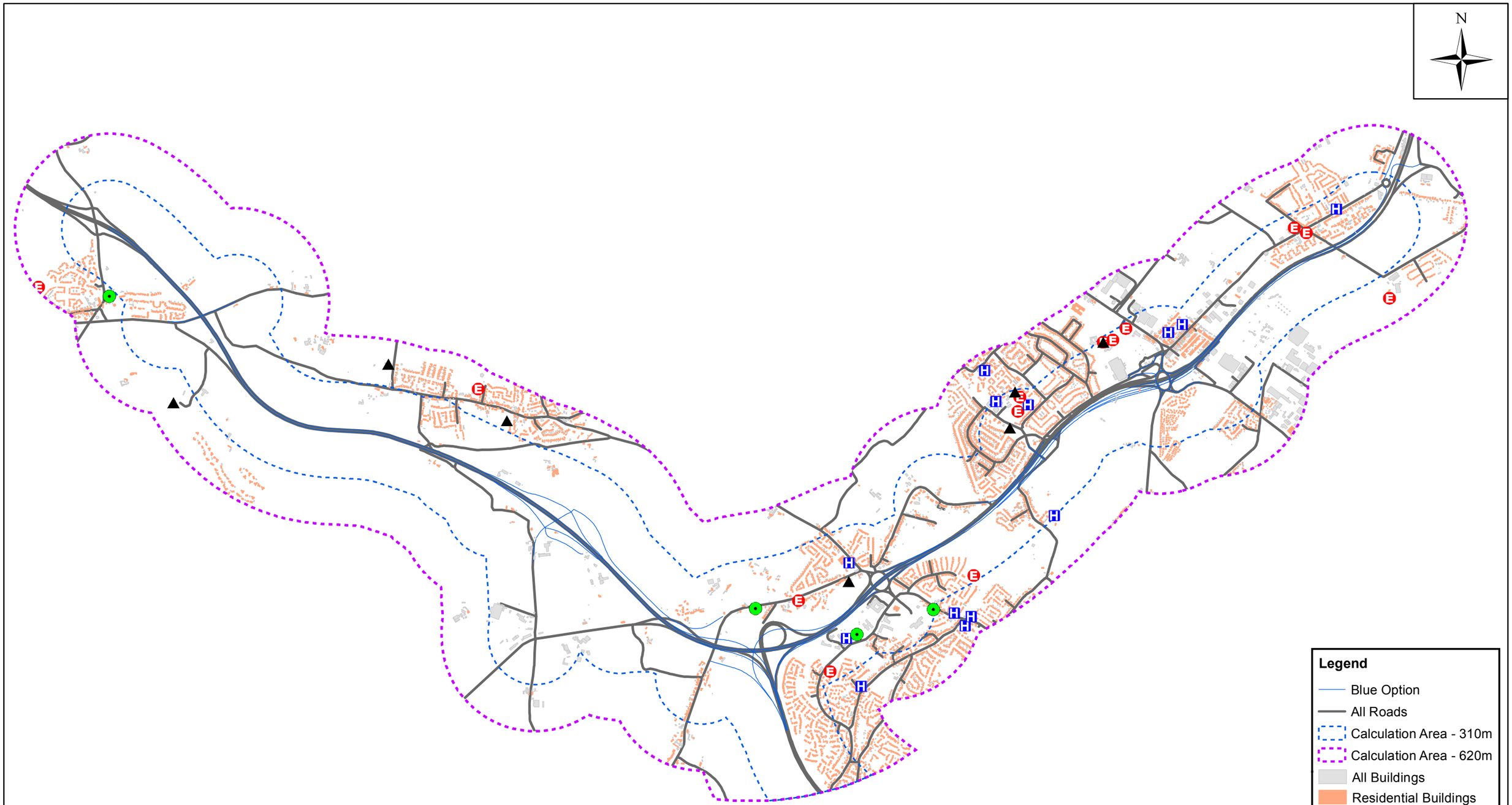

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.1A STUDY AREA BLUE OPTION

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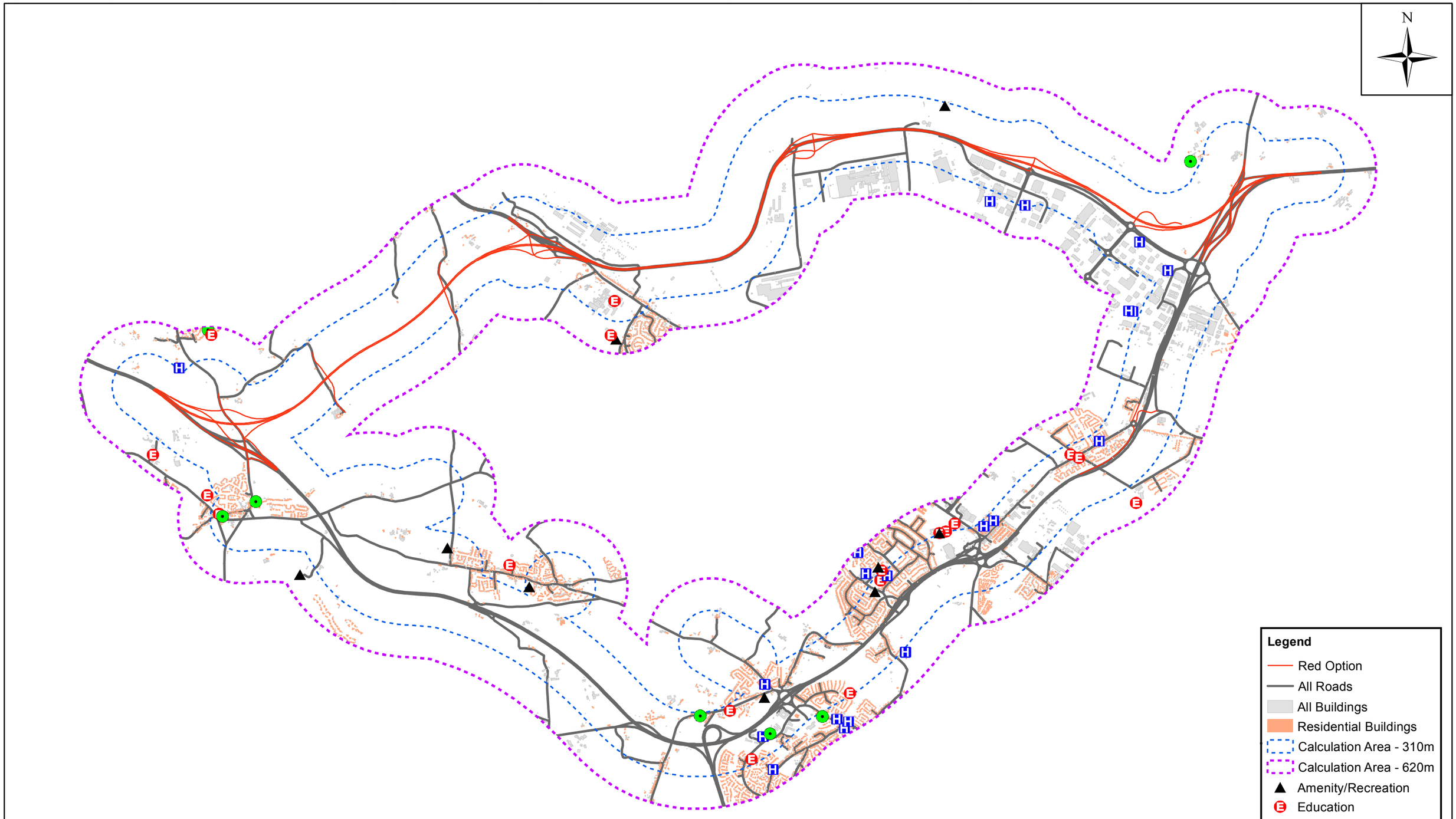

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.1B STUDY AREA RED OPTION

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N

Legend

- Blue Option
- Red Option
- Base Route
- Study Area - 1km
- Buildings

Community Facilities

- Education Faciliy
- Hospital
- Leisure Or Sports Centre
- Place Of Worship
- Residential Care Home
- Public Right of Way
- Scheduled Monuments
- Site of Special Scientific Interest (SSSI)
- Special Protected Area (SPA)
- RAMSAR

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.2 NOISE & VIBRATION SENSITIVE RECEPTORS

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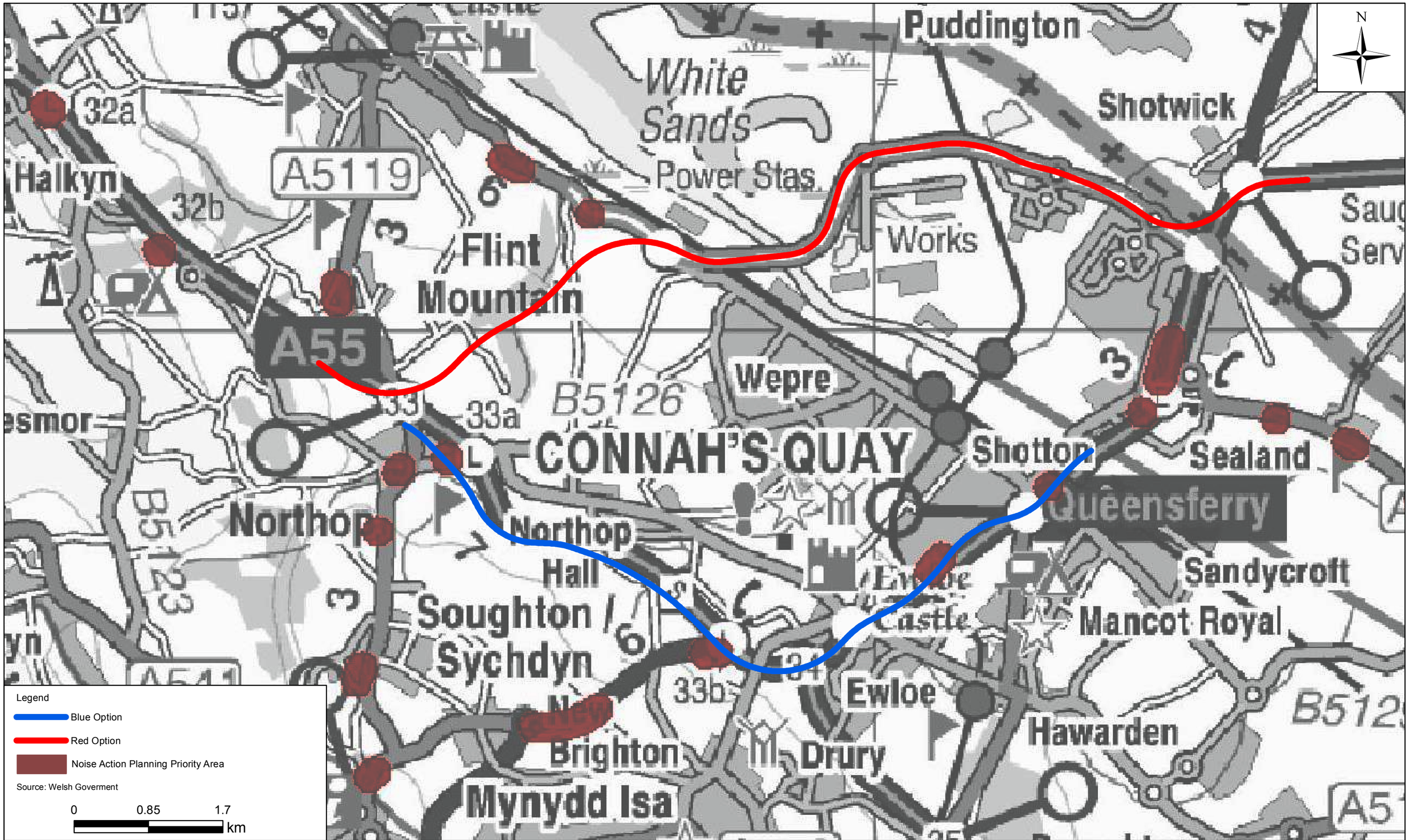

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title:

FIGURE 4.3
PRIORITY AREAS FROM NOISE ACTION PLAN FOR NORTH - EAST WALES

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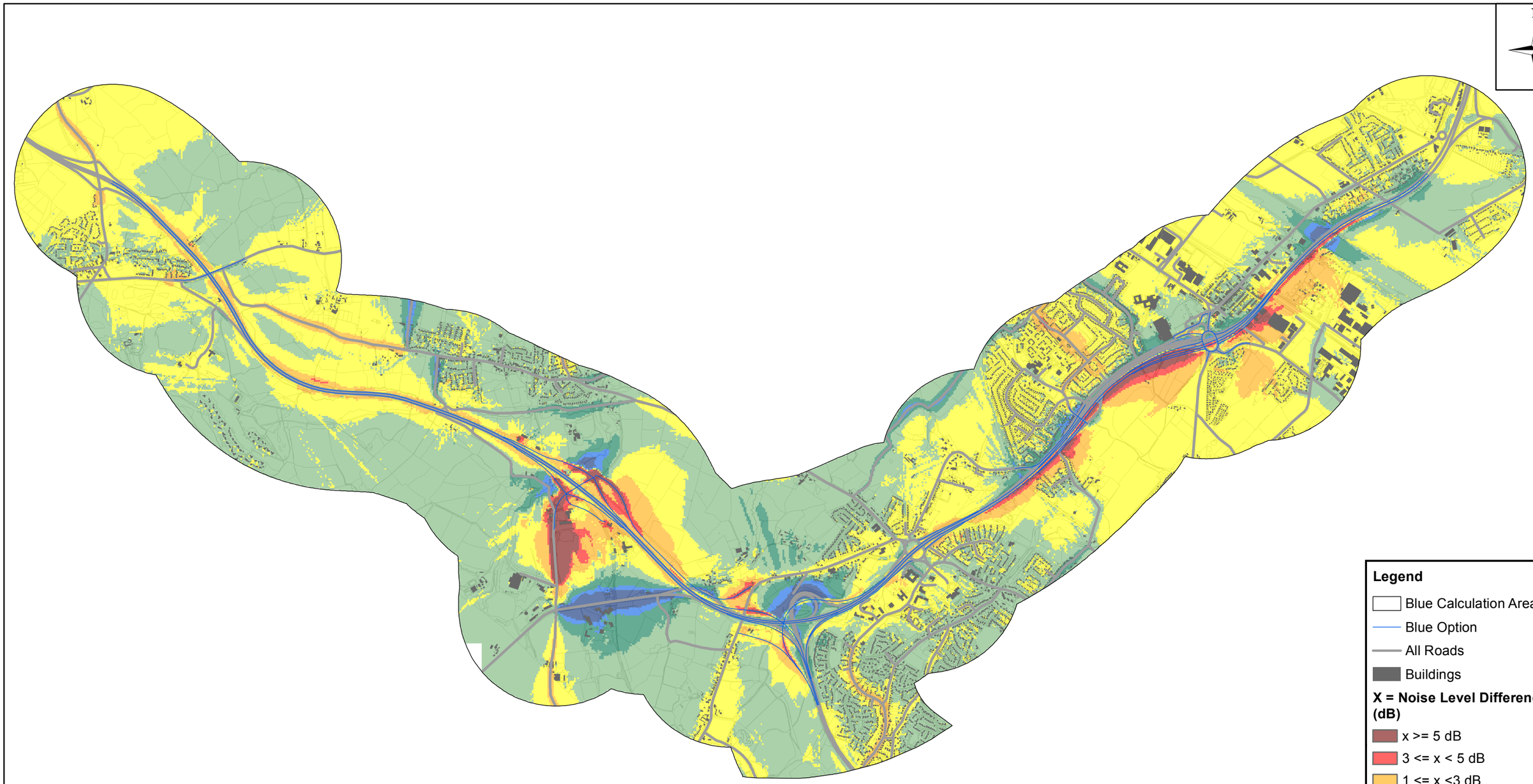

Legend

- Blue Calculation Area
- Blue Option
- All Roads
- Buildings

X = Noise Level Difference (dB)

- x >= 5 dB
- 3 <= x < 5 dB
- 1 <= x <3 dB
- 0 < x < 1 dB
- x = 0 dB
- -1 < x < 0 dB
- -3 < x <= -1 dB
- -5 < x <= -3 dB
- x <= -5 dB

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.4 BLUE OPTION SHORT TERM DAYTIME NOISE LEVEL DIFFERENCE $L_{10, 18HR}$ DM 2022 V DS 2022

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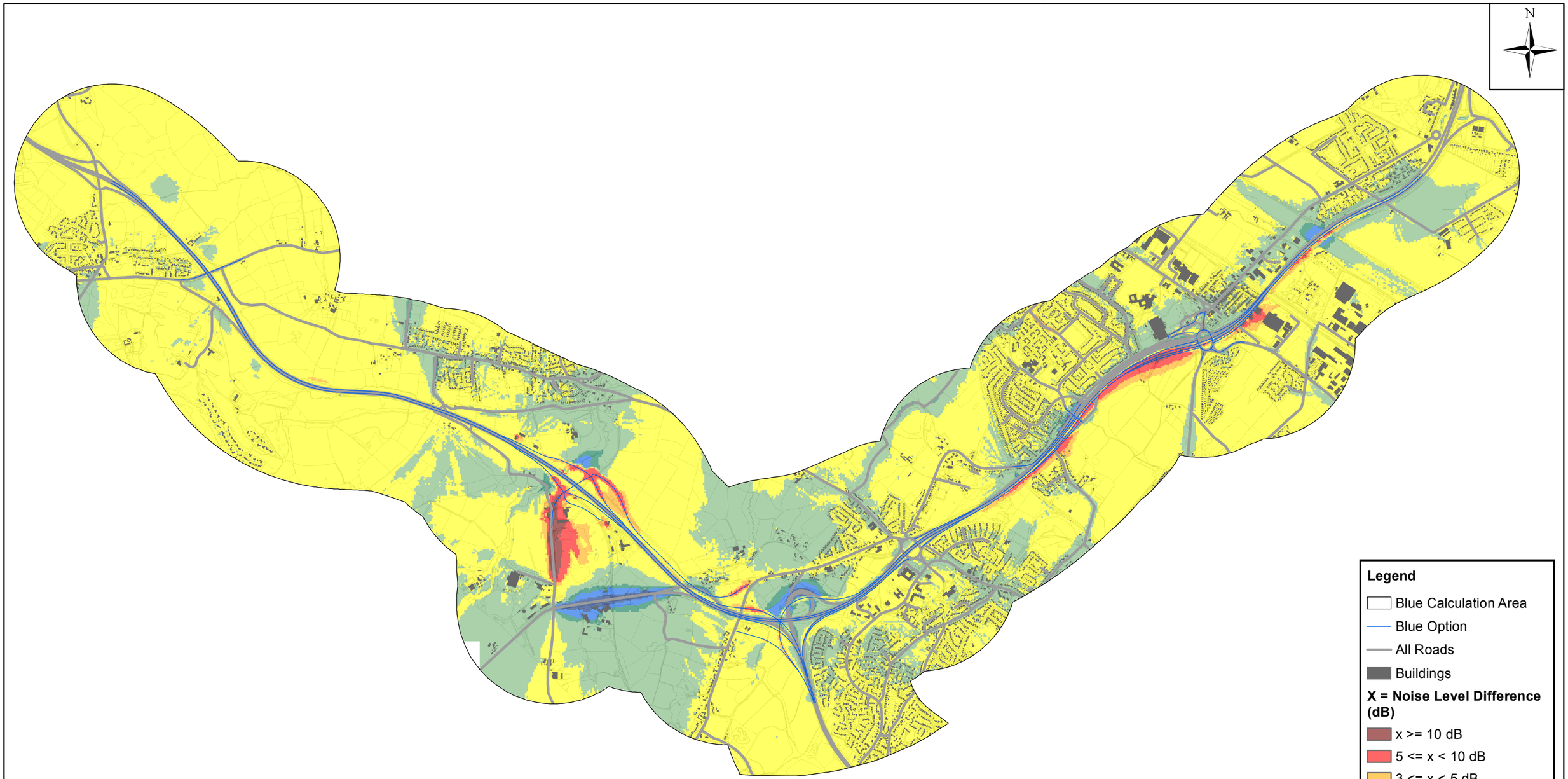

Legend

- Blue Calculation Area
- Blue Option
- All Roads
- Buildings

X = Noise Level Difference (dB)

- x >= 10 dB
- 5 <= x < 10 dB
- 3 <= x < 5 dB
- 0 < x < 3 dB
- x = 0 dB
- -3 < x < 0 dB
- -5 < x <= -3 dB
- -10 < x <= -5 dB
- x <= -10 dB

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.5 BLUE OPTION LONG TERM DAYTIME NOISE LEVEL DIFFERENCE $L_{10, 18HR}$ DM 2022 V DS 2037

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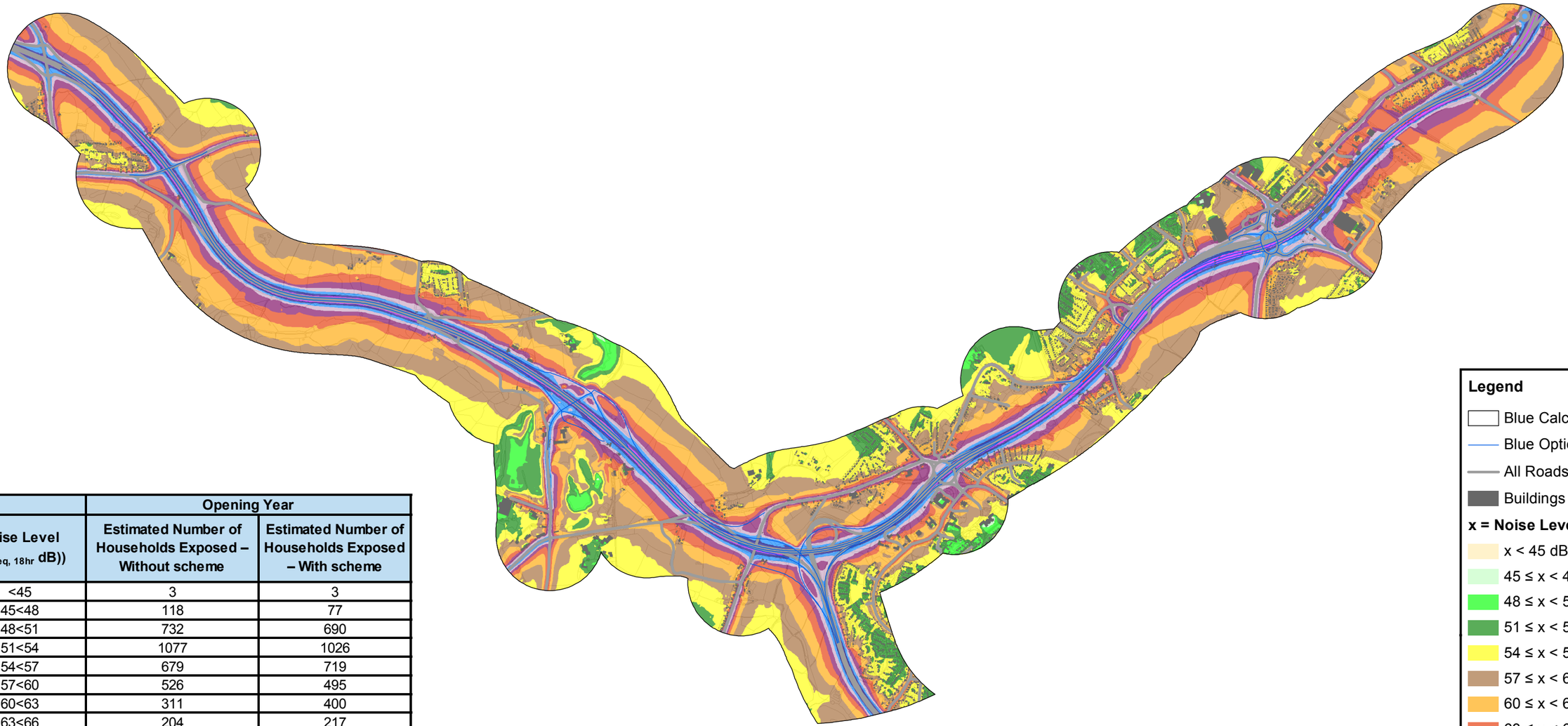

	Opening Year	
Noise Level ($L_{Aeq,\ 18hr}$ dB))	Estimated Number of Households Exposed – Without scheme	Estimated Number of Households Exposed – With scheme
<45	3	3
45<48	118	77
48<51	732	690
51<54	1077	1026
54<57	679	719
57<60	526	495
60<63	311	400
63<66	204	217
66<69	97	115
69<72	8	14
72<75	3	3
75<78	0	0
78<81	0	0
81+	1	0

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.6 3 dB NOISE LEVEL MAP AND ESTIMATED POPULATION PER CONTOUR DS 2022- BLUE OPTION

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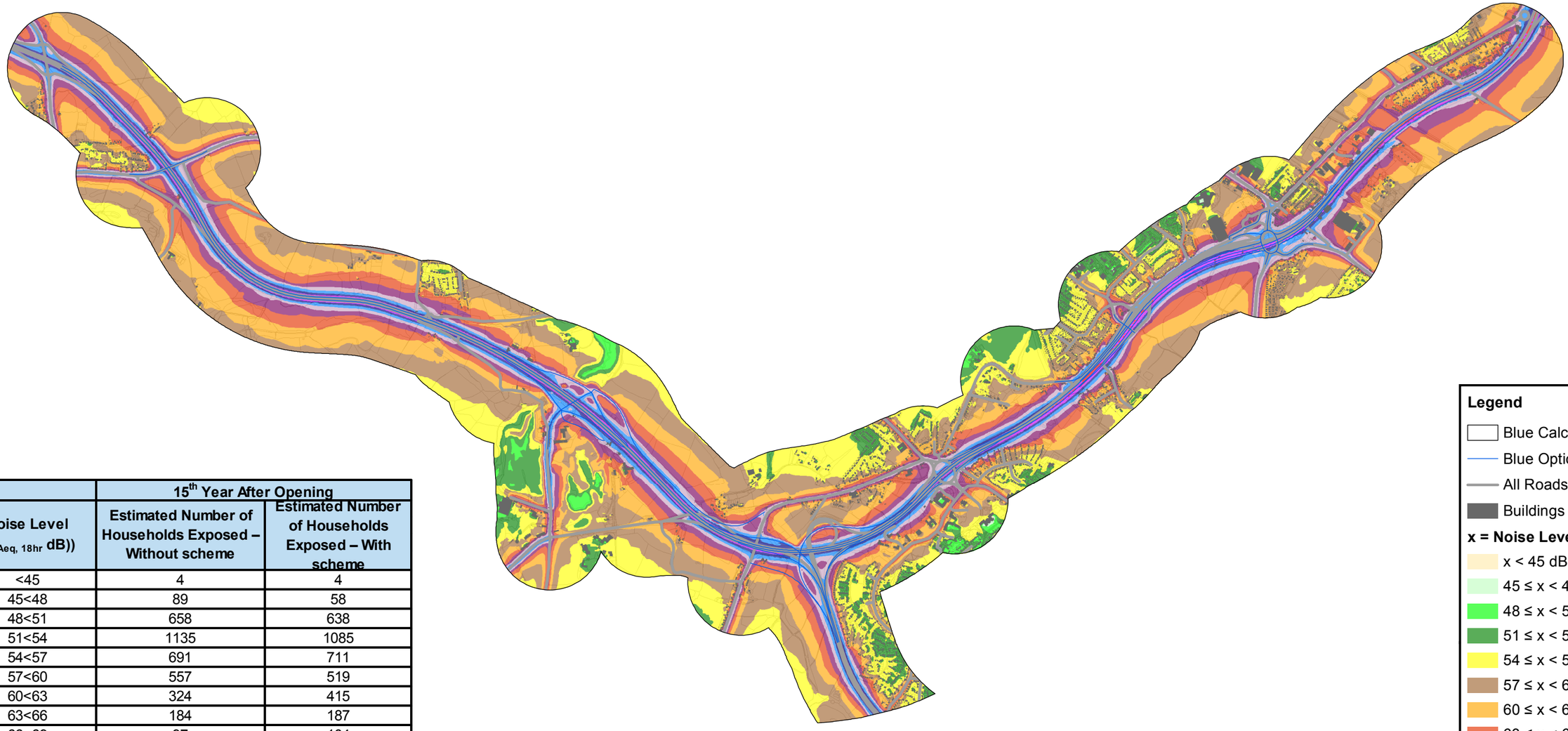
Drawing Number:	60436462\ENV\11.1		A3



	15th Year After Opening	
Noise Level ($L_{Aeq, 18hr}$ dB))	Estimated Number of Households Exposed – Without scheme	Estimated Number of Households Exposed – With scheme
<45	4	4
45<48	89	58
48<51	658	638
51<54	1135	1085
54<57	691	711
57<60	557	519
60<63	324	415
63<66	184	187
66<69	97	104
69<72	15	21
72<75	9	9
75<78	0	0
78<81	0	0
81+	1	13

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.7
3 dB NOISE LEVEL MAP AND ESTIMATED POPULATION PER CONTOUR
DS 2037- BLUE OPTION

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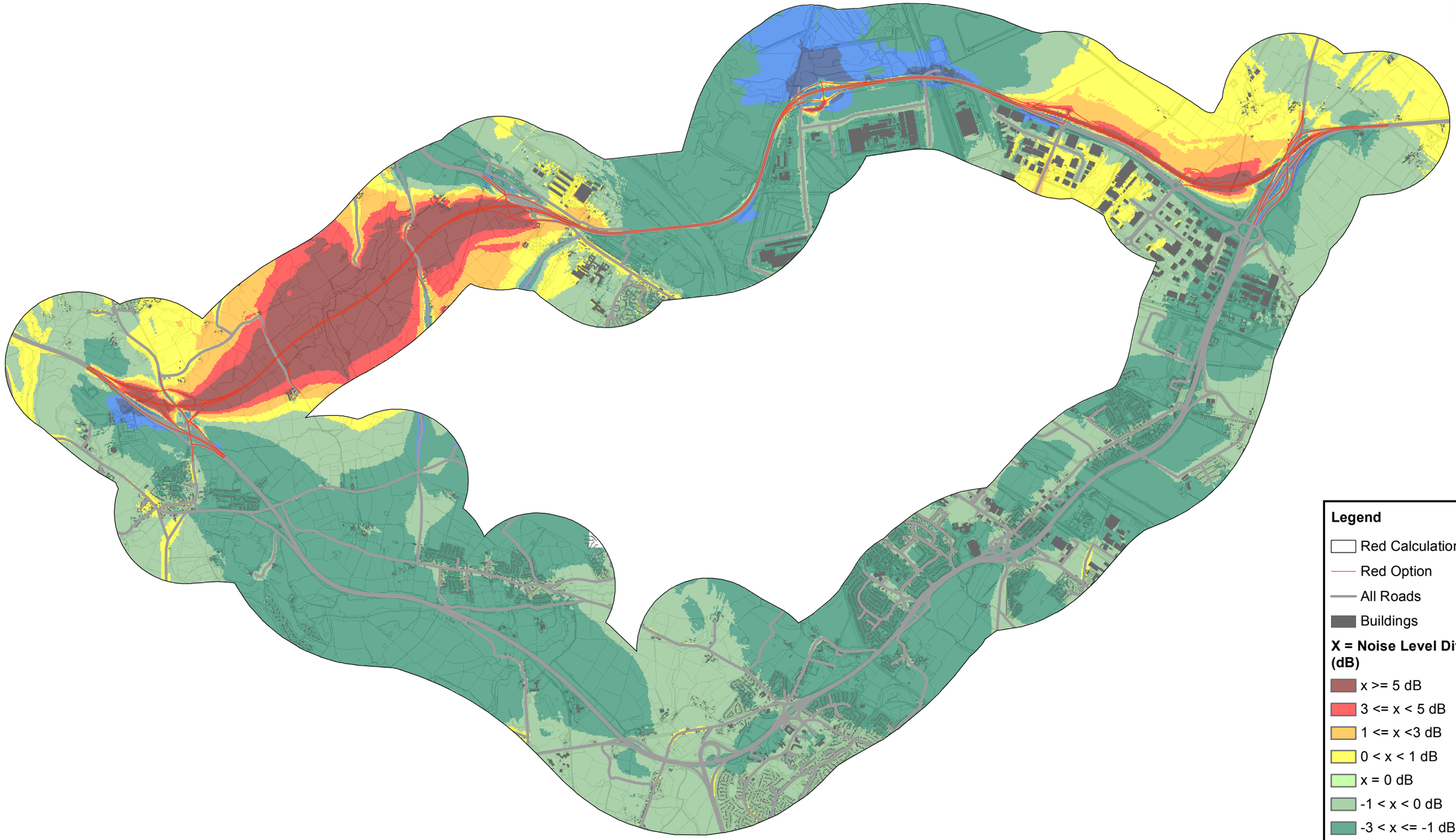

Legend

- Red Calculation Area
- Red Option
- All Roads
- Buildings

X = Noise Level Difference (dB)

- x >= 5 dB
- 3 <= x < 5 dB
- 1 <= x <3 dB
- 0 < x < 1 dB
- x = 0 dB
- -1 < x < 0 dB
- -3 < x <= -1 dB
- -5 < x <= -3 dB
- x <= -5 dB

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.8 RED OPTION SHORT TERM DAYTIME NOISE LEVEL DIFFERENCE $L_{10, 18HR}$ DM 2022 V DS 2022

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N

Legend

- Red Calculation Area
- Red Option
- All Roads
- Buildings

X = Noise Level Difference (dB)

- x >= 10 dB
- 5 <= x < 10 dB
- 3 <= x < 5 dB
- 0 < x < 3 dB
- x = 0 dB
- -3 < x < 0 dB
- -5 < x <= -3 dB
- -10 < x <= -5 dB
- x <= -10 dB

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title:

FIGURE 4.9
RED OPTION LONG TERM DAYTIME NOISE LEVEL DIFFERENCE $L_{10, 18HR}$
DM 2022 V DS 2037

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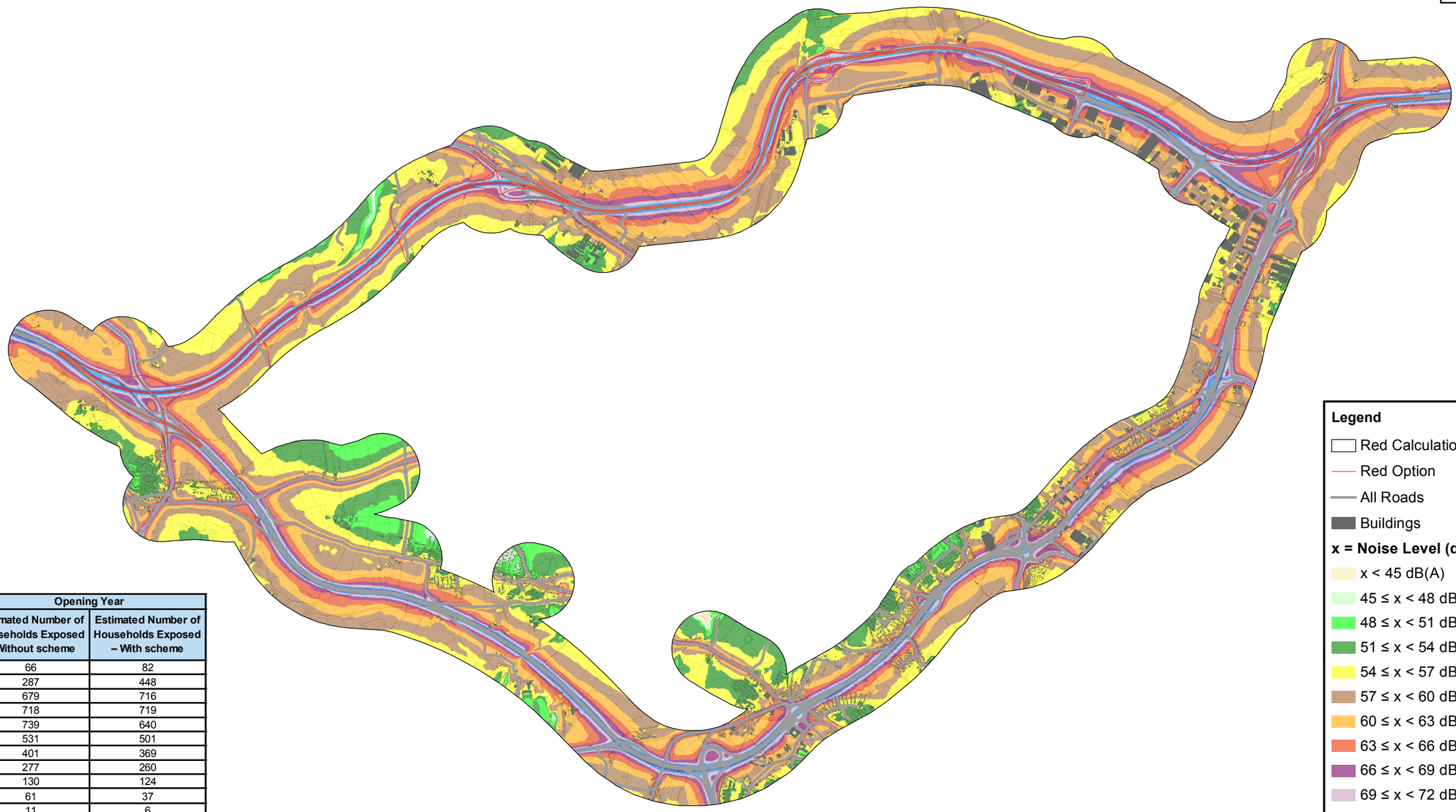

	Opening Year	
Noise Level ($L_{Aeq, 18hr}$ dB))	Estimated Number of Households Exposed – Without scheme	Estimated Number of Households Exposed – With scheme
<45	66	82
45<48	287	448
48<51	679	716
51<54	718	719
54<57	739	640
57<60	531	501
60<63	401	369
63<66	277	260
66<69	130	124
69<72	61	37
72<75	11	6
75<78	3	1
78<81	0	0
81+	1	1

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.10
3 dB NOISE LEVEL MAP AND ESTIMATED POPULATION PER CONTOUR DS 2022- RED OPTION

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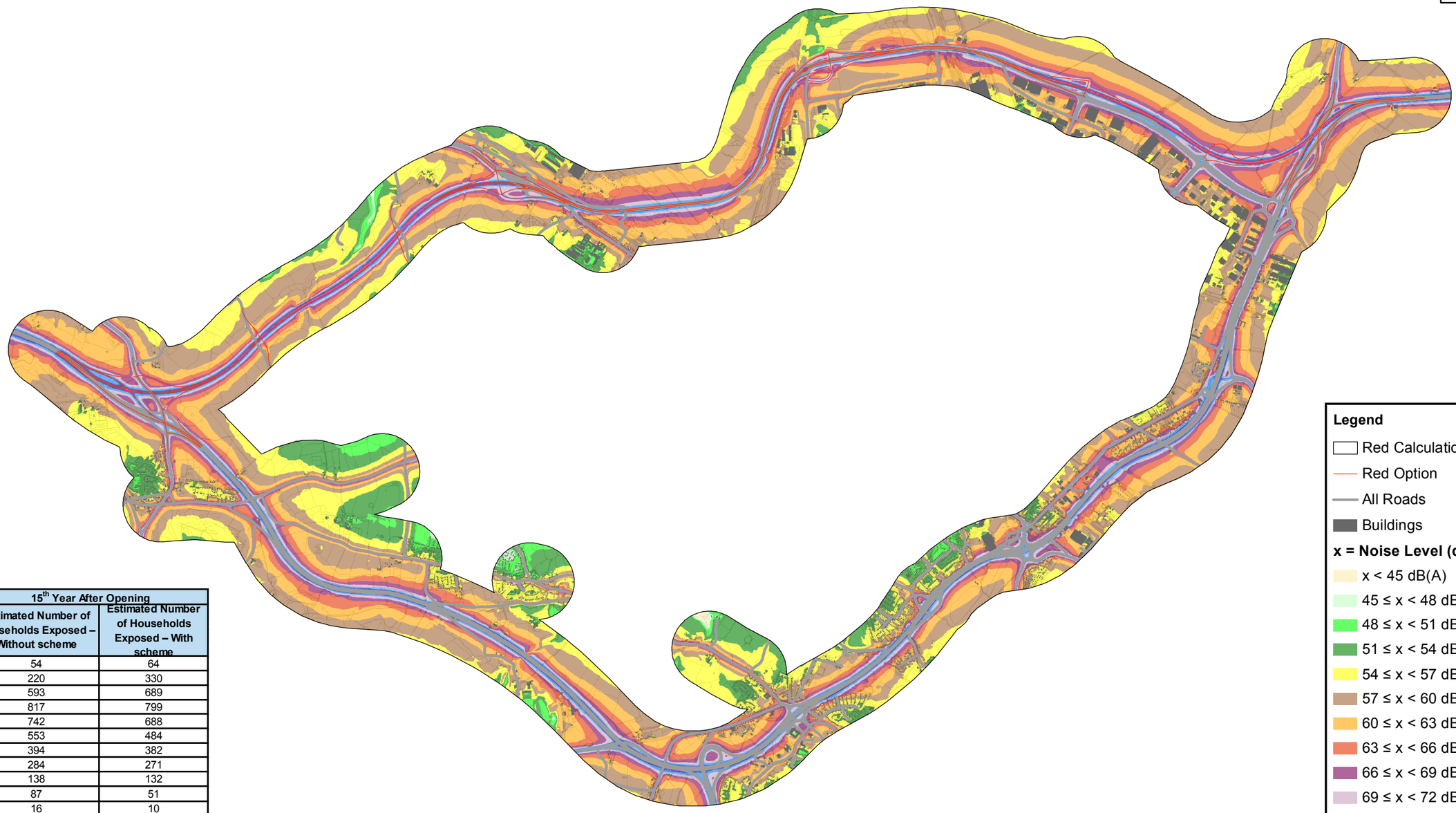

	15th Year After Opening	
Noise Level ($L_{Aeq, 18hr}$ dB))	Estimated Number of Households Exposed – Without scheme	Estimated Number of Households Exposed – With scheme
<45	54	64
45<48	220	330
48<51	593	689
51<54	817	799
54<57	742	688
57<60	553	484
60<63	394	382
63<66	284	271
66<69	138	132
69<72	87	51
72<75	16	10
75<78	5	3
78<81	0	0
81+	1	1

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: SHOTWICK TO NORTHOP A548 ALTERNATIVE A494/A55 IMPROVEMENTS

Title: FIGURE 4.11
3 dB NOISE LEVEL MAP AND ESTIMATED POPULATION PER CONTOUR
DS 2037- RED OPTION

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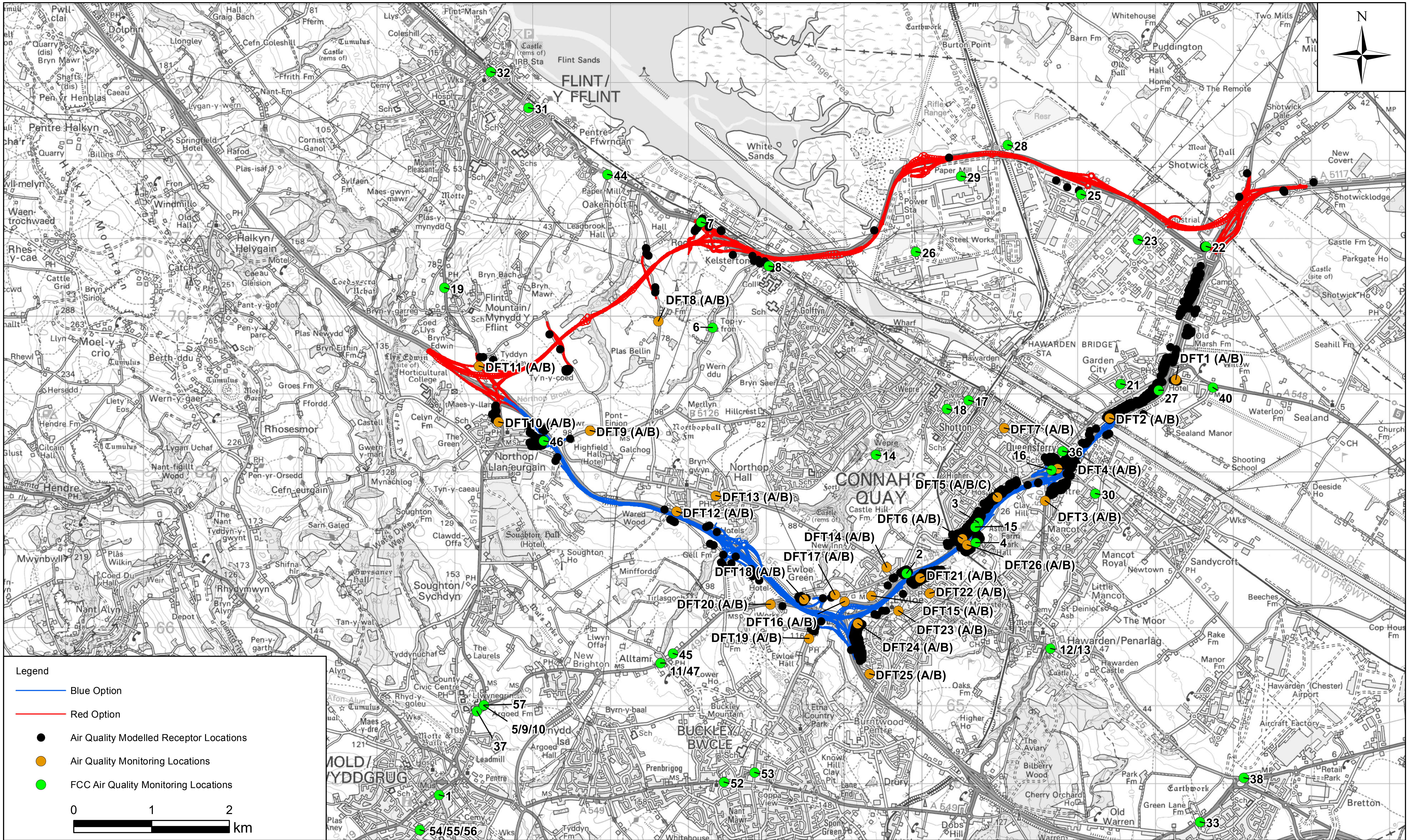

Client:

Llywodraeth Cymru
Welsh Government

Project:
A55/A494/A548 Deeside Corridor
Improvement Key Stage 2

Title:
FIGURE 5.1
AIR QUALITY MONITORING LOCATIONS

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Legend

NO2 Results

- <36 ug/m3
- 36-40 ug/m3
- >40 ug/m3

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 5.2 PREDICTED ANNUAL MEAN NO2 CONCENTRATIONS - DO MINIMUM

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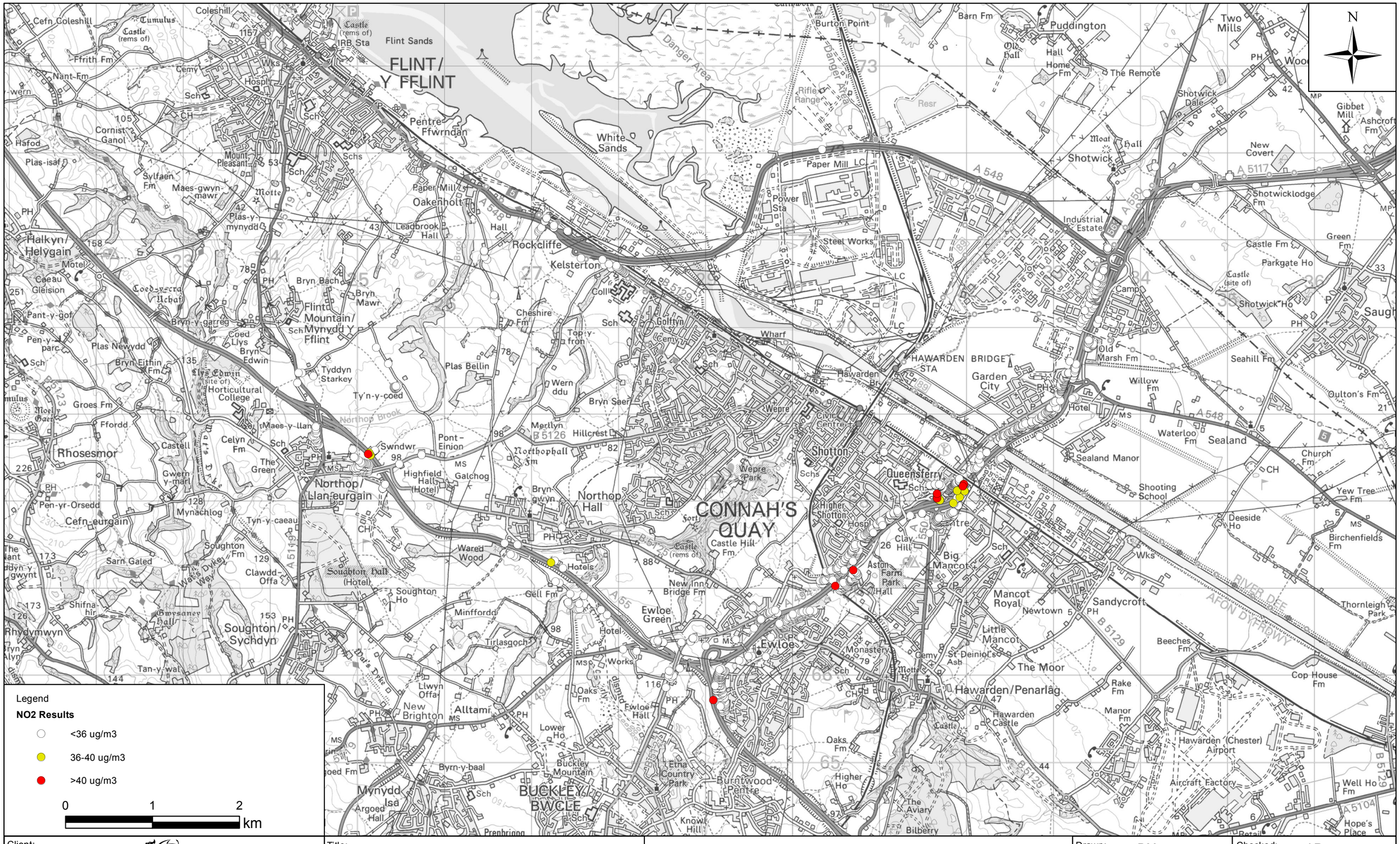

Legend

NO2 Results

- <36 ug/m3
- 36-40 ug/m3
- >40 ug/m3

0 1 2 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title:

FIGURE 5.3
PREDICTED ANNUAL MEAN NO2 CONCENTRATIONS - BLUE

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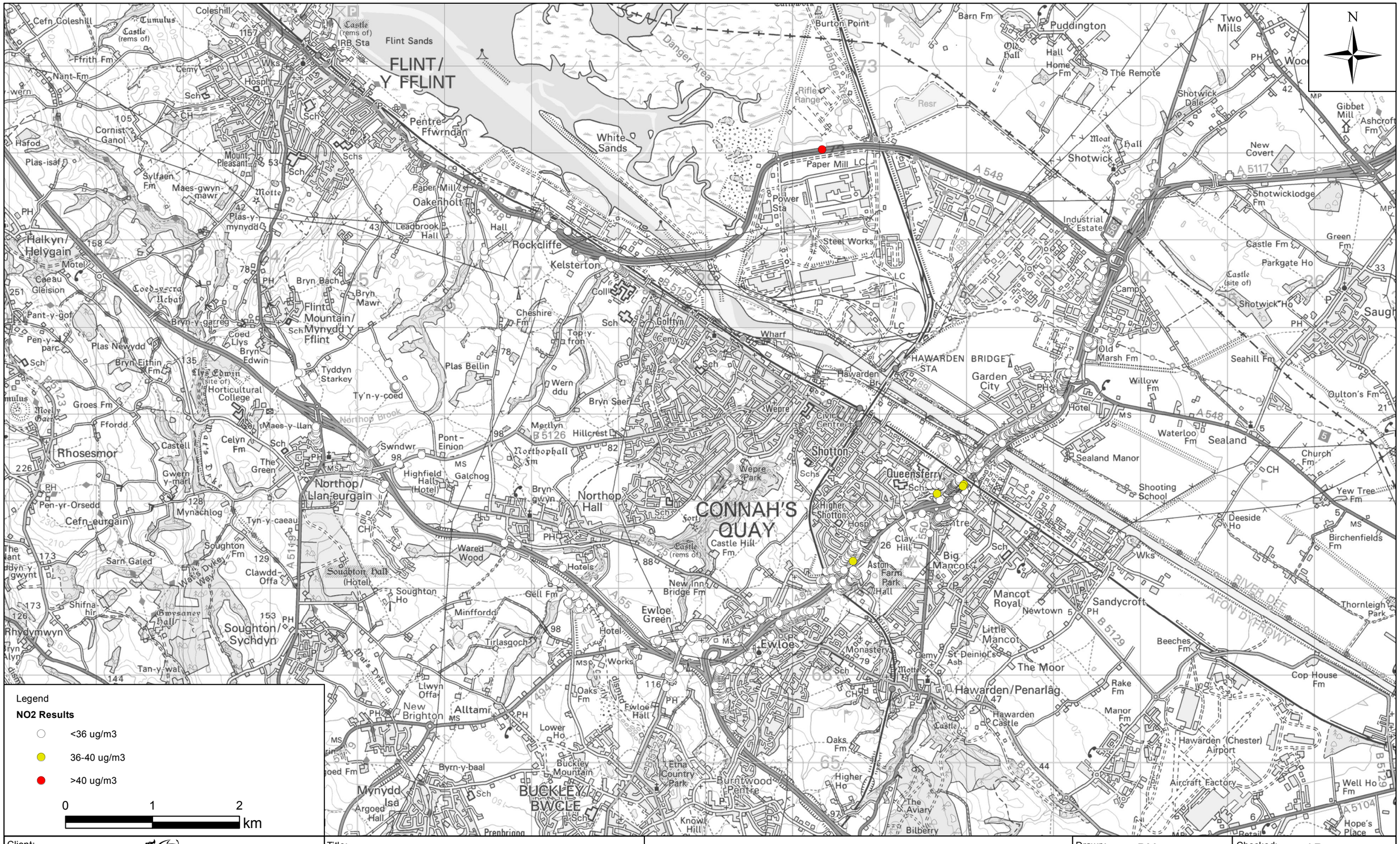

Client: Llywodraeth Cymru Welsh Government	Title: FIGURE 5.4 PREDICTED ANNUAL MEAN NO2 CONCENTRATIONS - RED	Drawn: DM	Checked: AR
Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2		Verified: DU	Approved: DU
		Date: 16/02/2017	Scale at A3: 1:40,000
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Checked:

Designer:

Project Management Initials:

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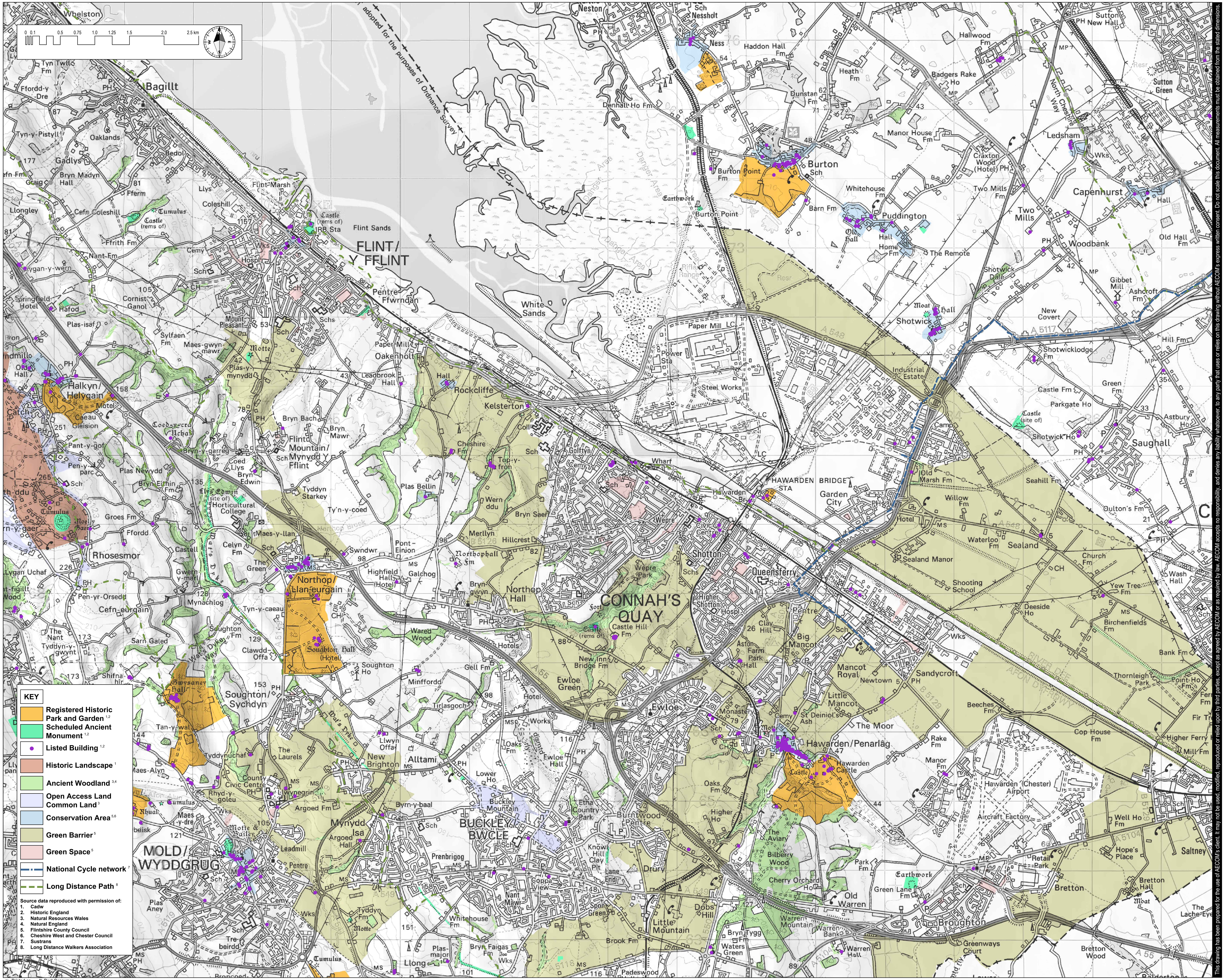

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KEY PLAN

PROJECT NUMBER

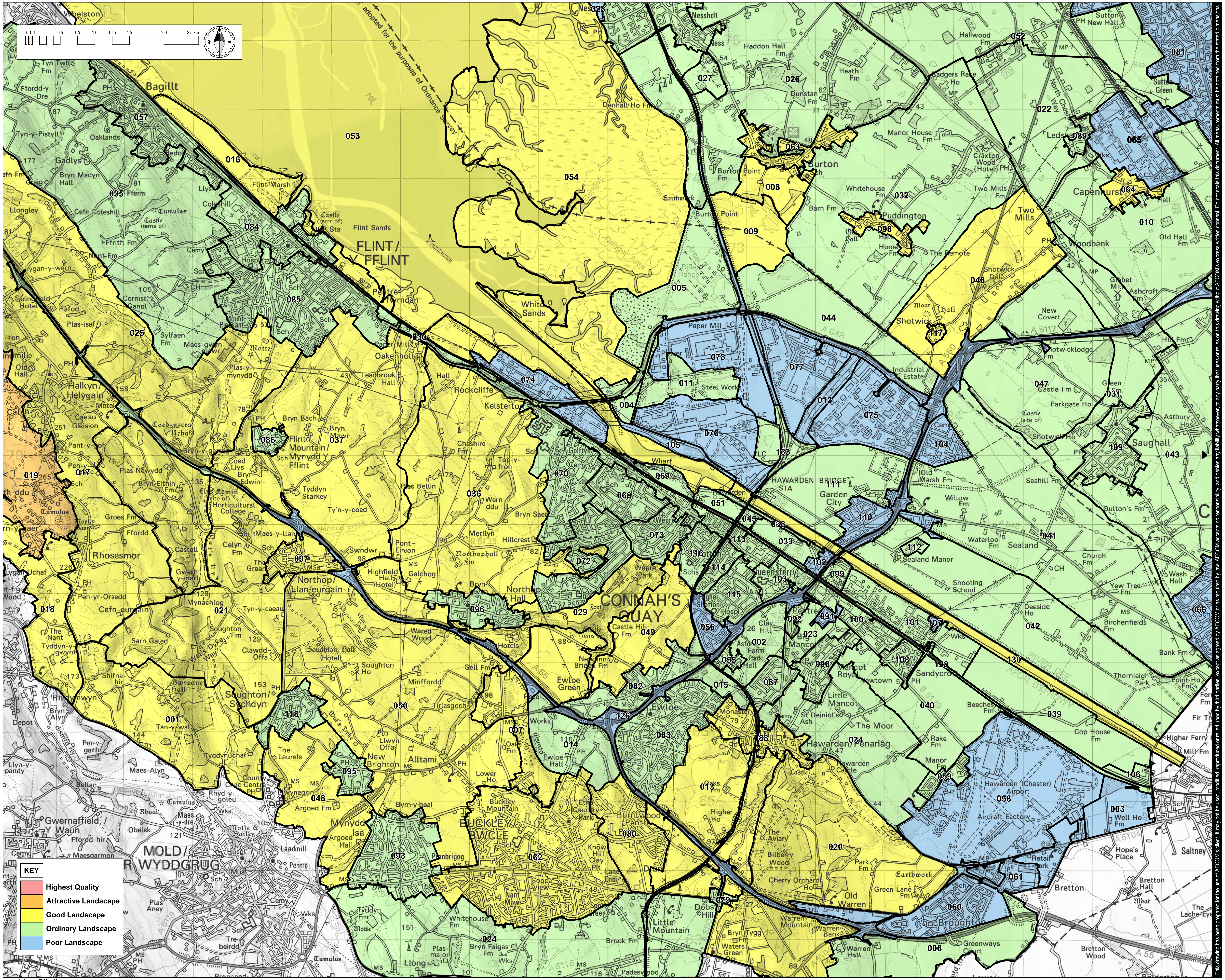
60436462

SHEET TITLE

Figure 7.1 - Landscape Designations

SHEET NUMBER

60436462-400-430-110-0701



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SHEET TITLE

Figure 7.5 - Landscape and Townscape Character Areas

SHEET NUMBER

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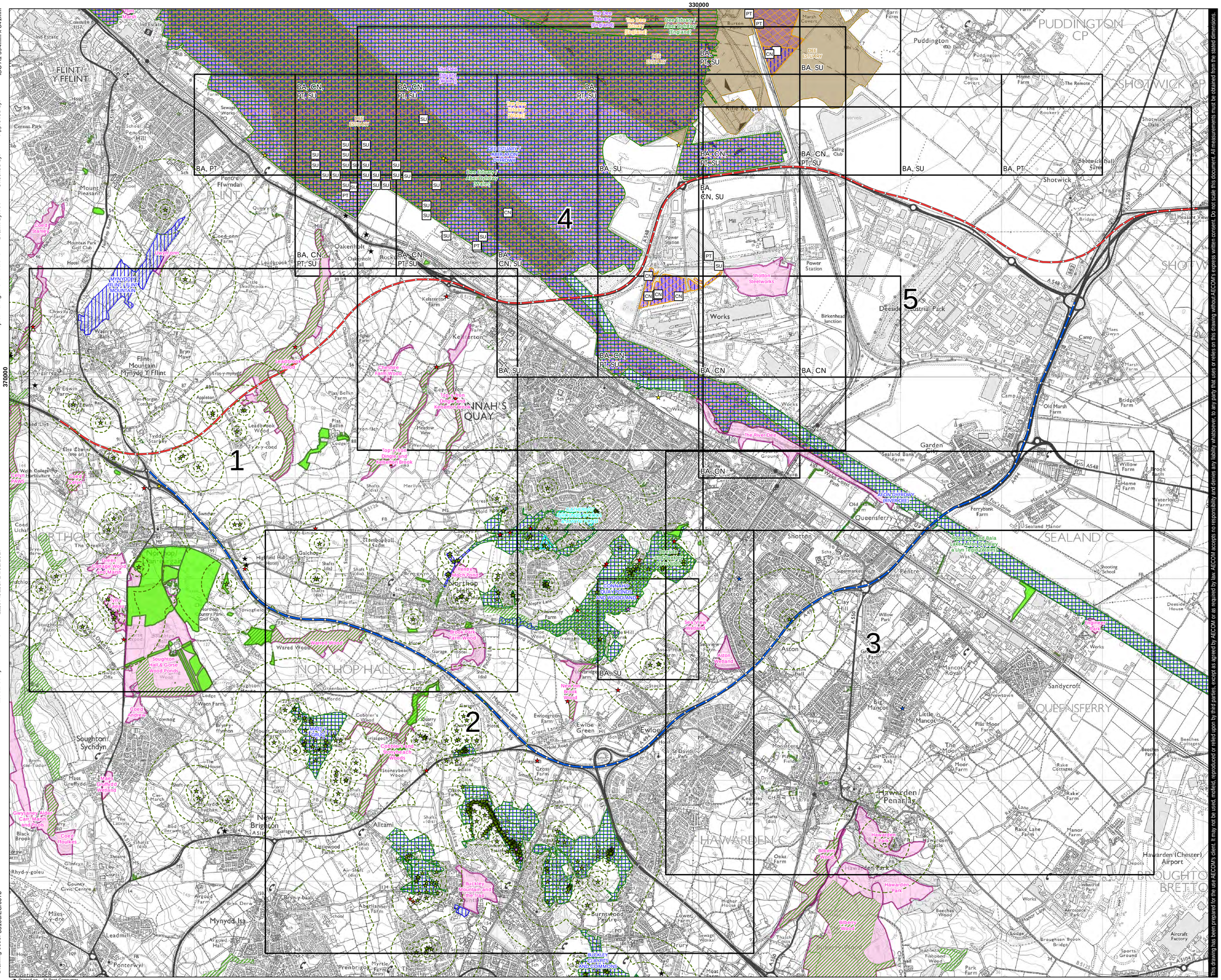
330000

370000



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A	2017-02-14	Environment Appraisal Report

Draft

KEY PLAN

Red corridor
Blue corridor
Flintshire CC Tree Preservation Orders (461)
Flintshire CC Local Wildlife Sites (32)
Local Nature Reserve (1)
Special Area of Conservation (4)
RAMSAR (2)
Site of Special Scientific Interest (8)
RSPB Reserve (1)
Special Protection Area (2)
Ancient Woodland Inventory (41)
Badger - setts and road casualties (26)
Otter - spraints and sightings (live or dead) (6)
Water Vole - burrows or field signs (5)
Bat Roost Record (2)
Black Poplar tree (10)
SPA qualifying bird species (44)
Great-crested newt record (428)
50, 100, 250 and 500m buffer of Great-crested newt records

contains National Resources Wales, Flintshire County Council and Cofnod data

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-1a
Draft Biodiversity Constraints Overview

SHEET NUMBER

60436432-400-430-110-0811

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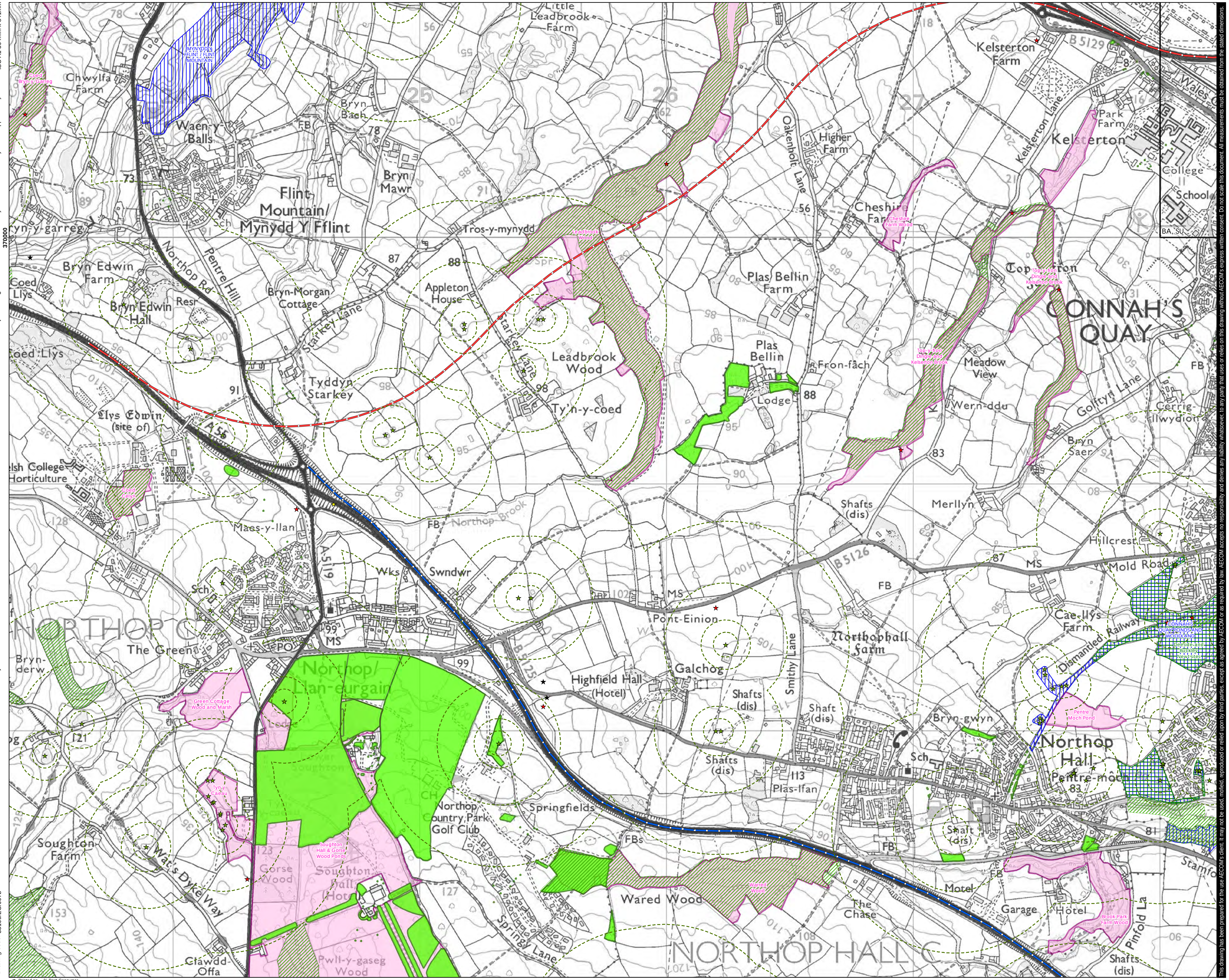

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A	2017-02-14	Environment Appraisal Report

KEY PLAN

- Red corridor
- Blue corridor
- Flintshire CC Tree Preservation Orders (231)
- Flintshire CC Local Wildlife Sites (12)
- Local Nature Reserve (0)
- Special Area of Conservation (1)
- RAMSAR (0)
- Site of Special Scientific Interest (2)
- RSPB Reserve (0)
- Special Protection Area (0)
- Ancient Woodland Inventory (15)
- Badger - setts and road casualties (12)
- Otter - spraints and sightings (live or dead) (1)
- Water Vole - burrows or field signs (1)
- Bat Roost Record (0)
- Black Poplar tree (3)
- SPA qualifying bird species (0)
- Great-crested newt record (64)
- 50, 100, 250 and 500m buffer of Great-crested newt records

CN - Common Tern
BA - Bar-tailed Godwit
SU - Shelduck
PT - Pintail

contains National Resources Wales, Flintshire County Council and Cofnod data

0 0.075 0.15 0.3 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-1b
Draft Biodiversity Constraints
Sheet A

SHEET NUMBER

60436432-400-430-110-0812

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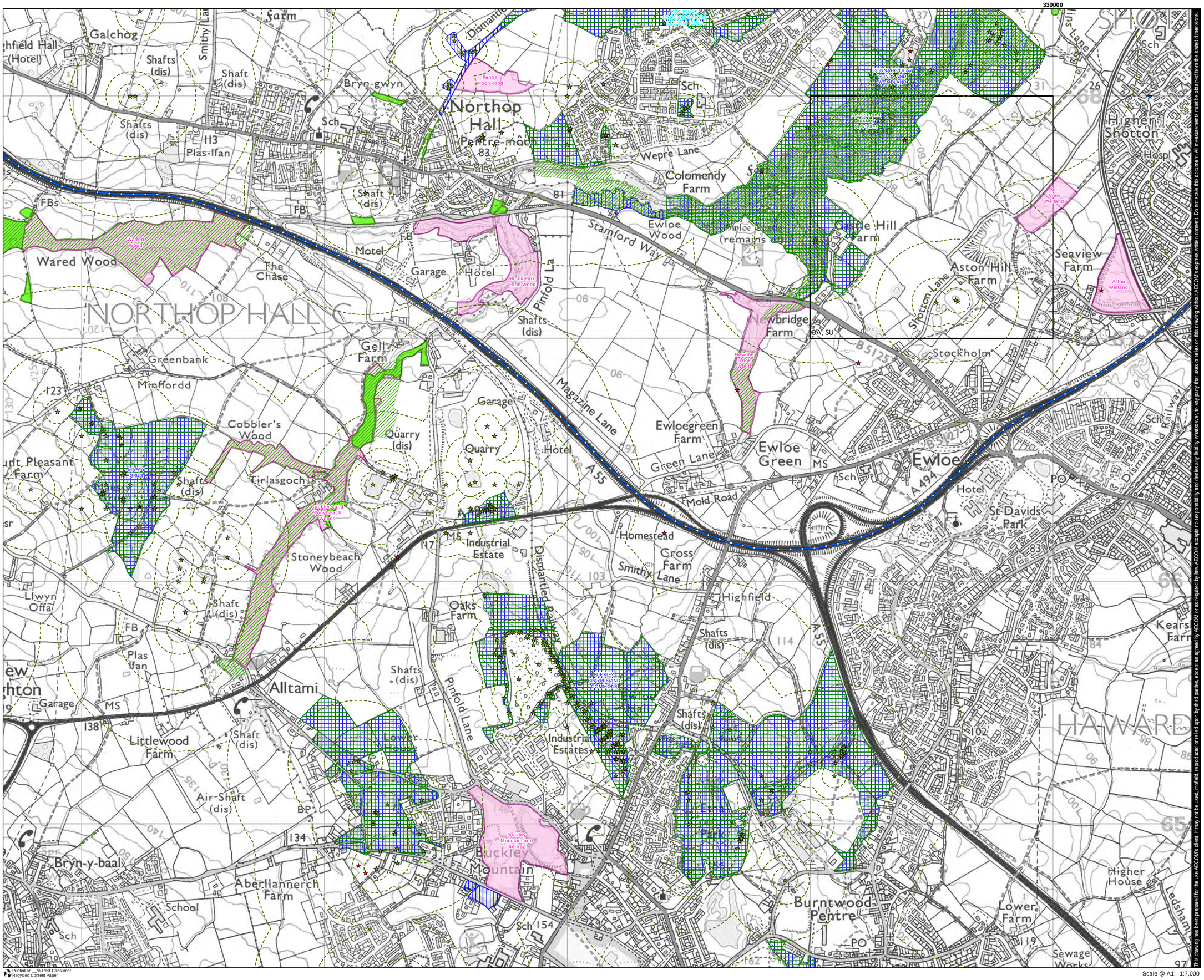

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- Red corridor
- Blue corridor
- Flintshire CC Tree Preservation Orders (89)
- Flintshire CC Local Wildlife Sites (8)
- Local Nature Reserve (1)
- Special Area of Conservation (1)
- RAMSAR (0)
- Site of Special Scientific Interest (3)
- RSPB Reserve (0)
- Special Protection Area (0)
- Ancient Woodland Inventory (11)
- Badger - setts and road casualties (12)
- Otter - spraints and sightings (live or dead) (0)
- Water Vole - burrows or field signs (3)
- Bat Roost Record (1)
- Black Poplar tree (1)
- SPA qualifying bird species (0)
- Great-crested newt record (351)
- 50, 100, 250 and 500m buffer of Great-crested newt records

CN - Common Tern
BA - Bar-tailed Godwit
SU - Shelduck
PT - Pintail

contains National Resources Wales, Flintshire County Council and Cofnod data

0 0.075 0.15 0.3 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-1c
Draft Biodiversity Constraints
Sheet B

SHEET NUMBER

60436432-400-430-110-0813

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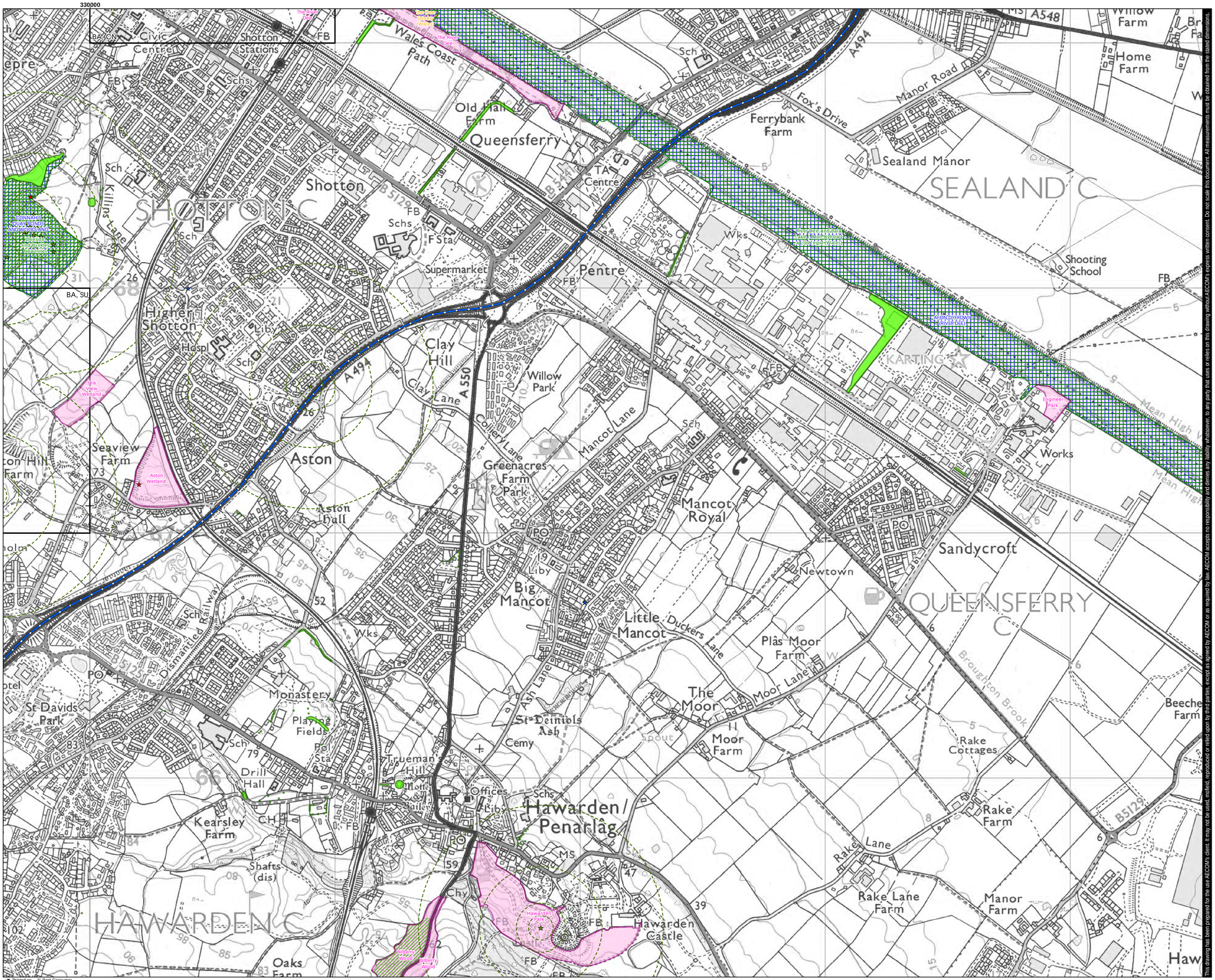

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KEY PLAN

- Red corridor
- Blue corridor
- Flintshire CC Tree Preservation Orders (79)
- Flintshire CC Local Wildlife Sites (6)
- Local Nature Reserve (0)
- Special Area of Conservation (3)
- RAMSAR (1)
- Site of Special Scientific Interest (3)
- RSPB Reserve (0)
- Special Protection Area (1)
- Ancient Woodland Inventory (2)
- Badger - setts and road casualties (2)
- Otter - spraints and sightings (live or dead) (0)
- Water Vole - burrows or field signs (0)
- Bat Roost Record (2)
- Black Poplar tree (0)
- SPA qualifying bird species (0) — CN - Common Tern; BA - Bar-tailed Godwit; SU - Shelduck; PT - Pintail
- Great-crested newt record (17)
- 50, 100, 250 and 500m buffer of Great-crested newt records

contains National Resources Wales, Flintshire County Council and Cofnod data

0 0.075 0.15 0.3 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-1d
Draft Biodiversity Constraints
Sheet C

SHEET NUMBER

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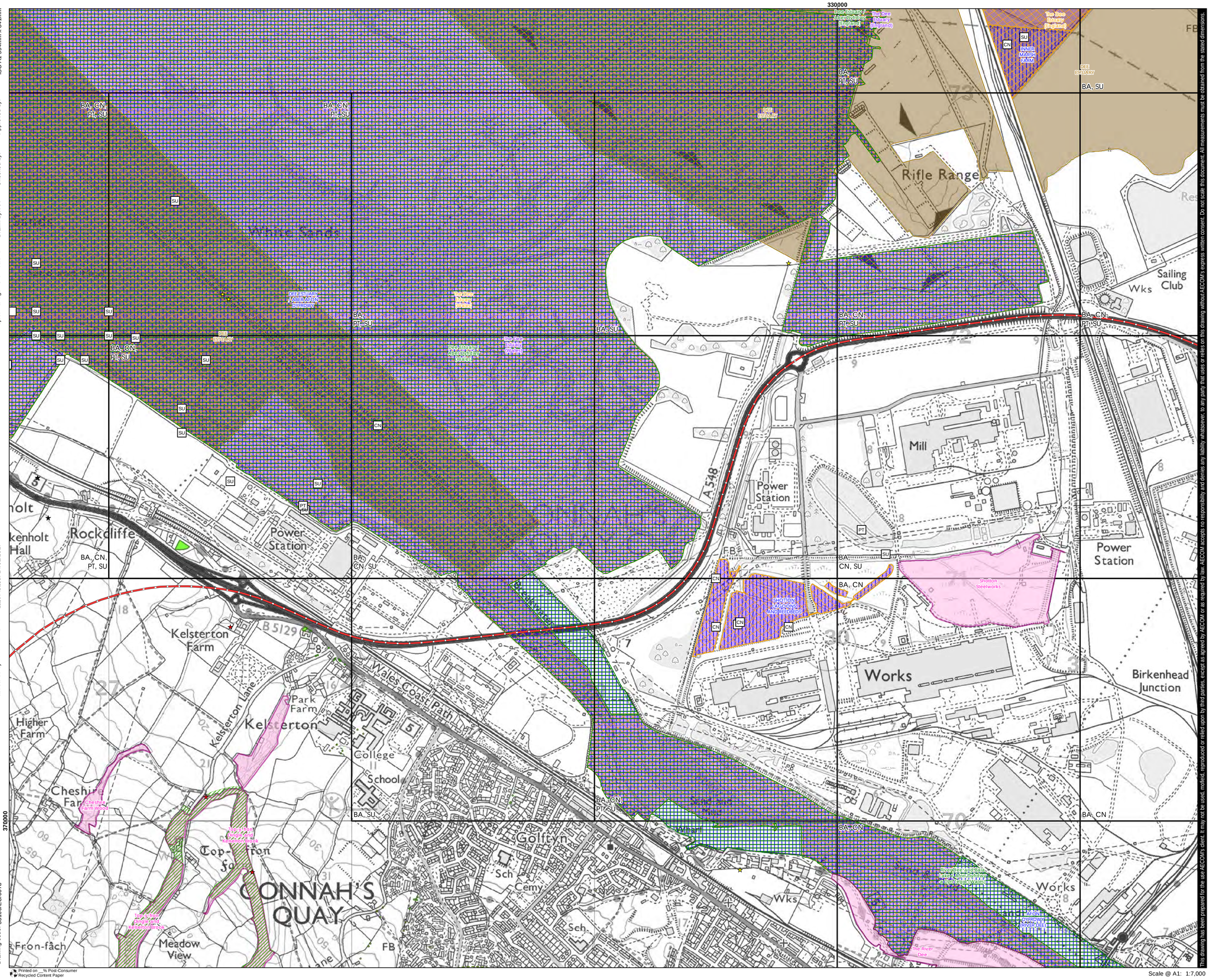

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- Blue corridor
- Flintshire CC Tree Preservation Orders (36)
- Flintshire CC Local Wildlife Sites (5)
- Local Nature Reserve (0)
- Special Area of Conservation (3)
- RAMSAR (2)
- Site of Special Scientific Interest (4)
- RSPB Reserve (1)
- Special Protection Area (2)
- Ancient Woodland Inventory (1)
- Badger - setts and road casualties (3)
- Otter - spraints and sightings (live or dead) (4)
- Water Vole - burrows or field signs (1)
- Bat Roost Record (0)
- Black Poplar tree (2)
- SPA qualifying bird species (32)
- Great-crested newt record (0)
- 50, 100, 250 and 500m buffer of Great-crested newt records

CN - Common Tern
BA - Bar-tailed Godwit
SU - Shelduck
PT - Pintail

contains National Resources Wales, Flintshire County Council and Cofnod data

0 0.075 0.15 0.3 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-1e
Draft Biodiversity Constraints
Sheet D

SHEET NUMBER

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ISO A1 594mm x 841mm

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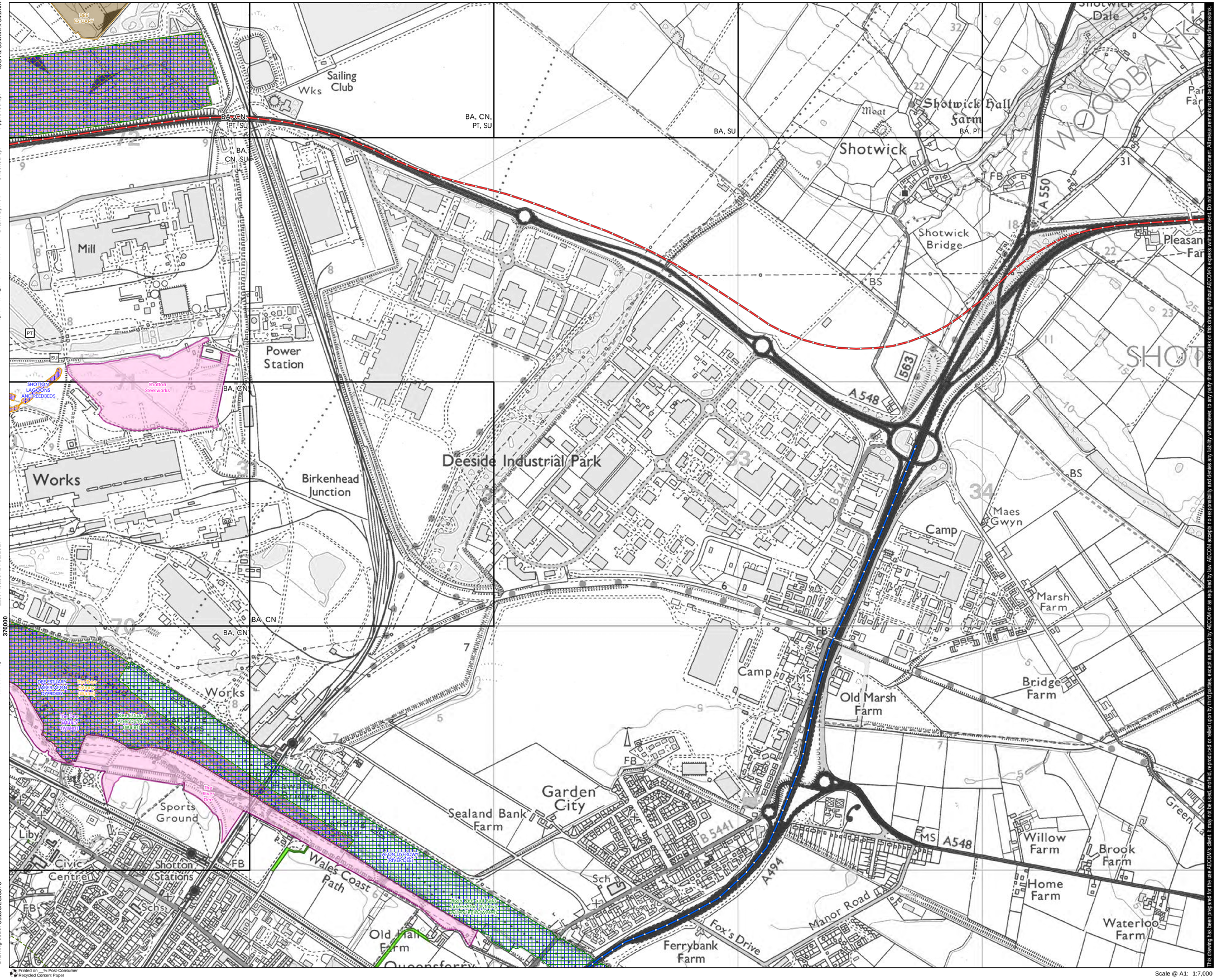

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- Flintshire CC Local Wildlife Sites (2)
- Local Nature Reserve (0)
- Special Area of Conservation (2)
- RAMSAR (1)
- Site of Special Scientific Interest (3)
- RSPB Reserve (1)
- Special Protection Area (1)
- Ancient Woodland Inventory (0)
- Badger - setts and road casualties (0)
- Otter - sprains and sightings (live or dead) (0)
- Water Vole - burrows or field signs (0)
- Bat Roost Record (0)
- Black Poplar tree (0)
- SPA qualifying bird species (3)
- Great-crested newt record (0)
- 50, 100, 250 and 500m buffer of Great-crested newt records

CN - Common Tern
BA - Bar-tailed Godwit
SU - Shelduck
PT - Pintail

contains National Resources Wales, Flintshire County Council and Cofnod data

0 0.075 0.15 0.3 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-1f
Draft Biodiversity Constraints
Sheet E

SHEET NUMBER

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KEY PLAN

- Proposed blue option
- Survey area (500m buffer)
- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Running water
- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Bracken - continuous
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland
- Bare ground

0 0.25 0.5 1 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-2a
Phase 1 Survey Results
Blue Corridor Overview

SHEET NUMBER

60436432-400-430-110-0821

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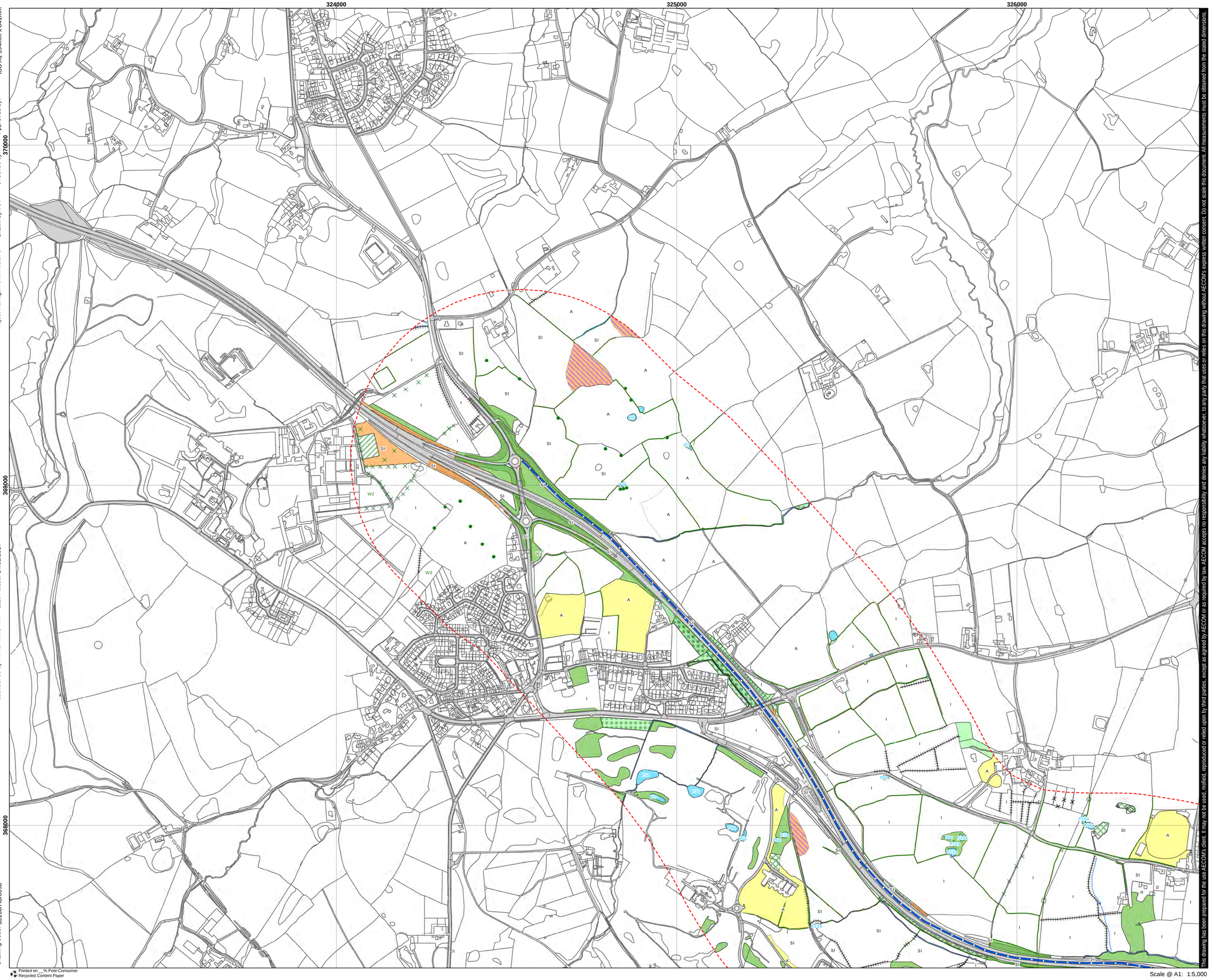

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- Broadleaved Parkland/scattered trees
- Running water
- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- I Improved grassland
- Marsh/marshy grassland
- SI Poor semi-improved grassland
- Bracken - continuous
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Q Quarry
- A Cultivated/disturbed land - arable
- A Cultivated/disturbed land - amenity grassland
- Bare ground

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-2b
Phase 1 Survey Results
Blue Corridor Sheet A

SHEET NUMBER

60436432-400-430-110-0822

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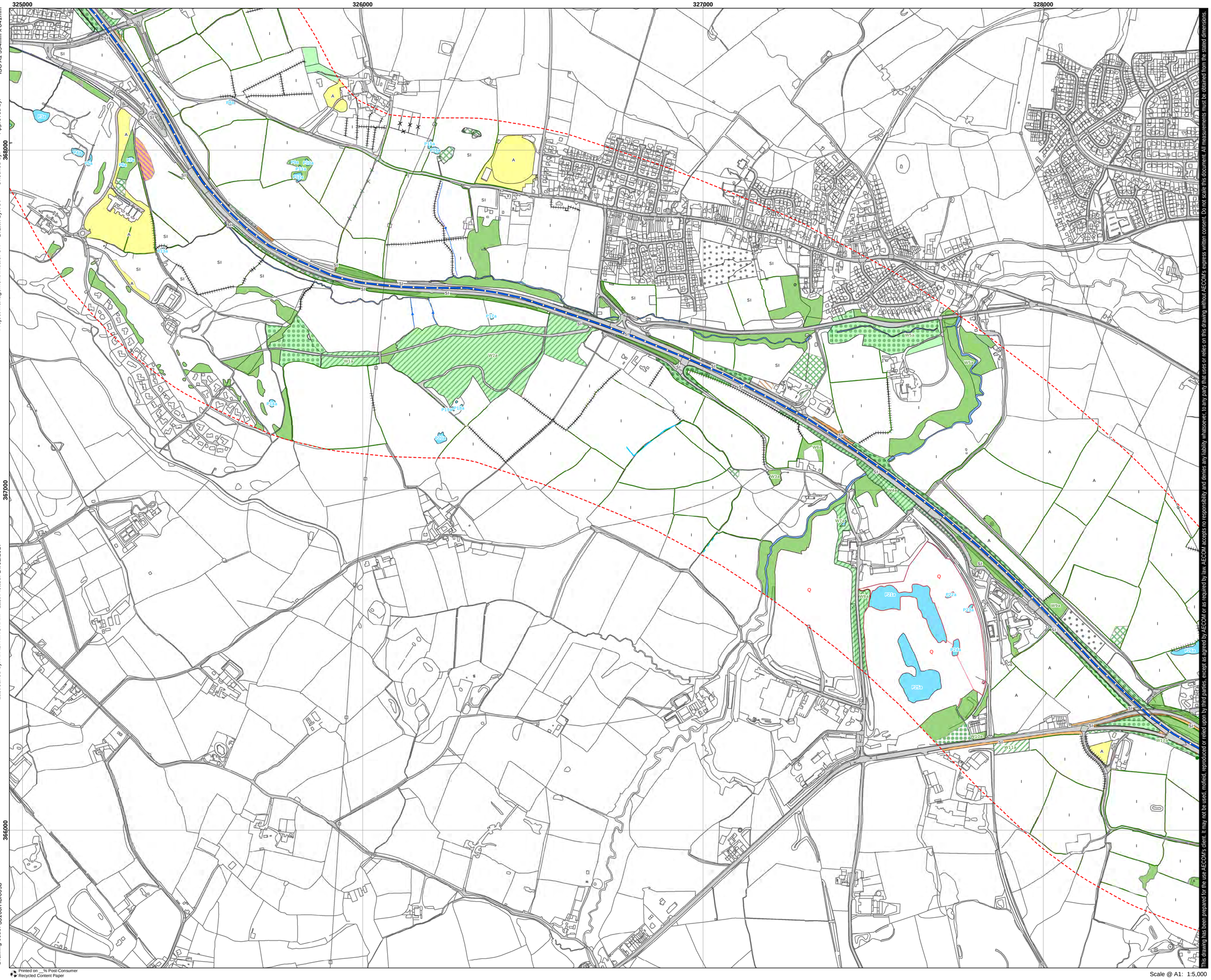

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- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Bracken - continuous
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland
- Bare ground

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-2c
Phase 1 Survey Results
Blue Corridor Sheet B

SHEET NUMBER

60436432-400-430-110-0823

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- Broadleaved Parkland/scattered trees
- Running water
- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Bracken - continuous
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland
- Bare ground

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-2d
Phase 1 Survey Results
Blue Corridor Sheet C

SHEET NUMBER

60436432-400-430-110-0824

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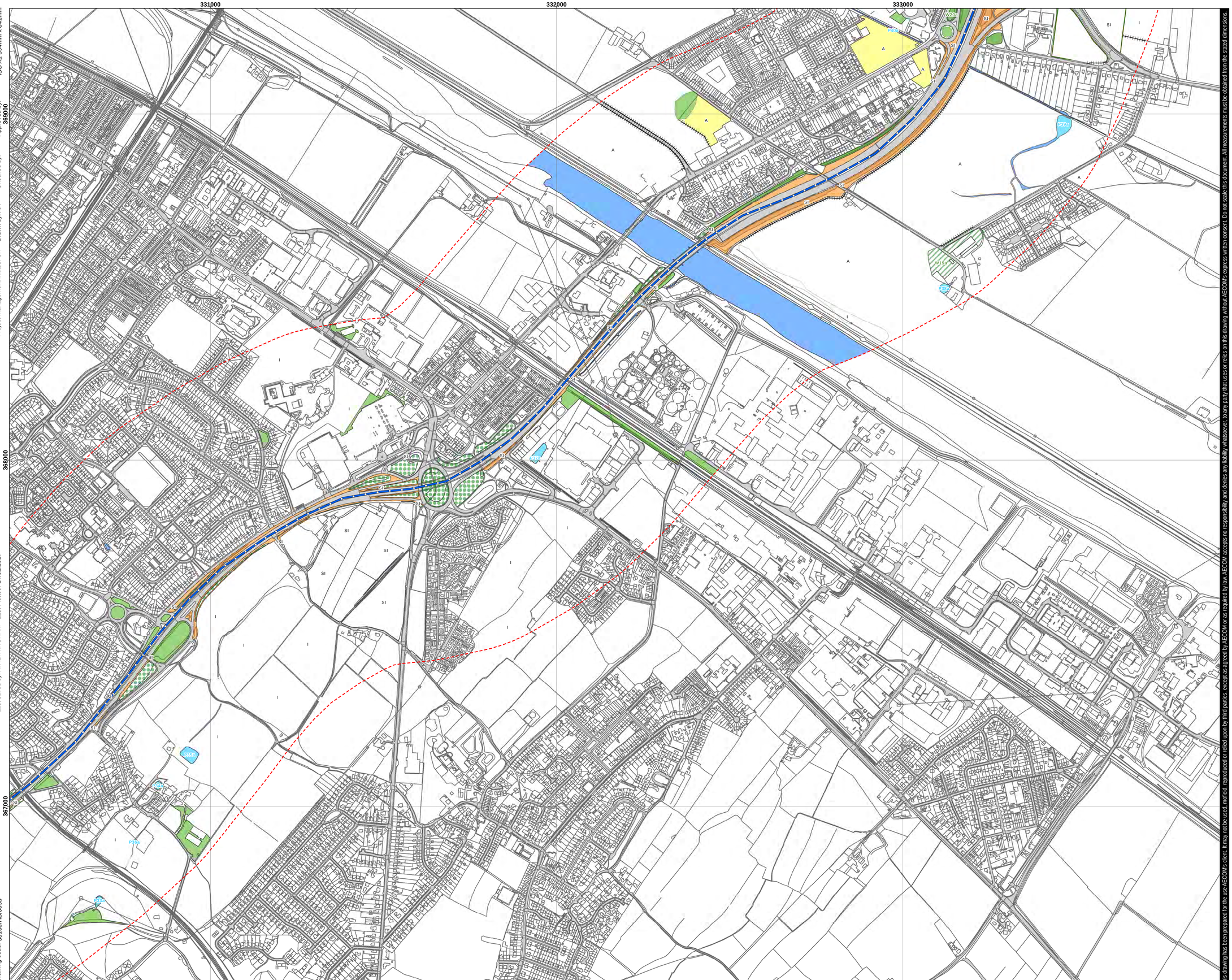

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- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Running water
- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Bracken - continuous
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland
- Bare ground

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-2e
Phase 1 Survey Results
Blue Corridor Sheet D

SHEET NUMBER

60436432-400-430-110-0825

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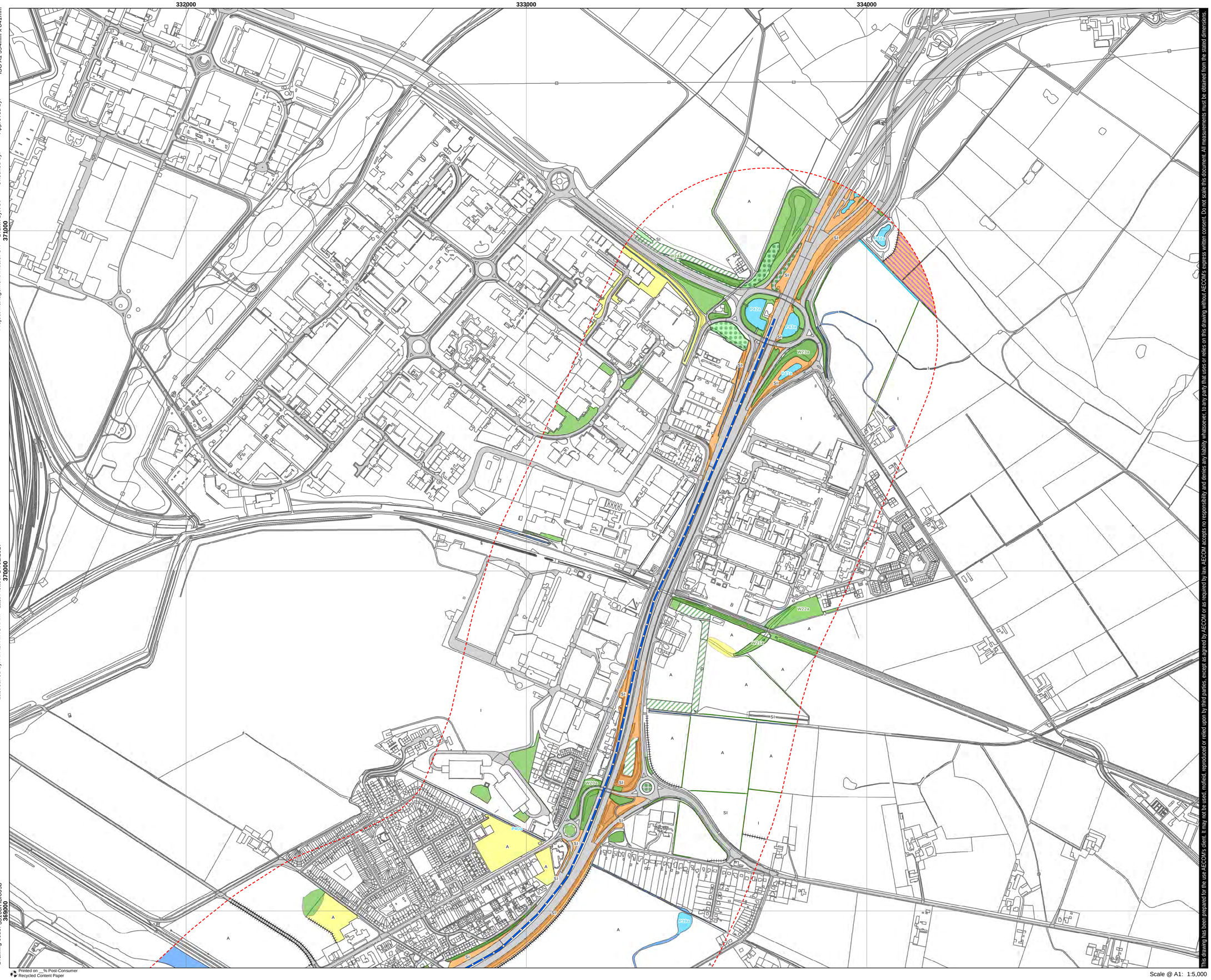

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- Running water
- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Bracken - continuous
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland
- Bare ground

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-2f
Phase 1 Survey Results
Blue Corridor Sheet E

SHEET NUMBER

60436432-400-430-110-0826

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Sheet A

Sheet B

Sheet C

Sheet D

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I/R	DATE	DESCRIPTION
A	2017-02-14	Environment Appraisal Report

Draft

KEY PLAN

- Proposed red corridor
- Survey area (1km/500m buffer)
- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Running water
- Dry ditch
- Wet ditch
- Hedge
- Fence
- Boundary removed
- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Neutral grassland - unimproved
- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Swamp
- Saltmarsh - dense/continuous; Saltmarsh
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland

0 0.25 0.5 1 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-3a
Phase 1 Survey Results
Red Option Overview

SHEET NUMBER

60436432-400-430-110-0831

ISO A1 594mm x 841mm

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Checked by:

Drawn by: AA

Project Management Initials: CH
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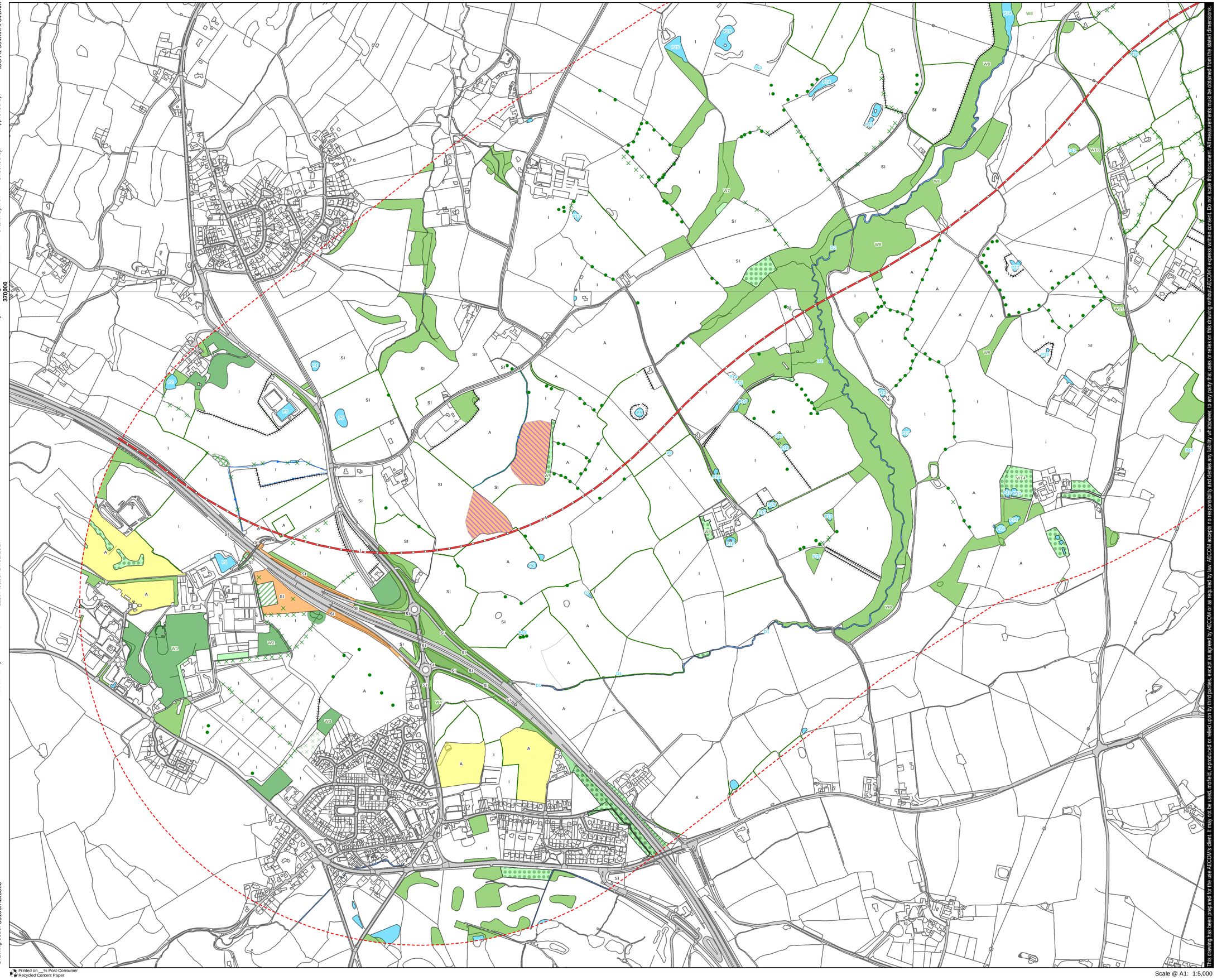

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PROJECT

A55/A494/A548 DEESIDE CORRIDOR IMPROVEMENT

CLIENT

Llywodraeth Cymru
Welsh Government

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- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Scrub - scattered
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- Improved grassland
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- Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Swamp
- Saltmarsh - dense/continuous; Saltmarsh
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-3b
Phase 1 Survey Results
Red Option Sheet A

SHEET NUMBER

60436432-400-430-110-0832

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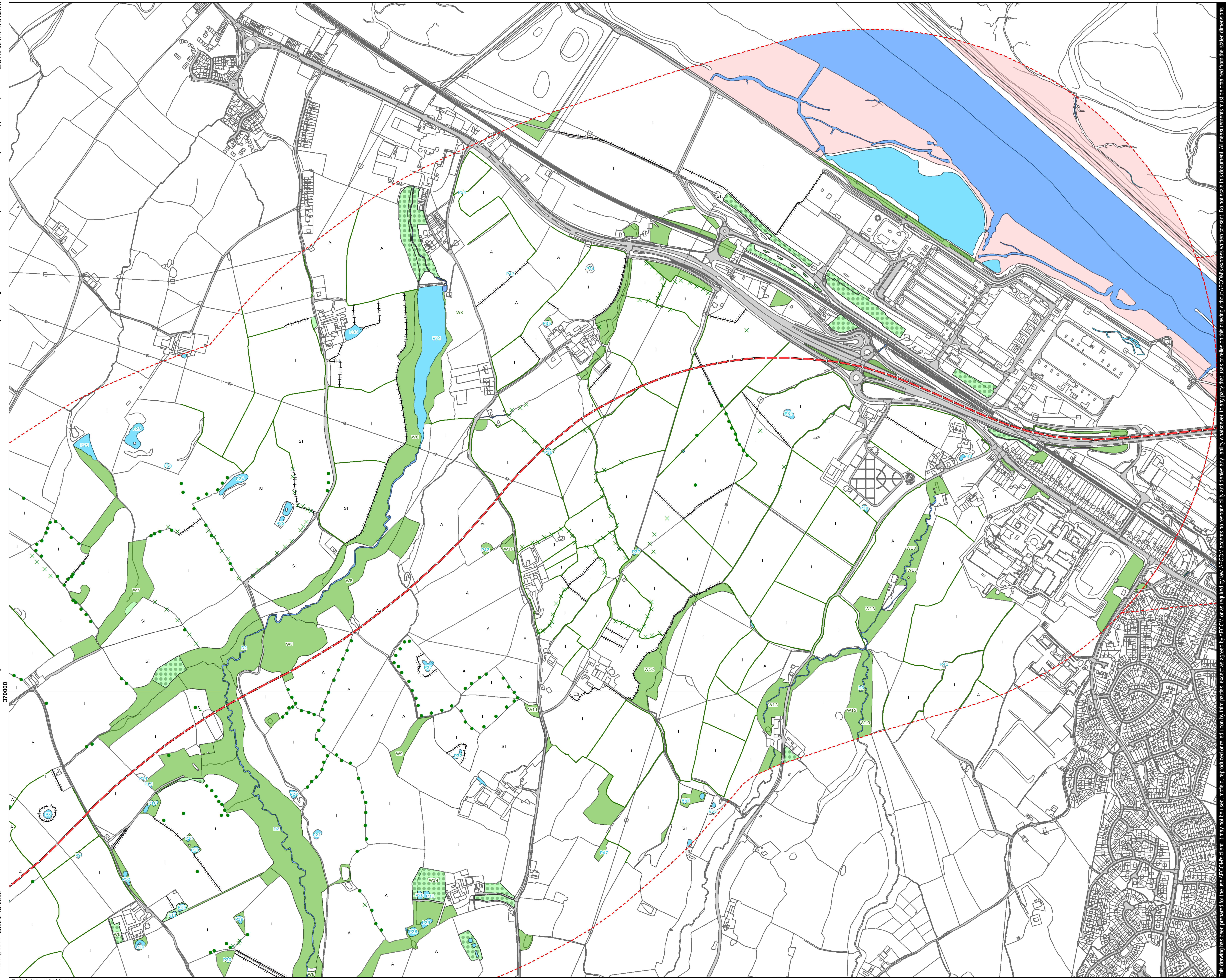

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- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Neutral grassland - unimproved
- SI Neutral grassland - semi-improved
- I Improved grassland
- Marsh/marshy grassland
- SI Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Swamp
- Saltmarsh - dense/continuous; Saltmarsh
- Q Quarry
- A Cultivated/disturbed land - arable
- A Cultivated/disturbed land - amenity grassland

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

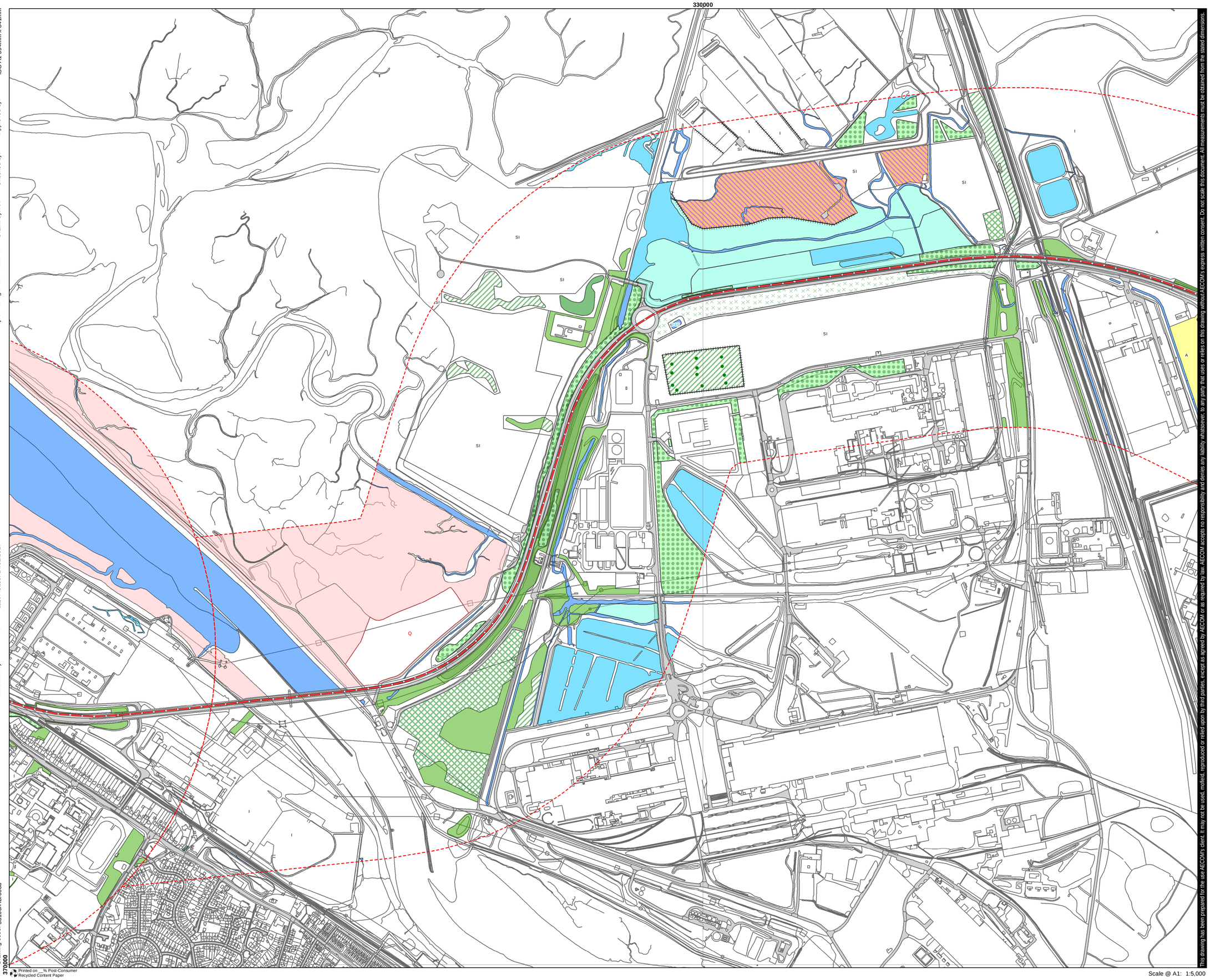
SHEET TITLE

Figure 8-3c
Phase 1 Survey Results
Red Option Sheet B

SHEET NUMBER

60436432-400-430-110-0833

330000



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- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Neutral grassland - unimproved
- SI Neutral grassland - semi-improved
- I Improved grassland
- Marsh/marshy grassland
- SI Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Swamp
- Saltmarsh - dense/continuous; Saltmarsh
- Q Quarry
- A Cultivated/disturbed land - arable
- A Cultivated/disturbed land - amenity grassland

0 0.05 0.1 0.2 km

PROJECT NUMBER

60436432

SHEET TITLE

Figure 8-3d
Phase 1 Survey Results
Red Option Sheet C

SHEET NUMBER

60436432-400-430-110-0834

ISO A1 594mm x 841mm

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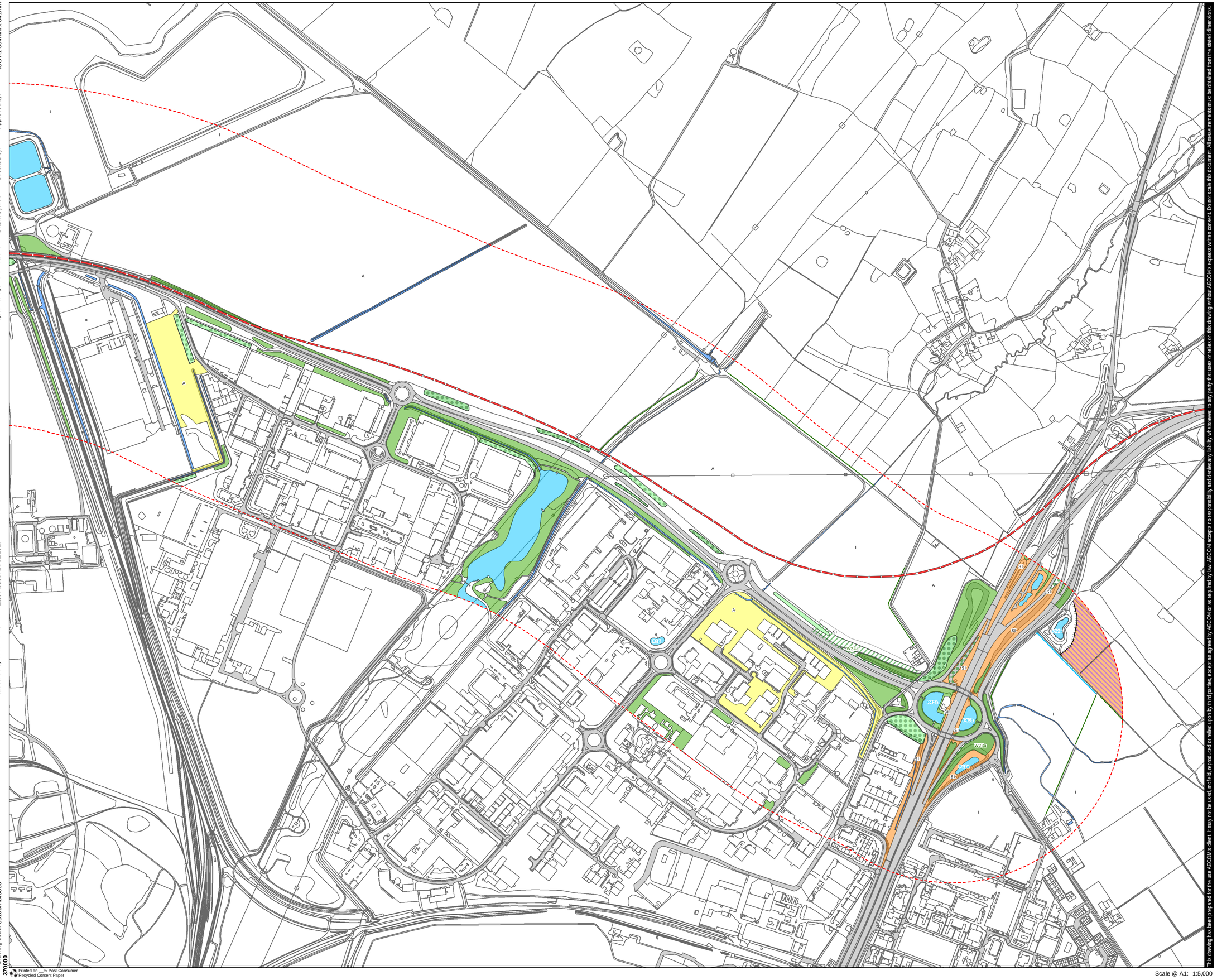

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- Broadleaved woodland
- Coniferous woodland
- Mixed woodland - plantation
- Mixed woodland
- Scrub - dense/continuous
- Scrub - scattered
- Broadleaved Parkland/scattered trees
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- Neutral grassland - semi-improved
- Improved grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Standing water
- Running water
- Swamp
- Saltmarsh - dense/continuous; Saltmarsh
- Quarry
- Cultivated/disturbed land - arable
- Cultivated/disturbed land - amenity grassland

0 0.05 0.1 0.2 km

PROJECT NUMBER

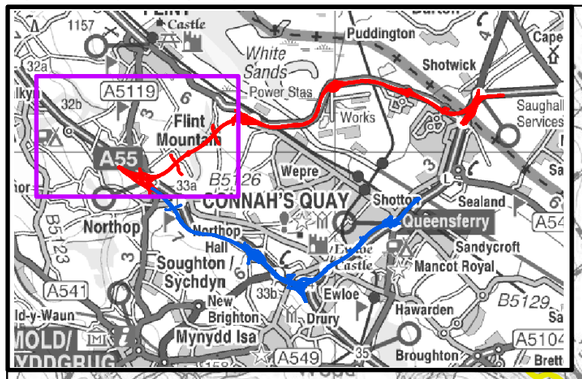
60436432

SHEET TITLE

Figure 8-3e
Phase 1 Survey Results
Red Option Sheet D

SHEET NUMBER

60436432-400-430-110-0835



Legend

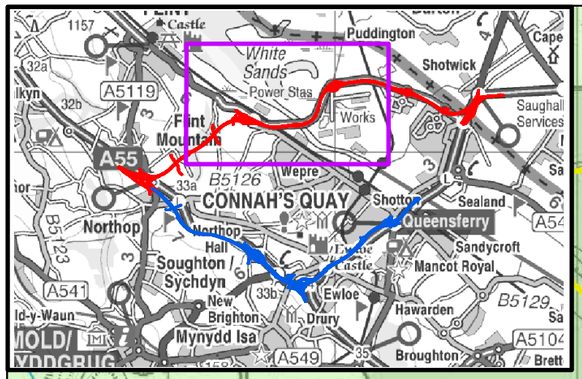
- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Sites of Special Scientific Interest
- Water Abstraction Licences
- Water Discharge Consents
- Water Pollution Incidents
- Watercourse
- Waterbodies

WFD Waterbodies:

1. 1. Dee Estuary (GB531106708200) Moderate Ecological Potential & failing to meet Good Chemical Status
2. 2. Sandycroft Drain (GB111067052160) Moderate Ecological Potential & Good Chemical Status
3. 3. Shotwick Brook (GB111067056960) Moderate Ecological Potential & Good Chemical Status
4. 4. Swinchiard Brook (GB111067056940) Good Ecological Status and Good Chemical Status
5. 5. Wepre Brook (GB111067056880) Moderate Ecological Status & Good Chemical Status

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government	Title: FIGURE 11.1 SURFACE WATER ENVIRONMENT RECEPTORS (SECTION A)	RICHARDS MOORHEAD & LAING LTD PLANNING | LANDSCAPE | ENVIRONMENT	Drawn: DM / Checked: AR
Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2		AECOM House, 179 Moss Lane, Altrincham, WA15 8FH Tel: +44 (0) 161 927 8200 Fax: +44 (0) 161 927 8299 www.aecom.com	Verified: OT / Approved: OT Date: 21/02/2017 / Scale at A3: 1:15,000 Drawing Number: 60436462\ENV\11.1 / A3



Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Sites of Special Scientific Interest
- Water Abstraction Licences
- Water Discharge Consents
- Water Pollution Incidents
- Watercourse
- Waterbodies

WFD Waterbodies:

1. 1. Dee Estuary (GB531106708200) Moderate Ecological Potential & failing to meet Good Chemical Status
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3. 3. Shotwick Brook (GB111067056960) Moderate Ecological Potential & Good Chemical Status
4. 4. Swinchiard Brook (GB111067056940) Good Ecological Status and Good Chemical Status
5. 5. Wepre Brook (GB111067056880) Moderate Ecological Status & Good Chemical Status

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government	Title: FIGURE 11.1 SURFACE WATER ENVIRONMENT RECEPTORS (SECTION B)	Drawn: DM	Checked: AR
Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2		Verified: OT	Approved: OT
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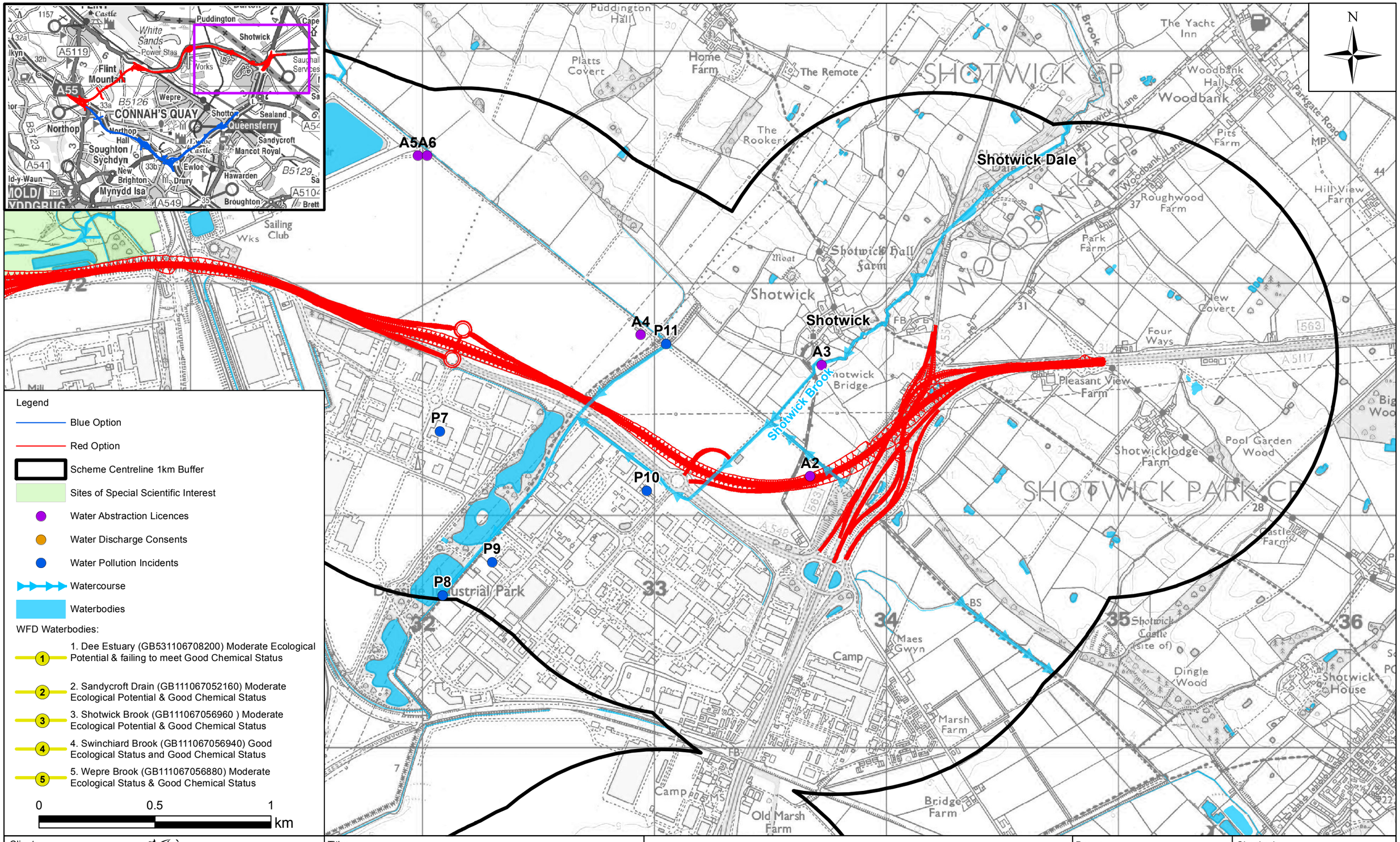

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Sites of Special Scientific Interest
- Water Abstraction Licences
- Water Discharge Consents
- Water Pollution Incidents
- Watercourse
- Waterbodies

WFD Waterbodies:

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2. Sandycroft Drain (GB111067052160) Moderate Ecological Potential & Good Chemical Status
3. Shotwick Brook (GB111067056960) Moderate Ecological Potential & Good Chemical Status
4. Swinchiard Brook (GB111067056940) Good Ecological Status and Good Chemical Status
5. Wepre Brook (GB111067056880) Moderate Ecological Status & Good Chemical Status

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.1 SURFACE WATER ENVIRONMENT RECEPTORS (SECTION C)

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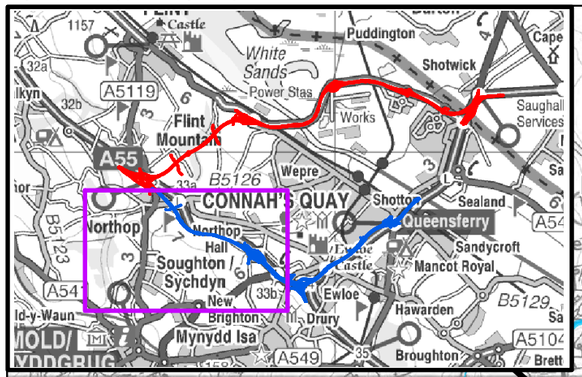

Crossings and route to be confirmed by further field survey

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Sites of Special Scientific Interest
- Water Abstraction Licences
- Water Discharge Consents
- Water Pollution Incidents
- Watercourse
- Waterbodies

WFD Waterbodies:

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5. Wepre Brook (GB111067056880) Moderate Ecological Status & Good Chemical Status

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.1 SURFACE WATER ENVIRONMENT RECEPTORS (SECTION D)

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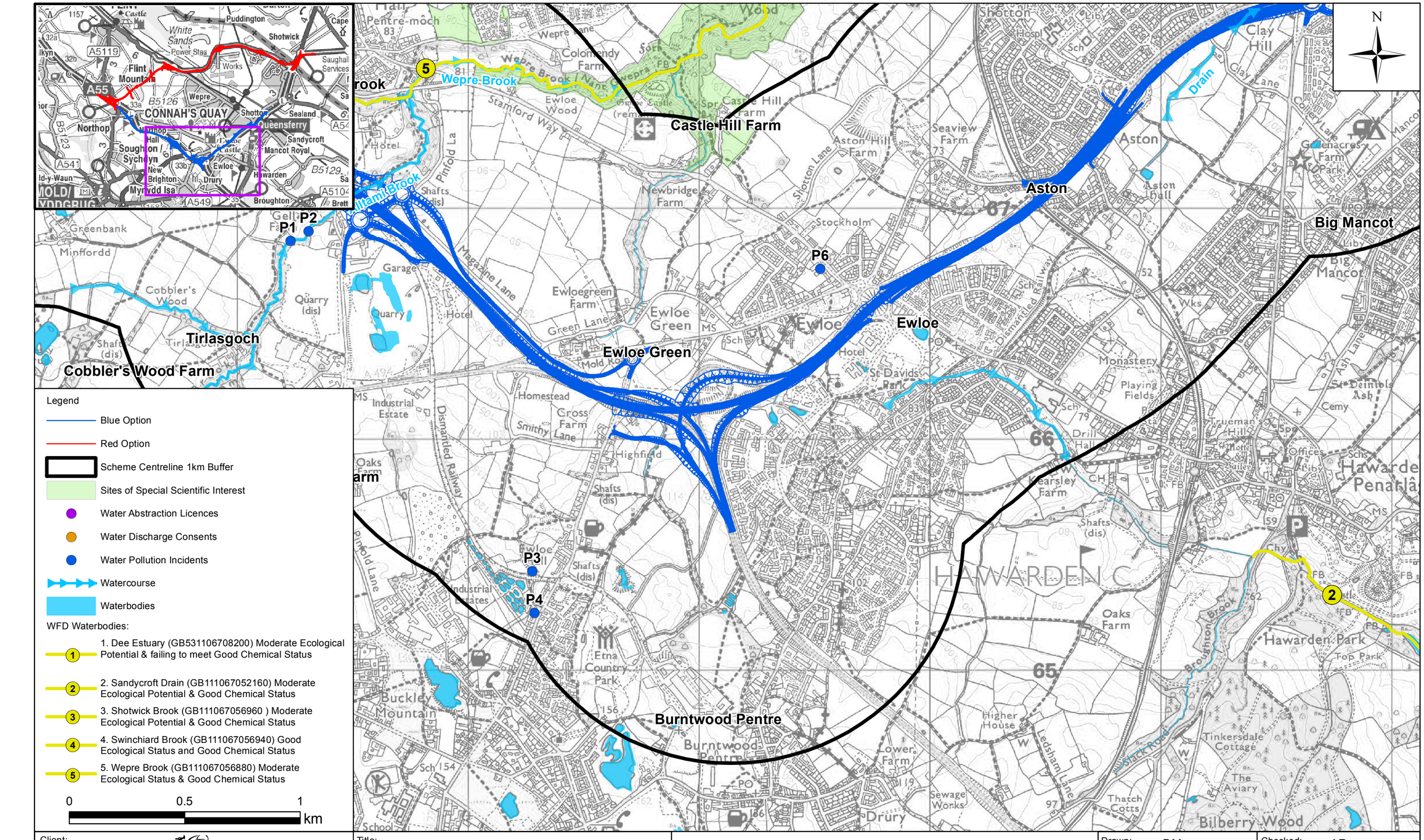

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Sites of Special Scientific Interest
- Water Abstraction Licences
- Water Discharge Consents
- Water Pollution Incidents
- Watercourse
- Waterbodies

WFD Waterbodies:

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4. 4. Swinchiard Brook (GB111067056940) Good Ecological Status and Good Chemical Status
5. 5. Wepre Brook (GB111067056880) Moderate Ecological Status & Good Chemical Status

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.1 SURFACE WATER ENVIRONMENT RECEPTORS (SECTION E)

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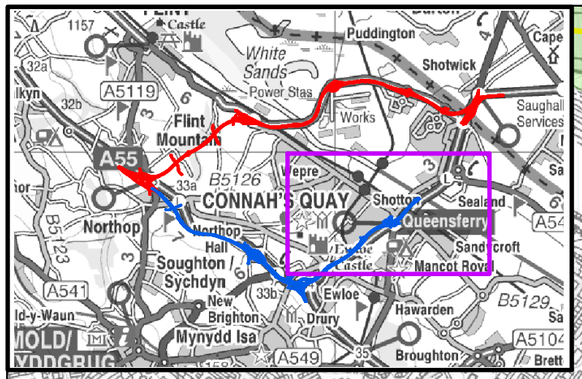

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Sites of Special Scientific Interest
- Water Abstraction Licences
- Water Discharge Consents
- Water Pollution Incidents
- Watercourse
- Waterbodies

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0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.1 SURFACE WATER ENVIRONMENT RECEPTORS (SECTION F)

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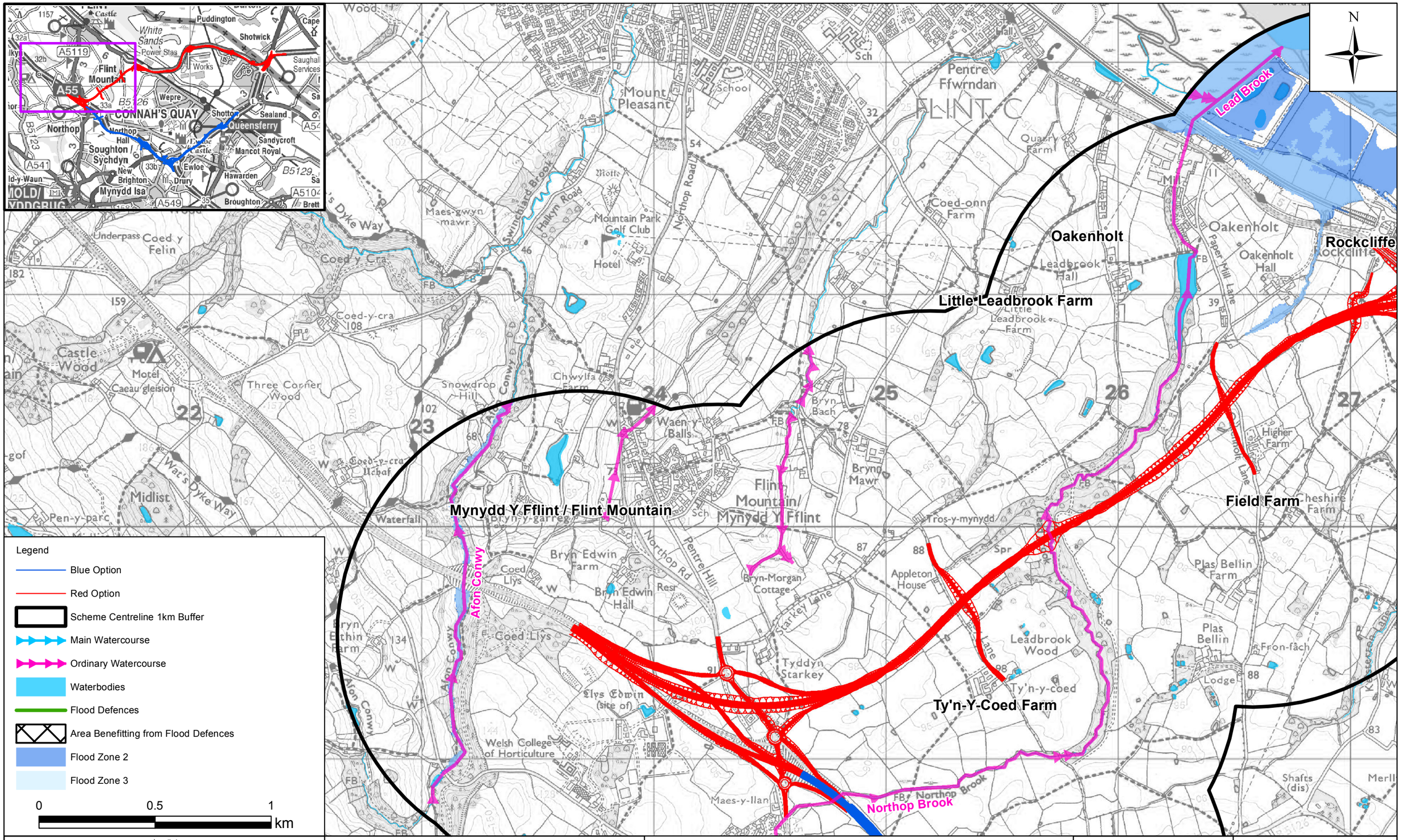

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Main Watercourse
- Ordinary Watercourse
- Waterbodies
- Flood Defences
- Area Benefitting from Flood Defences
- Flood Zone 2
- Flood Zone 3

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.2 FLUVIAL AND TIDAL FLOOD RISK (SECTION A)

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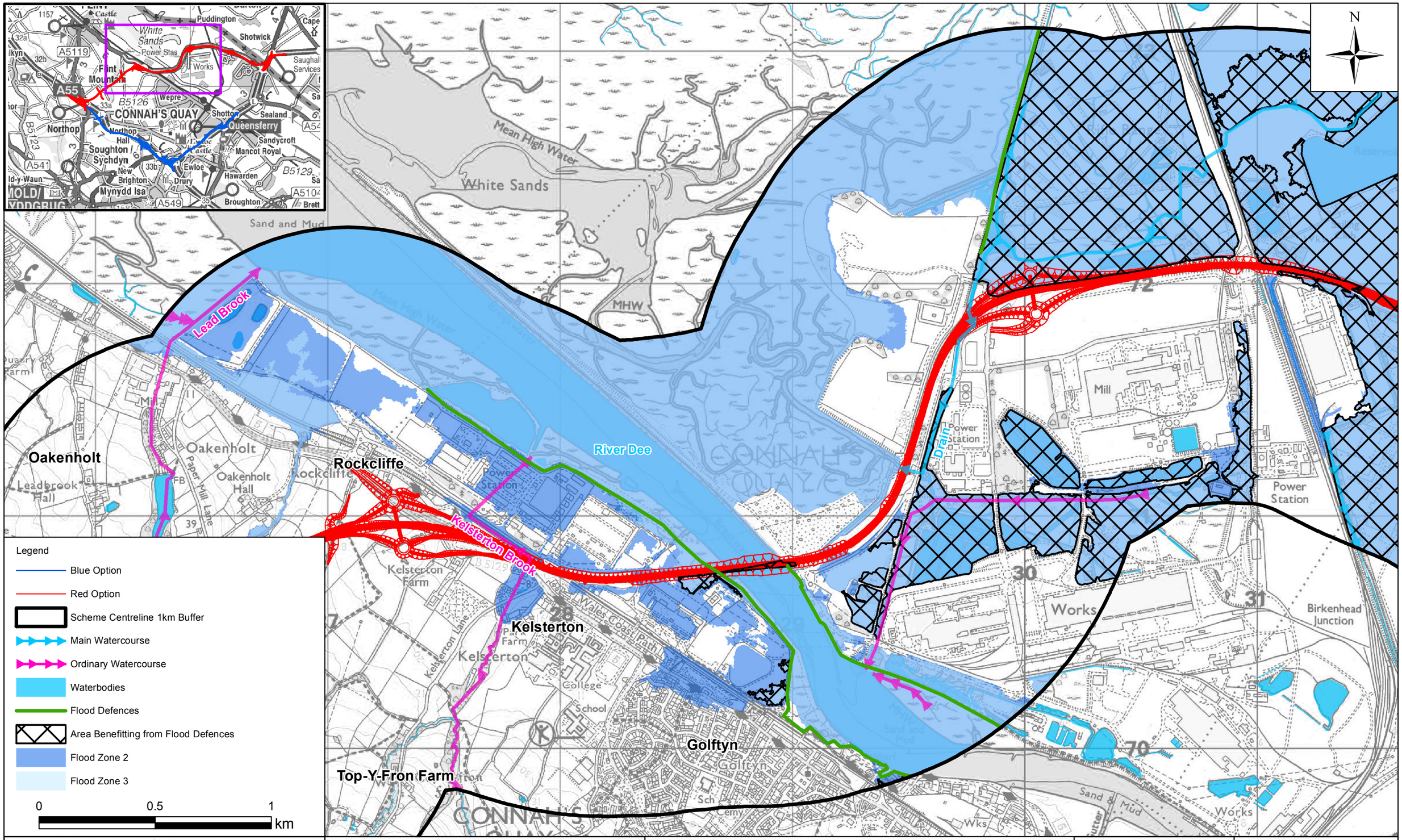

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Main Watercourse
- Ordinary Watercourse
- Waterbodies
- Flood Defences
- Area Benefitting from Flood Defences
- Flood Zone 2
- Flood Zone 3

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.2 FLUVIAL AND TIDAL FLOOD RISK (SECTION B)

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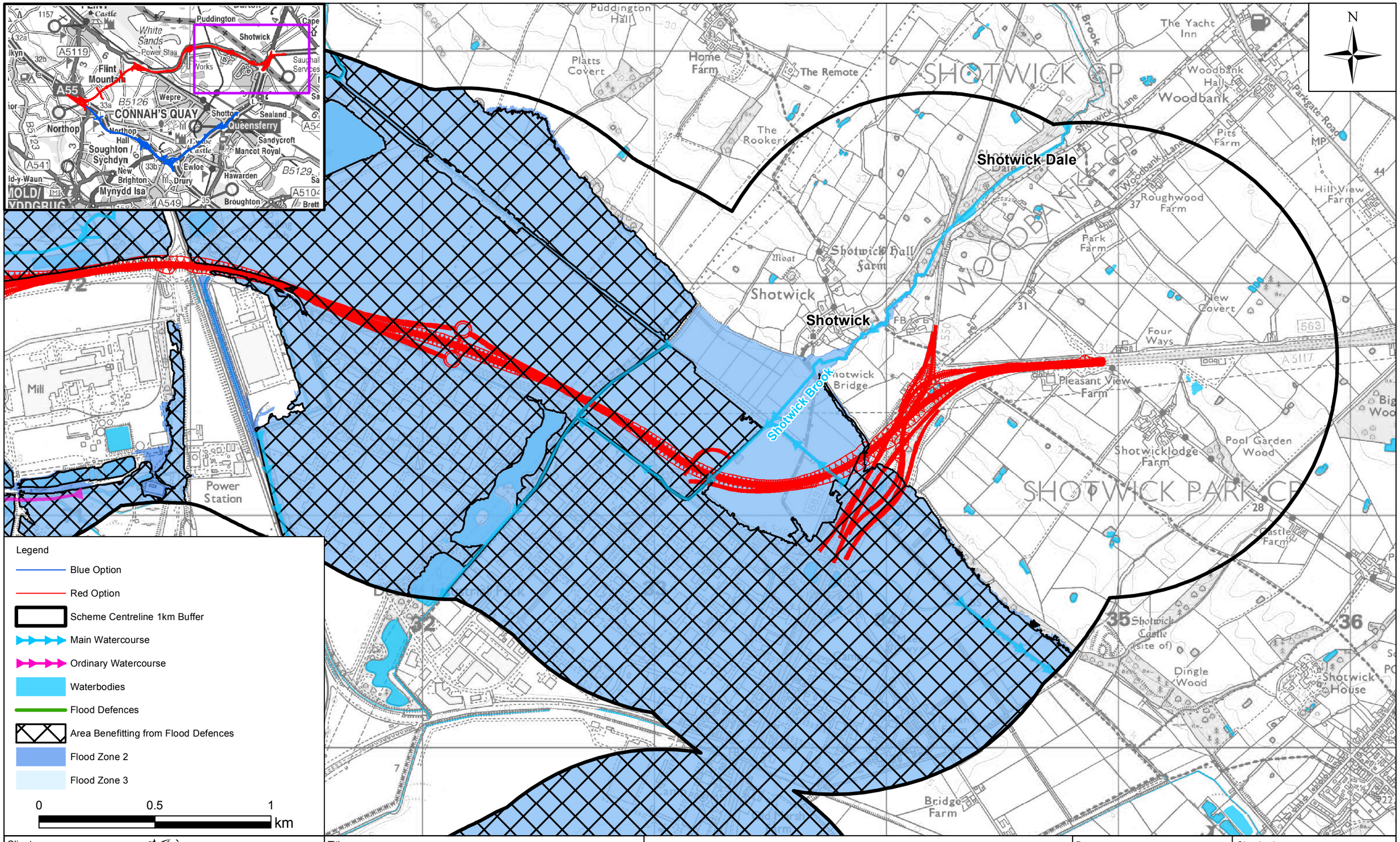

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Main Watercourse
- Ordinary Watercourse
- Waterbodies
- Flood Defences
- Area Benefitting from Flood Defences
- Flood Zone 2
- Flood Zone 3

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title:

FIGURE 11.2
FLUVIAL AND TIDAL FLOOD RISK
(SECTION C)

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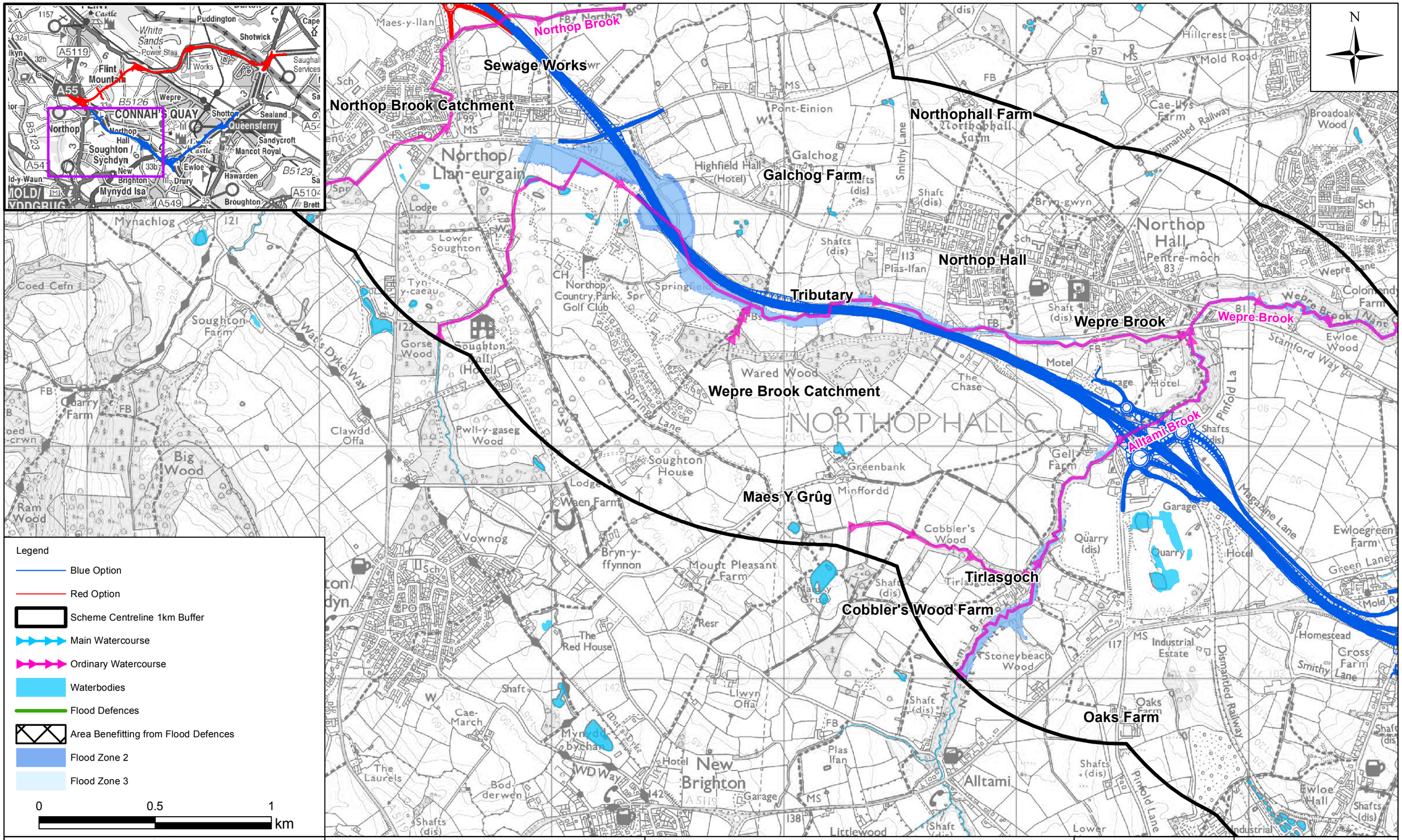

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Main Watercourse
- Ordinary Watercourse
- Waterbodies
- Flood Defences
- Area Benefitting from Flood Defences
- Flood Zone 2
- Flood Zone 3

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.2 FLUVIAL AND TIDAL FLOOD RISK (SECTION D)

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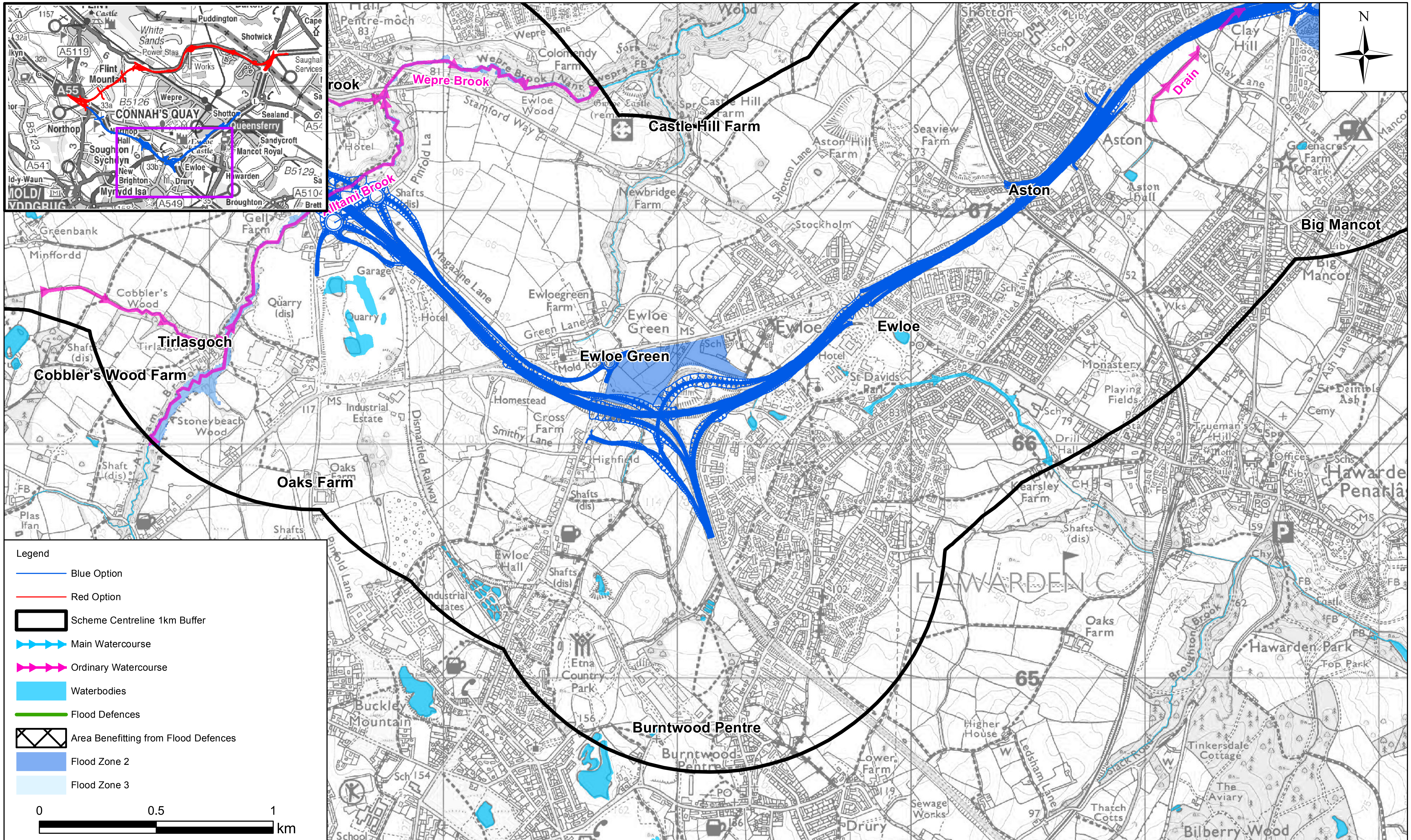

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Main Watercourse
- Ordinary Watercourse
- Waterbodies
- Flood Defences
- Area Benefitting from Flood Defences
- Flood Zone 2
- Flood Zone 3

0 0.5 1 km

Client: Llywodraeth Cymru Welsh Government

Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.2 FLUVIAL AND TIDAL FLOOD RISK (SECTION E)

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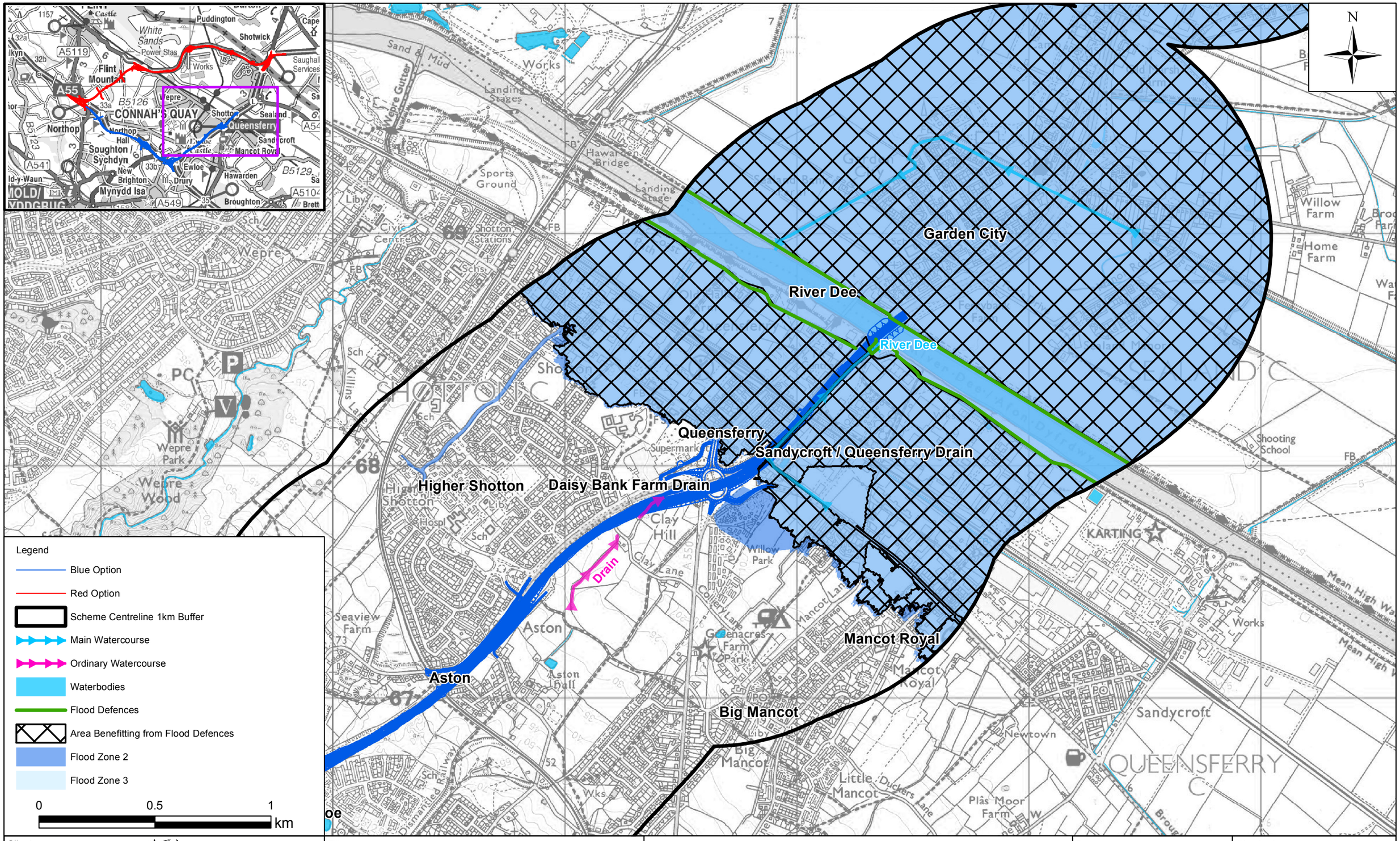

Legend

- Blue Option
- Red Option
- Scheme Centreline 1km Buffer
- Main Watercourse
- Ordinary Watercourse
- Waterbodies
- Flood Defences
- Area Benefitting from Flood Defences
- Flood Zone 2
- Flood Zone 3

0 0.5 1 km

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Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2

Title: FIGURE 11.2 FLUVIAL AND TIDAL FLOOD RISK (SECTION F)

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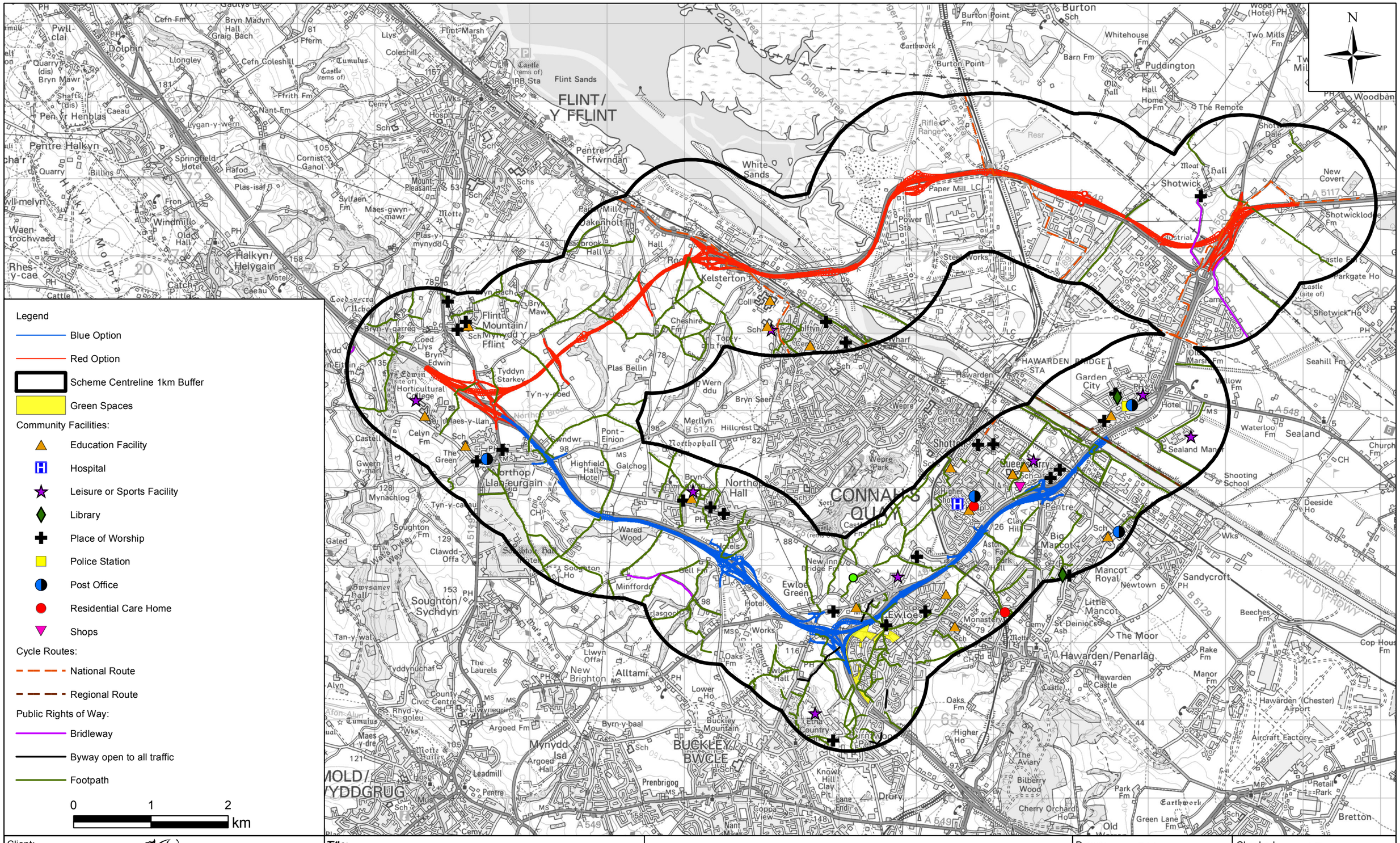

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Title:

FIGURE 12.1
COMMUNITY FACILITIES AND EXISTING PUBLIC RIGHTS OF WAY

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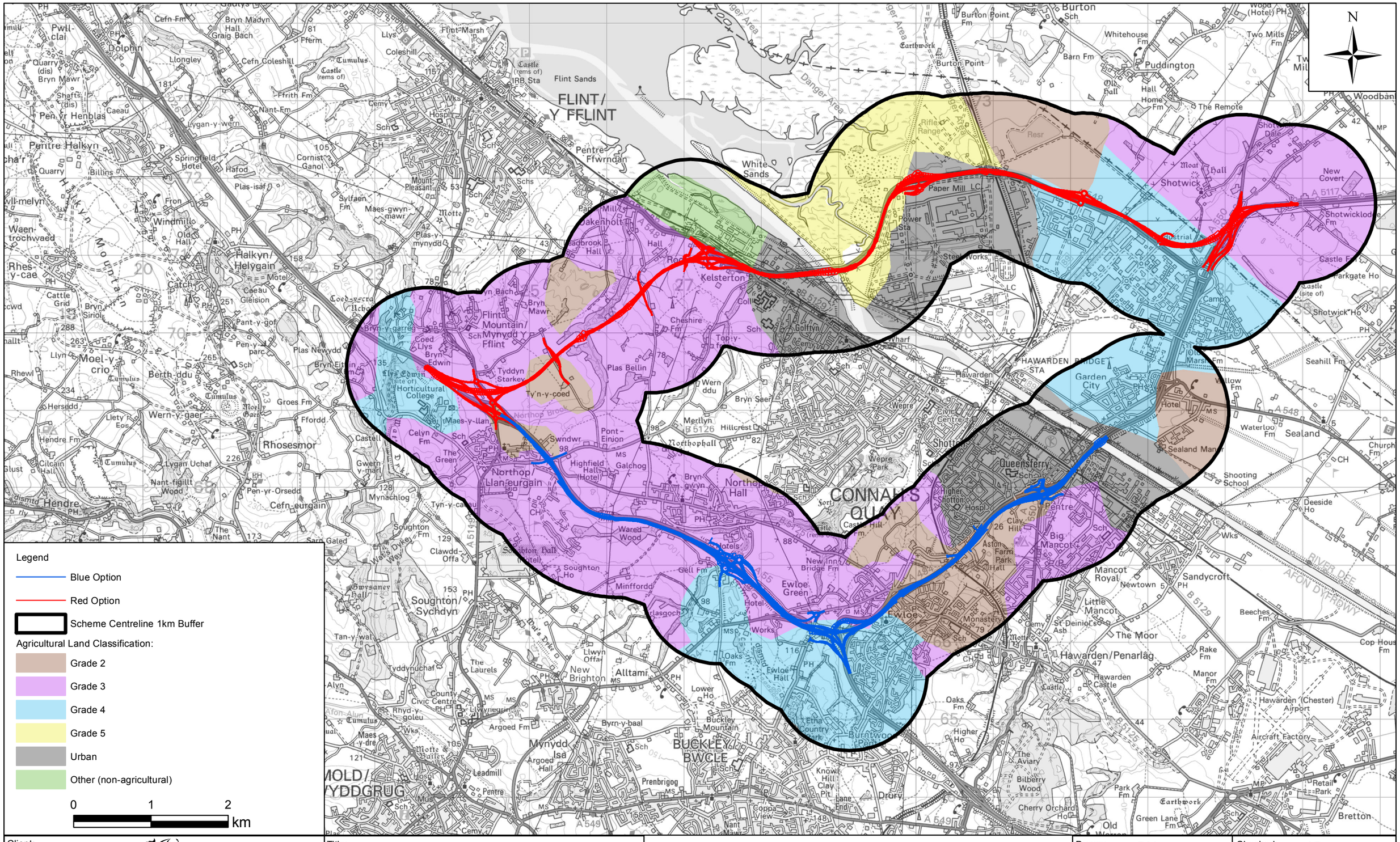

Client: Llywodraeth Cymru Welsh Government	Title: FIGURE 12.2 AGRICULTURAL LAND CLASSIFICATION	RICHARDS MOORHEAD & LAING LTD PLANNING | LANDSCAPE | ENVIRONMENT	Drawn: DM / Checked: AR
Project: A55/A494/A548 Deeside Corridor Improvement Key Stage 2		AECOM House, 179 Moss Lane, Altrincham, WA15 8FH Tel: +44 (0) 161 927 8200 Fax: +44 (0) 161 927 8299 www.aecom.com	Verified: AH / Approved: AH Date: 16/02/2017 / Scale at A3: 1:45,000 Drawing Number: 60436462\ENV\12.2 / A3

Appendices

B

Appendix B:

Table 4.3: Engineering Description of Alternative Scheme A (Blue Option)

Table 4.3 Engineering Description of Alternative Scheme A (Blue Option)

Approximate Mainline Chainage (m)	Section of Route		Approximate Mainline Chainage (m)	Proposed Mainline DMRB Road or Junction Type	DMRB Reference to Proposed Feature	DMRB Description	Number of Traffic Lanes (Mainline)		Proposed Speed Limit (mph)	Mainline Proposed Design Speed (kph)	Details of Junction Merge or Diverge	Slip Road Details	Interchange Links, Subsidiary or Parallel Road Details	Drawing Number	Relaxations or Departures from Standard which may be required	Justification for Departures or Relaxations from Standard
	From	To					Eastbound	Westbound								
0	Just East of the Northop A55 Junction 33 Overbridge	B5126 Connah's Quay Road Junction 33A	850	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	None	None	None	60436462-900-920-02-0101 & 0102	None currently anticipated	Not required
850 at centre of Junction 33A overbridge	B5126 Connah's Quay Road Junction 33A		850 at centre of Junction 33A overbridge	Grade separated junction	Junction to TD 22/06 Figure 5/1.1	Half-Diamond type junction with westbound exit slip road only	3	3	70	120	TD 22/06 Figure 2/6.1 Type A Taper Diverge	TD 27/05 Figure 4-3c DG1C Single Lane with hard shoulder	None	60436462-900-920-02-0102	None currently anticipated	Not required
850	B5126 Connah's Quay Road Junction 33A	A55 Ewloe Services (East and West Bound)	3,700	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	None	None	None	60436462-900-920-02-0102 to 0104	None currently anticipated	Not required
3,700 at centre of New Junction overbridge	Proposed Services Junction A55 (new)		3,700 at centre of New Junction overbridge	Grade separated junction	Junction to TD 22/06 Figure 5/2	Dumb-bell type junction	3	3	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merges and Figure 2/6.1 Type A Taper Diverges	TD 27/05 Figure 4-3c MG1C / DG1C Single Lane with hard shoulder	TD 16/07 Dumb-bell Roundabouts in junction	60436462-900-920-02-0104	None currently anticipated	Not required

3,700	Proposed Services Junction (new)	Eastbound Lane Drop to A55 South	4,800	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	None	None	Eastbound side Parallel Distributor Road to TD 27/05 Figure 4-3a Single Carriageway (S2) for Mold/St David's Traffic	60436462-900-920-02-0104 & 0105	None currently anticipated	Not required
4,800	Eastbound Lane Drop to A55 South	Westbound Lane Gain from A55 South to A55 Holyhead	5,050	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP/D3AP)	2	3	70	120	TD 22/06 Figure 2/6.2 Type C Lane Drop Eastbound	None	Interchange Link to A55 Southbound to TD 27/05 Figure 4-3c IL1C Single Lane with Hard Shoulder	60436462-900-920-02-0105	None currently anticipated	Not required
5,050	Westbound Lane Gain from A55 South to A55 Holyhead	Westbound Lane Drop from A494 to A55 South	5,670	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	TD 22/06 Figure 2/4.3 Type E Lane Gain Westbound and Figure 2/6.2 Type C Lane Drop Westbound	None	Interchange Links from A55 South to A55 Westbound and A494 Westbound to A55 South to TD 27/05 Figure 4-3c IL1C Single Lane with Hard Shoulder	60436462-900-920-02-0105	None currently anticipated	Not required
5,670	Westbound Lane Drop from A494 to A55 South	Eastbound Lane Gain from A55 South to A494 Eastbound	5,970	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP/D3AP)	2	3	70	120	TD 22/06 Figure 2/4.3 Type E Lane Gain Eastbound	None	Interchange Links from A55 South to A494 Eastbound and Parallel Distributor Road from St Davids Junction to A55 South to TD 27/05 Figure 4-3c IL1C Single Lane with Hard Shoulder	60436462-900-920-02-0105	None currently anticipated	Not required

5,400	A55 Junction 34 / A494 Ewloe Interchange		A55 South		Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merge and Figure 2/6.1 Type A Taper Diverge	TD 27/05 Figure 4-3c MG1C / DG1C Single Lane with hard shoulder	None	60436462-900-920-02-0106	None currently anticipated	Not required
5,970	Eastbound Lane Gain from A55 South to A494 Eastbound	A494 St Davids Junction	6,325 at centre of A494 St David's Junction Roundabout	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	None	None	Parallel Distributor Road from St Davids Junction to A55 South to TD 27/05 Figure 4-3c IL1C Single Lane with Hard Shoulder	60436462-900-920-02-0105 & 0107	None currently anticipated	Not required
6,325 at Centre of A494 St David's Junction Roundabout	A494 St Davids Junction		7,150 at A494 Aston Railway Bridge	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merge and Figure 2/6.1 Type A Taper Diverge (east facing slips only to St David's Junction)	TD 27/05 Figure 4-3c MG1C / DG1C Single Lane with hard shoulder	None	60436462-900-920-02-0107	None currently anticipated	Not required
7,150	A494 Aston Railway Bridge	A494 Plough Lane Junction Overbridge	7,690	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merge and Figure 2/6.1 Type A Taper Diverge (west facing slips only to Plough	TD 27/05 Figure 4-3c MG1C / DG1C Single Lane with hard shoulder	Parallel Distributor Road from Old Aston Hill to Plough Lane (eastbound side) and from Chainage 7,410 to Plough Lane on	60436462-900-920-02-0107 & 0108	Weaving Lengths between east facing merge and diverge slip roads at St David's Junction and west facing slip roads at Plough	Existing junction locations relatively fixed without significant demolition of existing properties.

											Lane Junction)		westbound side)		Lane Junction	
7,690	Plough Lane Junction Overbridge	Queensferry Junction	8,660 at centre of A494 Queensferry Junction	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merge and Figure 2/6.1 Type A Taper Diverge	TD 27/05 Figure 4-3c MG1C / DG1C Single Lane with hard shoulder	None	60436462-900-920-02-0108	None currently anticipated	Not required
8,660 at centre of A494 Queensferry Junction	A494 Queensferry Junction		9,500 at approximate tie-in to A494 Dee Bridge Renewal Scheme	Dual carriageway	Cross Section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D3AP)	3	3	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merge and Figure 2/6.1 Type A Taper Diverge	TD 27/05 Figure 4-3c MG1C / DG1C Single Lane with hard shoulder	None	60436462-900-920-02-0108 & 0109	None currently anticipated	Not required

Appendices

C

Appendix C:

Table 4.4: Engineering Description of Alternative Scheme B (Red Option)

Table 4.4 Engineering Description of Alternative Scheme B (Red Option)

Approximate Mainline Chainage (m)	Section of Route		Approximate Mainline Chainage (m)	Proposed Mainline DMRB Road or Junction Type	DMRB Reference to Proposed Feature	DMRB Description	Number of Traffic Lanes (Mainline)		Proposed Mainline Speed Limit (mph)	Mainline Proposed Design Speed (kph)	Details of Junction Merge or Diverge	Slip Road Details	Interchange Links, Subsidiary or Parallel Road Details	Drawing Number	Relaxations or Departures from Standard which may be required	Justification for Departures or Relaxations from Standard
	From	To					Eastbound	Westbound								
0	Proposed Northop Interchange		1,300	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merges and Figure 2/6.1 Type A Taper Diverges	TD 27/05 Figure 4-3c DG1C Single Lane with hard shoulder	None	60436462-900-910-02-0101	None currently anticipated	Not required
1,300	New A55 to A548 Link Road		4,300	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	Side Road Overbridges at Starkey Lane (Ch 1,900) and at Oakenholt Lane (Ch 3,325)	60436462-900-910-02-0102 & 0103	None currently anticipated	Not required
4,300 at centre of Proposed Kelsterton Interchange	Proposed Kelsterton Junction		4,300 at centre of Proposed Kelsterton Interchange	Grade separated junction	Junction to TD 22/06 Figure 5/2	Dumb-bell type junction	2	2	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merge1 and Figure 2/6.1 Type A Taper Diverge	TD 27/05 Figure 4-3c DG1C Single Lane with hard shoulder	Proposed Kelsterton Road Diversion into Proposed Kelsterton Interchange (Ch 4,325 to Ch 4,900, westbound side)	60436462-900-910-02-0103 & 0104	None currently anticipated	Not required
4,300	New A55 to A548 Link Road		5,000	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	None	60436462-900-910-02-0104 To 0106	None currently anticipated	Not required

5,000	South of the River Dee to Proposed Weighbridge Road Junction via A548 Flintshire Bridge	7,725	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	None	60436462-900-910-02-0104 To 0106	Existing carriageway may not comply with current rural all-purpose dual carriageway (D2AP) standard and a Departure from Standard on cross-section may be required. The need for a Departure would be confirmed once a detailed topographic survey has been carried out and a detailed check of existing cross-section checked for compliance with Standard.	Widening of existing carriageway could have significant impacts on businesses in Deeside Industrial Park, environmentally sensitive areas of land and disruptive to traffic. Flintshire Bridge itself may not be suitable for widening without significant alterations to or replacement of existing structure.
7,725 at centre of Proposed Weighbridge Road Junction Overbridge	Proposed Weighbridge Road Junction	7,725 at centre of Proposed Weighbridge Road Junction Overbridge	Grade separated junction	Junction to TD 22/06 Figure 5/2	Dumb-bell type junction	2	2	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merges and Figure 2/6.1 Type A Taper Diverges	TD 27/05 Figure 4-3c DG1C Single Lane with hard shoulder	None	60436462-900-910-02-106		
7,725	Following existing A548 to point where existing and proposed alignments separate	9,000	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	None	60436462-900-910-02-0106 & 0107		
9,000	Existing A548 and proposed alignments separate / Proposed Tenth Avenue Junction	9,900	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	None	60436462-900-910-02-0104 To 0106	None currently anticipated	Not required
9900 at centre of Proposed Tenth Avenue Junction underbridge	Proposed Tenth Avenue Junction	9900 at centre of Proposed Tenth Avenue Junction underbridge	Grade separated junction	Junction to TD 22/06 Figure 5/2	Dumb-bell type junction	2	2	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merges and	TD 27/05 Figure 4-3c DG1C Single Lane with	None	60436462-900-910-02-0107 & 0108	None currently anticipated	Not required

											Figure 2/6.1 Type A Taper Diverges	hard shoulder				
9,900	Proposed Tenth Avenue Junction	Proposed Parkway Junction	11,500	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	None	60436462-900-910-02-0107 & 0108	None currently anticipated	Not required
11500 at centre of Proposed Parkway Junction underbridge	Proposed Parkway Junction		11500 at centre of Proposed Parkway Junction underbridge	Grade separated junction	Junction to TD 22/06 Figure 5/2	Dumb-bell type junction	2	2	70	120	TD 22/06 Figure 2/4.1 Type A Taper Merges and Figure 2/6.1 Type A Taper Diverges	TD 27/05 Figure 4-3c DG1C Single Lane with hard shoulder	None	60436462-900-910-02-0108 & 0109	None currently anticipated	Not required
11,500	Proposed Parkway Junction	Tie-in to existing A494	12,650	Dual carriageway	Cross-section to TD 27/02 Figure 4-3a	Rural all-purpose dual carriageway (D2AP)	2	2	70	120	None	None	Multiple Interchange links between existing A494 and A550	60436462-900-910-02-0109	None currently anticipated	Not required

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