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A55(T) Abergwyngregyn to Tai'r Meibion Improvement

VOLUME 1:
ENVIRONMENTAL STATEMENT




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Chapter 1.0: Introduction

This chapter identifies the project that has been the subject of the Environmental Impact Assessment, as summarised in this Environmental Statement. It also defines the legal basis for the Environmental Statement, explains its purpose and outlines its scope and content.

1.1 Identifying the Project

1.1.1 The Welsh Ministers propose to improve a 2.2km length of the A55(T) Chester to Bangor Trunk Road from the Abergwyngregyn interchange to Tai'r Meibion farm along with associated access provisions. The scheme is titled the A55(T) Chester – Bangor Trunk Road: Abergwyngregyn to Tai'r Meibion Improvement (hereafter referred to as 'the Scheme').

1.1.2 The Scheme (see Figure 1, Volume 1a) is located along and adjacent to the A55(T) in Gwynedd, North Wales approximately 6.5km (4 miles) east of Bangor (NGR: 262050, 371200 to 265270, 372768) and runs parallel with the main London to Holyhead railway, south of the Menai Strait. It is approximately 410m south of Traeth Lafan at its closest, which is part of a Special Area of Conservation (SAC) and Special Protection Area (SPA) (with the main highway improvement approximately 625m south) and approximately 25m north (at its closest point) of the Snowdonia National Park.

1.1.3 The overall aim of the Scheme is to improve safety standards and resilience to flooding and potential traffic growth along this section of the A55(T). The overarching scheme objectives for the Scheme are therefore as follows:

- improving the standards of a strategically important highway to ensure that it provides efficient future connectivity between communities and economic hubs;
- alleviating flooding issues to ensure ongoing transport connectivity and resilience to climate change;
- improving pedestrian and cycling connections to provide alternative, healthier forms of travel;
- enhancing biodiversity and future connectivity for wildlife at the locality, and;
- considering the aims of sustainable development within the design, construction and operation of the Scheme.

1.1.4 The Sustainable Development Report (YGC, 2016), which is available as a separate document to this ES, describes how the Scheme would contribute to achieving wider long-term sustainable development goals in Wales in consideration of the Wellbeing of Future Generations (Wales) Act (2015).

1.1.5 The Scheme encompasses the following design measures:

- Improvement of a 2.2km length of the A55(T) Chester to Holyhead Trunk Road between Junctions 12 and 13. A 1m wide hard strip would be added to each side of both carriageways. The vertical alignment would be improved to meet current standards and the existing pavement reconstructed.
- A new concrete safety barrier would be built in the central reserve to replace the current steel barrier. The central reserve would be 2.5m wide (excluding the hardstrips) and hard surfaced.
- The central reserve gaps and almost all existing direct accesses onto the A55(T) over the scheme length would be permanently closed, as would the county road junction to Wig Crossing Cottages.
- A new Non-Motorised User (NMU) route (2 – 2.5m wide) would run parallel with the eastbound carriageway from the Abergwyngregyn interchange (Junction 13) west to Wig farm. West of Wig farm the NMU route would be combined with a Private Means of Access (PMA) serving Wig Farm. The PMA would then become a County road (4.8m

wide) between the junction with the road to Wig Crossing cottages and the Tal-y-Bont interchange (Junction 12).

- A new agricultural access track would be created through fields from Roman Road (Henffordd) north-east to link with the existing Wig farm underpass and access track.
- An 860m section of Roman Road (Henffordd) would be widened to 4.8m to better accommodate agricultural vehicles using the new access track.
- The westbound access junction for Numbers 1 and 2 Bryn Meddyg would be combined with that for Y Glyn and improved to comply with current standards.
- The existing cattle underpasses at Tai'r Meibion and Wig farms would be retained and extended to allow for the widened highway.
- A new footway (generally 2m wide) between Tan yr Allt cottages and Llain y Ffwlbart to improve pedestrian access to the local bus service.
- The risk of flooding of the carriageway would be reduced by improving the drainage system. A new culvert would be constructed to accommodate the Afon Wig and a drainage channel/bund would be provided along the south side of the A55(T) to reduce the risk of the road being flooded.
- New wildlife pipes would be installed under the A55(T) near the westbound part of Tal-y-bont interchange and at the site of Wig Bach.

1.2 The Legal Basis for the Environmental Statement

1.2.1 This Environmental Statement (ES) has been prepared by YGC and their sub-consultants on behalf of the Welsh Government. The legislative framework for EIA is set by European Directive 2011/92/EU, as amended by Directive 2014/52/EU (collectively referred to as the EIA Directive). The Directive requires EIA to be undertaken in support of an application for development consent for certain types of scheme and is transposed into UK law by Section 105A of the Highways Act 1980 (as amended). This legislation is enacted by the Highways (Assessment of Environmental Effects) Regulations 2007 (as amended). These are often collectively termed the EIA Regulations.

1.2.2 Directive 2014/52/EU requires Member States to transpose its requirements into national law by 16th May 2017 and sets out arrangements for a transitional period from the regime laid down by Directive 2011/92/EU. These transitional measures require that the provisions of Directive 2011/92/EU apply to schemes for which the EIA process has been initiated or for which the ES has been submitted within the transitional period. Therefore, for the purposes of the Scheme, Directive 2011/92/EU remains the relevant consideration.

1.2.3 Although the proposed project does not constitute an Annex I project, Annex II projects are defined as all projects not listed within Annex I of the EIA Directive that are not considered to be strictly maintenance projects. In order to confirm whether the project is considered a 'relevant project' under EIA Regulations the thresholds of size and environmental sensitivity are applied.

1.2.4 Essentially, an Annex II 'relevant project' is defined as:

"a project for constructing or improving a highway where the area of the completed works together with any area occupied during the period of construction or improvement by requisite apparatus, equipment, machinery, materials, plant, spoil heaps or other such facilities exceeds 1 hectare or where any such area is situated in whole or in part in a sensitive area."

1.2.5 The proposed project is not situated within a 'sensitive area', as defined by the EIA Regulations as amended. However, the project size does exceed 1 hectare and thus the proposed project is classified as a 'relevant project'. All 'relevant' Annex II projects require a determination to be undertaken to confirm whether the project is considered likely to have

a significant environmental effect. This examines the characteristics of the proposed project in terms of its location and the potential impacts that may arise and is informed by the selection criteria in Annex III of the EIA Directive.

- 1.2.6 The determination concluded that the proposed works are of more than local importance, are set within a sensitive location and are anticipated to have significant negative effects on the receiving and surrounding environment. To ensure that all environment effects are considered during the design process a Statutory Environmental Assessment has therefore been undertaken on the proposed project. A Notice of Determination confirming the findings of the determination process will be published concurrently with this ES.

Assessment of Implications on European Sites

- 1.2.7 The Scheme would involve work within at least 410m of the Y Fenai a Bae Conwy Special Area of Conservation (SAC) and Traeth Lafan Special Protection Area (SPA) (see Figure 5.4.1, Volume 1a). Regulation 61 of The Conservation of Habitats and Species Regulations 2010 (as amended) states that:

*“A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which—
(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects), and
(b) is not directly connected with or necessary to the management of that site,
must make an appropriate assessment of the implications for that site in view of that site’s conservation objectives”.*

- 1.2.8 Therefore, an Assessment of Implications on European Sites (AIES) has been undertaken by the relevant competent authority (the relevant Welsh Government Minister/s) of the potential impacts on these sites associated with the construction and operation of the Scheme. A Statement to Inform an Appropriate Assessment (SIAA) to facilitate the AIES decision-making process has been published as a separate document to this ES and can be viewed at the addresses provided in Section 1.5. The SIAA is also contained in Volume 2, Technical Appendix E.

1.3 The Purpose of the Environmental Statement

- 1.3.1 This ES identifies, describes and assesses the potential environmental impacts that may arise as a result of the Scheme, and outlines measures to avoid, reduce and, if possible, remedy the major adverse effects. The ES also outlines potential enhancement measures that have been identified as part of the EIA process. It provides relevant information regarding the design of the Scheme to enable the Welsh Ministers to take into consideration any representations before deciding whether or not to proceed with the project, with or without modifications. It also provides an outline of the main alternatives and the reasons why these have not been presented as the Scheme.

1.4 The Scope and Content of the Environmental Statement

- 1.4.1 This ES has been prepared in accordance with the guidance provided by the Design Manual for Roads and Bridges (DMRB) Volume 11: Environmental Assessment, Sections 1 - 3 and Interim Advice Note 125/09(W)¹ adopting standard initial assessment methods, except where specified otherwise.

¹ Interim Advice Note 125/09(W): Supplementary Guidance for Users of DMRB Volume 11 ‘Environmental Assessment’ (Wales only), Welsh Assembly Government, July 2010.

1.4.2 The EIA process and this ES have been co-ordinated by YGC, which also produced the chapters relating to Nature Conservation, Geology and Soils, Materials, Effects on All Travellers, Community and Private Assets and Road Drainage and the Water Environment. The following contributors have provided specialist support:

- ADAS: Agricultural Assessment (Community and Private Assets)
- Bureau Veritas: Air Quality, Noise and Vibration
- Gwynedd Archaeological Trust: Cultural Heritage
- Mouchel: Landscape

1.4.3 This ES comprises the following documents:

- Non-Technical Summary: a brief summary of the main findings of the ES in a non-technical language.
- Volume 1: The Environmental Statement (this document) - a comprehensive and concise document drawing together all relevant information about the predicted environmental impacts of the Scheme.
- Volume 1a: Plans and figures to which this ES refers.
- Volume 2: Detailed Technical Appendices of specific assessment topics described in this ES.

1.4.4 In accordance with HD48/08 *Reporting of Environmental Impact Assessments*² this ES contains the following sections:

- **The Scheme (Chapter 2.0):** Describing the background to the Scheme, justifying its need and highlighting its objectives. Other relevant information includes a summary of the existing site conditions, land use and land take information, a description of the Scheme and general details about the construction, operation and long term management of the project.
- **Alternatives Considered (Chapter 3.0):** Explaining which alternatives were considered before reaching the final decision on the chosen design.
- **Environmental Assessment Methods and Consultations (Chapter 4.0):** Stating and justifying the methods and predictive techniques used in the assessment process, the scoping techniques applied and the consultations carried out.
- **Topic Analysis (Chapter 5.0):** Considering each environmental topic as outlined in the DMRB (Volume 11, Section 3) and IAN 125/09(W), this section establishes the baseline and regulatory/policy framework for each topic and uses the information gathered to identify the likely impacts. Mitigation measures are proposed and a summary of residual significant effects for each topic after mitigation is provided.
- **Cumulative Effects (Chapter 6.0):** Assessing the likelihood of further effects as a result of a combination of the Scheme with other proposed projects/plans and incremental effects within the project itself. Cumulative effects are considered with regard to the guidance provided in HA205/08 and HD48/08.
- **Environmental Management (Chapter 7.0):** Outlining how the proposed mitigation measures and the principles of sustainable development and good practice will be delivered during the construction phase of the Scheme.
- **Conclusions (Chapter 8.0):** A summary of the main effects and mitigation measures resulting from the Scheme.

Consideration of EIA Directive 2014/52/EU

1.4.5 Although, as previously stated, this ES has been written in accordance with EIA Directive 2011/92/EU, elements of Directive 2014/52/EU have been taken in to consideration in some chapters. Annex IV Directive 2014/52/EU states what information should be included in the

² The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 6, HD48/08, Highways Agency, August 2008.

Environmental Impact Assessment report (*i.e.* ES), and includes the following areas which differ from Directive 2011/92/EU:

Heat and radiation

- 1.4.6 Given the nature and scale of the Scheme, there are not anticipated to be any significant effects from heat or radiation and these have not been included in this assessment.

Material assets

- 1.4.7 Annex IV of the EIA Directive includes reference to 'material assets'. The phrase 'material assets' has a broad scope, which may include assets of human or natural origin, valued for socio-economic/community or heritage reasons. Material assets are in practice considered across a range of topic areas within this ES, in particular Chapter 5.2: Cultural Heritage and Chapter 5.9: Community and Private Assets.

Effects of the Scheme on climate

- 1.4.8 Atmospheric emissions associated with the use of the Scheme during construction and operation are assessed within Chapter 5.1 (Air Quality) of the ES.

Human health

- 1.4.9 Although no overall assessment of the Scheme on human health has been undertaken, the thresholds on which the assessment of the impact of noise is based, is largely concerned with how noise can affect human health (see Chapter 5.7: Noise and Vibration). The assessment of air quality explained in Chapter 5.1: Air Quality also highlights how the Scheme will impact human health.

- 1.4.10 One of the main aims of the Scheme is to improve safety standards for the users of this section of the A55(T). Improving pedestrian and cycling access connections to provide alternative, healthier forms of travel is also included within the Scheme and these aspects are explained in more detail in Chapter 5.8: Effects on All Travellers.

Vulnerability of the Scheme to climate change

- 1.4.11 Climate change has been considered during the Scheme design process. The design has taken into account, for example, future flood risk and resilience to extreme weather events. In the case of flooding, this is considered in Chapter 5.10: Road Drainage and the Water Environment.

1.5 Further Information

- 1.5.1 The following draft Orders have been prepared and published concurrently with this ES and its accompanying Notice of Determination:

- 1) THE CHESTER TO BANGOR TRUNK ROAD (A55) (ABERGWYNGREGYN TO TAI'R MEIBION IMPROVEMENT) (SIDE ROADS) ORDER 201-.
- 2) THE WELSH MINISTERS (THE CHESTER TO BANGOR TRUNK ROAD (A55) (ABERGWYNGREGYN TO TAI'R MEIBION IMPROVEMENT) COMPULSORY PURCHASE ORDER 201-.

- 1.5.2 Copies of the Environmental Statement (ES), Statement to Inform an Appropriate Assessment (SIAA) and draft Orders may be inspected free of charge during all reasonable business hours during the objection period as set out in the Public Notice, at the following premises:

- Welsh Government Offices, Cathays Park, Cardiff, CF10 3NQ.
- Welsh Government Offices, Sarn Mynach, Llandudno Junction, Conwy, LL31 9RZ.
- Gwynedd Council, County Offices, Shirehall Street, Caernarfon, Gwynedd, LL55 1SH.

- Conwy County Borough Council, The Heath, Penmaenmawr Road, Llanfairfechan, Conwy, LL33 0PF.
- 1.5.3 Copies of the ES and SIAA can be purchased from Orders Branch, Transport, Welsh Government, Cathays Park, Cardiff, CF10 3NQ at a cost of:
- ES Volume 1 (Main Text): £50 (per copy);
 - ES Volume 1a (Figures): £75 (per copy);
 - ES Volume 2 (Technical Appendices): £50 (per copy of each part)
 - Statement to Inform an Appropriate Assessment (SIAA): £30 (per copy)
- 1.5.4 Electronic copies of the complete ES and SIAA can be purchased at a cost of £5. Copies of the ES Non-Technical Summary may be obtained from Orders Branch, Transport, Welsh Government, Cathays Park, Cardiff CF10 3NQ. An electronic copy of the ES Non-Technical Summary is published on-line at:
www.gov.wales/topics/transport/roads/schemes/a55/abergwyngregyn.
- 1.5.5 Any comments about the project and/or the Environmental Statement and/or the Statement to Inform an Appropriate Assessment, should be made in writing to the Welsh Government at the Cathays Park address given above and should arrive no later than the end of the period set out in the Public Notice.
- 1.5.6 The Welsh Ministers will take all written comments into consideration before deciding whether or not to proceed with the project with or without modifications.
- 1.5.7 Further information about the project, the Environmental Statement or the Statement to Inform an Appropriate Assessment, can be obtained from Orders Branch, Transport, Welsh Government, Cathays Park, Cardiff CF10 3NQ.

Chapter 2.0: The Scheme

This chapter explains the justification for the Scheme and describes its key elements. Relevant policies, plans and strategies are summarised and the construction and operational aspects are outlined.

2.1 Background to the Scheme

- 2.1.1 The Welsh Government has statutory powers and responsibility for the maintenance and improvement of the A55(T). The section of the A55(T) between Tai'r Meibion and Abergwyngregyn was one of the first to be improved to dual carriageway standards in the late 1960's and does not comply with current highway standards. The document 'Driving Wales Forward' (The Welsh Office, 1998) identified the A55(T) as part of the core network in Wales and recognised a lack of safe turning arrangements between Tal-y-Bont and Abergwyngregyn.
- 2.1.2 When the issue of re-construction of the highway pavement initially arose the work was to be undertaken under the Welsh Government's Major Maintenance Programme. However, as the scheme was being developed it was decided that a full upgrade was required to bring the section up to the same standards as the remainder of the A55(T). The scheme was listed as a repair and upgrade scheme in Annex 2 of the Welsh Government's Trunk Road Forward Programme in 2002 and moved to Phase 2 ("could be ready to start by April 2010") in the 2004 supplement (Welsh Assembly Government, 2004).
- 2.1.3 An Environmental Statement and draft Orders for the Scheme were published in July 2008, but under the 2008 Reprioritisation of the Trunk Road Forward Programme the scheme was moved to Phase 3 (*'unlikely to be ready to start before April 2014'*) and the draft Orders were withdrawn in 2009.
- 2.1.4 Since then, flooding events have led, with increasing frequency, to partial or total closure of this section of the A55(T), and the scheme objectives have therefore evolved to include flood risk reduction.
- 2.1.5 The Scheme has been identified within the Welsh Government's National Transport Finance Plan 2015³ (NTFP) to be implemented in the short term in order to address journey time reliability and improve network resilience. Therefore, the previously-published design has been reviewed against the current standards and objectives, and new draft Orders are to be published along with this Environmental Statement.
- 2.1.6 Following the publication of the 2008 draft Orders representations were received regarding aspects of the proposed design. The following changes/design features have therefore been included within the current scheme design to address some of these:
- The design of the agricultural access track for Wig farm has been amended to avoid severing land farmed by Tai'r Meibion and would result in an extension in length of the Roman Road (Henffordd) widening to approximately 860m.
 - A new footway is proposed between Tan-yr-Allt cottages and Llain y Ffwlbart to improve pedestrian access to the local bus service provision.
 - A drainage detention pond has been relocated from agricultural land to an adjacent plot formerly occupied by a residential property.

³ National Transport Finance Plan –Welsh Government, 2015

2.2 Justification in relation to relevant policies and plans and the project objectives

2.2.1 The A55(T) Chester to Bangor Trunk Road is an important strategic transport route in North Wales forming a link between the ferry port of Holyhead and the motorway system in Cheshire and Merseyside. It also serves numerous settlements along the North Wales Coast, providing a route for commercial, tourist and local traffic.

2.2.2 Under the United Nations Agreement of 1975 on international traffic arteries, the A55(T) forms part of the 5,320km Euroroute E22 between Holyhead, Wales and Ishim, Russia. The route is of international importance for commercial vehicles travelling through Continental Europe and the United Kingdom, and the continuing improvement of the highway network is hence vital for the ongoing economic development and social well-being of the area.

General Design and Construction

2.2.3 This section of the A55(T) is now around 45 years old and the vertical alignment does not comply with the present-day standards to which the adjacent sections have been built. The existing forward visibility distances are below current requirements and the central reserve gaps, private entrances, field accesses and junction with the county road to Wig Crossing Cottages are often used by slow-moving vehicles, which is a detriment to the free and safe flow of through traffic on the A55(T). The Scheme would aim to address these deficiencies.

Existing Road

2.2.4 The 2.2km length of existing A55(T) to be improved commences west of the property known as Tai'r Meibion farm (see Figure 2.1, Volume 1a). The existing alignment follows a south-westerly – north-easterly route and consists of dual two-lane 7.3m wide carriageways with grass verges, but no hard strips. The eastbound and westbound carriageways are segregated by a 4.5m wide grassed central reserve. The horizontal alignment is relatively straight whilst the vertical alignment undulates with sub-standard forward visibility in places. The channels on both carriageways are kerbed on both sides whilst the grass verges vary in width with an average of 2.5m.

2.2.5 A county road and various farm and domestic accesses all link directly onto the A55(T) dual carriageway. None of the accesses have merge/diverge tapers and most have restricted visibility. Eight gaps in the central reserve allow vehicles to drive through and change direction of travel. Most of these are located near field accesses and junctions with private means of access, allowing vehicles to make right turn movements across the path of oncoming vehicles. There are currently no restrictions in place to prohibit such traffic movements.

2.2.6 There are several cross-carriageway culverts of varying diameters along the scheme length. These culverts take the highway surface water drainage and adjacent watercourses under the A55(T) eventually discharging into the western end of Conwy Bay in the Menai Strait at Traeth Lafan.

Current and Predicted Traffic Flow

2.2.7 The two-way traffic flow for 2016 is an Annual Average Daily Traffic figure (AADT 24hr) of 30,622 vehicles. Predictions for the anticipated opening year of 2018 and the design year of 2033 (without the Scheme occurring) at central growth rates are shown in Table 2.2.1. No increase in traffic flow above that which would occur naturally is expected as a result of the Scheme.

Table 2.2.1: Existing and predicted two-way traffic flow figures (AADT 24hr)

Existing flows (2016)	Opening year (2018)	Design Year (2033)
	Central Growth	Central Growth
30,622	31,224	34,458

Notes:

- i. AADT figure for 2016 is based on manual junction counts located on the A55(T) at Junction 12 and Junction 13. The traffic flow figures provided are based on 12 hour and 24 hour surveys in August and October 2015 and January 2016.
- ii. 2018 was assumed as the year of opening of the Scheme at the time of calculation.
- iii. Traffic growth is based on National Road Traffic Forecasts (NRTF).

2.2.8 The Scheme is situated in a rural area with no viable alternative east–west local route. Roman (Henffordd) Road runs east–west to the south of the A55(T), but this is considered too narrow and unsuitable to accommodate large numbers of vehicles. Therefore, vehicles are not expected to transfer to the improved section from another route in the locality, nor are current A55(T) travellers expected to change their mode of transport as a result of the Scheme.

2.2.9 The Scheme is an 'on-line' improvement and does not therefore have any alternative 'route options' in the strict sense of this term. However, alternative means of meeting the objectives were considered and are outlined in Chapter 3.0.

Drainage

2.2.10 In July and November 2012 and December 2015, there was severe flooding on the A55(T) when culverts upstream became blocked and water flowed across the fields and onto the highway, causing partial and/or total closure of the A55(T). There are many other instances when one westbound lane has been closed due to flooding. Improvements are therefore required to alleviate this problem and ensure future resilience to flooding.

2.2.11 Culverts under the A55(T) also act as discharge points for the surface water drainage from the road and improvements are required to drain this water effectively.

Accidents

2.2.12 Accident statistics for this section of the A55(T) between 2010 and 2015 are summarised in Table 2.2.1. These are accidents involving personal injury that have been recorded by the North Wales Police. There are likely to have been further accidents, involving vehicle damage only, which are unrecorded.

Table 2.2.2: Personal Injury Statistics: 2010 – 2015 (Source: Integrated Roads Information System (IRIS), Welsh Government, 02/12/15)

Year	Fatal	Serious	Slight
2010	-	-	2
2011	-	-	1
2012	1	1	-
2013	-	-	2
2014	-	1	-
2015	-	1	-
<i>Total 2010-15</i>	<i>1</i>	<i>3</i>	<i>5</i>

2.2.13 Although the accident record in recent years has been below the national average, the scheme length is considered to have a high accident potential.

2.3 Description of the Scheme

Design Standards adopted for the Scheme

- 2.3.1 The Scheme has been designed in accordance with the Government's Design Manual for Roads and Bridges (DMRB). The DMRB is a comprehensive manual which incorporates current Standards and Advice Notes relating to Trunk Roads. The design speed of 120kph (75mph), which is the normal design speed for dual carriageways, would match that of the adjacent sections.

Design of the Scheme (see Figures 2.2 to 2.7, Volume 1a)

- 2.3.2 The Scheme involves on-line improvements to a relatively straight section of dual carriageway and as such there are no viable alternative horizontal alignments. The western extent of the improvement to the A55(T) itself commences opposite Tai'r Meibion farm and continues eastwards to terminate approximately 300m south-west of the Abergwyngregyn interchange eastbound slip road (Junction 13).
- 2.3.3 Advance works commenced within the scheme footprint in February 2017 to improve network resilience to flood risk. These are works which would have been carried out, subject to landowner agreement, irrespective of whether the Scheme proceeds and are explained in more detail in paragraph 2.5.5.
- 2.3.4 The length of the improvement is approximately 2.2km and consists of dual 7.3m wide two-lane carriageways with minimum 1.0m wide hard strips each side and a 2.5m wide verge beyond, giving at least 3.5m of relatively flat area beyond the edge of carriageway. A new concrete safety barrier is to be constructed within the central reserve. The central reserve would be 2.5m wide and hard-surfaced which combined with the 1.0m hardstrips on each side, gives an area totalling 4.5m in width.
- 2.3.5 The Scheme would involve improving the vertical alignment of the A55(T) to the required standard in order to achieve the required stopping sight distance (SSD). This would be achieved mainly through new construction but, where possible, re-surfacing would be carried out.
- 2.3.6 The proposed vertical alignment of each carriageway differs from the existing due to the need to comply with current design standards. Each carriageway would therefore have varying levels, in order to minimise the extent of works required and to keep within the level variation limit that can be accommodated by the proposed concrete barrier in the central reserve.
- 2.3.7 On the eastbound carriageway the points where the new carriageway level would differ most from the existing carriageway level are:
- approximately 0.5m above it in the vicinity of the Tai'r Meibion cattle underpass;
 - approximately 0.8m above it just west of Wig Farm;
 - slightly more than 1m above it just east of Wig Farm cattle underpass;
 - approximately 1m above it at Bryn Meddyg;
 - slightly less than 1m above it just west of The Old School.
- 2.3.8 On the westbound carriageway the greatest variations would be:
- approximately 0.6m above at the Tai'r Meibion cattle underpass;
 - approximately 0.7m above just west of Wig Farm;
 - approximately 0.8m above just east of Wig Farm cattle underpass;
 - approximately 0.6m above at Bryn Meddyg;
 - approximately 0.6m above just west of The Old School.

- 2.3.9 There are also some locations where the new carriageway level may be below the existing carriageway, but in general these are less than 0.5m differences. The changes to the carriageway level and addition of hardstrips would result in some modest variation of the existing earthworks slopes, generally involving no more than an extra 2m in width of the highway footprint. The construction of the drainage channel and bund to the south of the existing road would require additional land take, but not result in significant earthworks, with the bund being a maximum of 1m above existing ground level.
- 2.3.10 The central reserve gaps as well as almost all existing direct accesses onto the A55(T) over the scheme length would be stopped up, as would the county road junction to Wig Crossing Cottages, thus eliminating all vehicular accesses onto the eastbound carriageway. To accommodate this, a new county road and Private Means of Access would be constructed parallel to the eastbound carriageway, to provide safer access to the fields and properties located north of the A55(T).
- 2.3.11 The new county road (4.8m in width) would commence at the junction with Tal-y-Bont road (Junction 12) and continue for approximately 1.6km in an easterly direction parallel with the A55(T) eastbound carriageway and connect at a new junction with the existing county road to Wig Crossing Cottages. A new Private Means of Access (4.8m in width) would provide vehicular access from this point to Wig farm and from there a new NMU route would continue east to Junction 13. The NMU route would be incorporated within the new county road and PMA to provide an access link for non-motorised travellers along the whole of the northern side of the A55(T) between Junctions 12 and 13. Where it is separate from the county road/PMA, it would generally be 2.5m wide, but narrowing to around 2m at a pinch point alongside the buildings of Pentre Aber farm.
- 2.3.12 A new combined direct access for Y Glyn Farm and the Bryn Meddyg properties onto the westbound A55(T) is proposed, with a link road to the Bryn Meddyg properties; this would provide a safer alternative to the current situation by providing a more gradual exit lane and better visibility on entering the A55(T).
- 2.3.13 To the south of the A55(T), the unclassified Roman (Henffordd) Road would be widened over a length of approximately 860m from the access to Tai'r Meibion farm to approximately 180m west of the settlement of Crymlyn. Over this length a 4.8m carriageway width would be provided to enable access for agricultural vehicles. A new agricultural track would be provided to maintain access for Wig farmland between Roman Road (Henffordd) and the Wig underpass.
- 2.3.14 A new footway is proposed between Tan yr Allt cottages and Llain y Ffwlbart to improve pedestrian access to the local bus service. This would have a 2m width from Tan yr Allt to the existing A55(T) overbridge. From the overbridge to Llain y Ffwlbart the width would be 1.8m. The new footway would be approximately 870m in length.

Structures

- 2.3.15 The existing cattle underpasses at Tai'r Meibion farm and Wig farm (each measuring internally 2.7m wide x 2.4m high) would be retained and extended 12m to the north and 2m to the south and 6m to the north and 2m to the south respectively, and the waterproofing renewed. These structures provide a valuable passage underneath the A55(T) for livestock and small agricultural vehicles, as well as wildlife including bats. The cattle underpasses would also be available as new links in the public footpaths underneath the A55(T).
- 2.3.16 A new culvert is proposed for the Afon Wig measuring internally 3m wide x 1.6m high; this culvert would incorporate a 500mm wide mammal shelf on each side.

Verges and kerbs

- 2.3.17 The northern and southern A55(T) verges would be 2.5m wide and grassed. The southern verge width would vary to provide the required visibility splay at the new junction for Y Glyn Farm and the Bryn Meddyg properties.
- 2.3.18 On the A55(T) kerbs would only be provided at the new junction on the westbound carriageway and at the cattle underpasses. Both the new county road along the north side of the A55(T) and the widened Roman Road (Henffordd) would have kerbs on both sides to protect the grass verges from being damaged.

Drainage

- 2.3.19 The proposed drainage extends over a length of approximately 3.2km from the Tal-y-Bont interchange (Junction 12) to the stream adjacent to Pentre Aber Farm. Eight minor watercourses and two field drainage features are crossed, each being currently culverted/piped under the A55(T) (see Figures 2.1 and 5.10.1, Volume 1a).
- 2.3.20 There is a differentiation between the design of the highway drainage and the design of the culverts that carry watercourses under the highway. The highway drainage is for a 1 in 5 year storm event (plus 30% to allow for climate change), but the cross culverts are designed to cater for a 1 in 100 year storm event (plus 30% to allow for climate change), both in accordance with current DMRB guidance.
- 2.3.21 The proposed highway drainage consists of a filter drain in the northern verge, together with a system of surface water channels and filter drains in the southern verge. These would discharge into existing watercourses as at present either through new outfalls, through modifications to existing headwalls, or through direct connections into existing culverts restricted to a third of the value of current discharge using flow control devices.
- 2.3.22 Permeable conveyance systems like filter drains move runoff water slowly towards a receiving stream allowing storage, filtering and some loss of runoff water through evaporation and infiltration before the discharge point. Filter drains comprise a trench, filled with gravel, possibly wrapped in a geotextile membrane, into which runoff water is led, either directly from the drained surface or via a pipe system. The gravel in the filter drain provides some filtering of the runoff, trapping sediment, organic matter and oil residues that can be broken down by bacterial action through time. Runoff velocity is slowed, and storage of runoff is also provided. Infiltration of stored water through the membrane can also occur and some filter drains need not lead to a stream at all. Filter drains have been reported to be effective at the removal of total suspended solids (85%), total lead (83%), total zinc (81%) and oil (estimated around 70%), on an annual basis (CIRIA, 2000).
- 2.3.23 Proposed surface water channels along the highway boundary on the southern (westbound) side of the Scheme would collect runoff from the surrounding fields. A raised bund would be used to divert overland flow to the nearest watercourse, preventing it from flowing on to the highway. At Tai'r Meibion farm the existing land drains would connect into the proposed highway drains.
- 2.3.24 The surface water runoff from the new county road on the northern side of the Scheme would be collected by gullies along the kerb line, into a new carrier drain system discharging into the nearest watercourse; these are designed to a 1 in 1 year storm and tested to a 1 in 5 year storm event, as required by the DMRB. Discharge would be restricted to a third of the hard surface runoff. Runoff from the NMU route on the northern side of the Scheme would be discharged using over-the-edge drainage.

- 2.3.25 The surface water runoff from the proposed access track to the Bryn Meddyg properties would be directed, by gullies along the kerb line, into a new carrier drain system discharging into Stream 7 adjacent to the westbound carriageway. Runoff from the NMU route on the north side of the Scheme would be discharged using over-the-edge drainage.
- 2.3.26 Although the pollution risk is below the applicable threshold for requiring pollution control measures to be provided, pollution control points for accidental spillages would be installed at the outfalls of each watercourse, providing an opportunity for an enhancement measure as part of the scheme. Subject to agreement with NRW at detailed design, such pollution control measures would typically include a chamber and isolation valve that would cut off flows from the highway, and can be remotely triggered to close in a few seconds. It is expected that the unit would be stand-alone, with solar and battery power operation so that it would not be vulnerable to power outages. The device would effectively protect downstream areas from fuel chemicals or milk spillages.
- 2.3.27 Due to the network having to accommodate runoff from a large catchment area from the fields to the south oversized carrier pipes and a detention pond on the site of Wig Bach (Grid Reference: 264021, 372157) would be used. The pond would typically comprise an inlet structure, fore bay, vegetative treatment for pollution control, detention storage, lined wet area, and outlet control structure. Together with flow control devices on the outfalls these would accommodate a reduced discharge rate which would discharge in to the nearest watercourse adjacent to the eastbound carriageway. The pond would be equipped with skim plates and flow controls which would operate on the same principles as oil separators (subject to agreement with NRW at detailed design). Emergency shut-off valves and bypasses would be provided upstream of critical discharge locations to enable the pond to be isolated from receiving watercourses in the event of an accidental spillage.
- 2.3.28 The cattle underpasses would be drained in such a manner that does not discharge directly into watercourses *i.e.* filtered through/over adjacent ground.

Lighting, Signs and Roadside Features

- 2.3.29 There would be a small number of associated road signs for the new westbound junction and other minor items. A concrete safety barrier would be erected along the central reserve to prevent vehicles crossing onto the opposite carriageway. Steel safety barriers would be erected at selected locations in the verges on the approaches to the cattle underpasses, between the new county road and A55(T), and by other small structures such as culvert headwalls and traffic management communication cabinets. A Variable Message Sign (VMS) is proposed adjacent to the westbound carriageway opposite the site of Wig Bach. No new lighting is envisaged and there would be no gantries, camera posts, or other 'controlled highway' infrastructure installed. A single lighting column at the entrance to Bryn Meddyg would be replaced by a new unit to current specifications.

Statutory Undertakers

- 2.3.30 The Scheme would affect apparatus owned by BT, Power Systems (Electricity), Traffic Wales (Fibre Optic Cable), Dŵr Cymru (Water) and Wales and West Utilities (Gas). The exact extent of this work is subject to the results of ongoing consultation and site surveys by the relevant third parties. However, it is currently anticipated that the apparatus would be diverted within the scheme footprint during the construction phase as follows (this work would be managed by the main contractor):
- BT cables at the western end of the scheme would be diverted to run under the new county road, while at the eastern end the existing chambers would be modified.
 - Power Systems have overhead cables in the area. Any diversionary works would require relocation of poles.

- Traffic Wales ducts in the southern verge would be moved across slightly and still be in the southern verge.
- Welsh Water have a main running east from Tai'r Meibion to opposite the site of Wig Bach, along the existing southern highway boundary. A new main would be placed under the new county road/PMA as far as Wig farm.
- WWU have a high pressure gas main which would require a protective slab over it where it passes under Roman Road (Henffordd), and also where it crosses under the A55(T) and proposed NMU route east of the site of Wig Bach. A protective slab may also be required to be installed over it where the Wig access track crosses it.

2.4 Land use setting and land take

- 2.4.1 The Scheme is situated in a rural area mainly comprising improved agricultural grazing land with associated farms and buildings. There are also small areas of mixed woodland and a small number of private non-agricultural dwellings within the study area. The Snowdonia National Park is situated at least 25m to the south at its closest point.
- 2.4.2 The A55(T) is the only Trunk Road within the study area, but there is a single track unclassified county road, Roman (Henffordd) Road, linking the village of Abergwyngregyn to the various farms and properties along the southern side of the A55(T). This road is narrow and is not a satisfactory alternative to the A55(T). The Chester to Holyhead railway line is located parallel to and approximately 300m to the north of the A55(T).
- 2.4.3 The need to minimise land take and ensure continued use of affected land during and after the construction phase was a key consideration as part of the design process. The total land take required for the Scheme (including the existing carriageway and land required temporarily) is approximately 27 hectares in total area. Approximately 5.7ha of land additional to the existing carriageway boundary would be permanently taken by the scheme. The affected land is predominantly improved grassland for grazing. Approximately 9.1ha of land additional to the existing carriageway boundary would be temporarily taken during the construction period. See Chapters 5.4 (Nature Conservation) and 5.9 (Community and Private Assets) for further details on land take impacts due to the scheme.

2.5 Construction, Operation and Long Term Management

Buildability

- 2.5.1 Subject to the proposals satisfying the statutory approvals process, the commitments made within this ES and in response to any objections/representations would be incorporated into an Environmental Commitments Register (ECR), which would form part of the contract documents. A project team consisting of a principal contractor and designer would then be appointed to complete the detailed design and construction of the scheme. The detailed design stage would involve, for example, finalising the landscape and drainage proposals based on the principles established within this ES, obtaining statutory environmental permits/consents and ongoing liaison with the statutory environmental bodies. It is envisaged that part of the duties placed upon the appointed project team would be to establish and maintain a Construction Environmental Management Plan (CEMP) to manage and record the delivery of the commitments made within this ES and recorded in the ECR, and any subsequent commitments made during the detailed design phase (see Chapter 7.0 for further details).
- 2.5.2 The land required for construction of the scheme is to be acquired by compulsory purchase. The Compulsory Purchase Order, if made, will include all permanent and temporary land acquisition required for construction of the scheme. It is anticipated that

construction work would commence in the spring of 2018 and be completed by the winter/spring of 2019/20, taking 18 to 24 months to complete.

- 2.5.3 Any agricultural land and associated boundary features taken on a temporary basis during the construction period would be reinstated on completion. During the construction period local residents would suffer temporary adverse impacts from construction noise and vibration arising from excavation, earth-moving activities, compaction of materials and resurfacing works. Additionally, works for the extension of the cattle underpasses at Tai'r Meibion and Wig Farm would create noise and vibration. These impacts would be limited in duration and associated with the improvement of the A55(T) close to particular properties. Two lanes of traffic would be kept open in each direction for as much of the construction period as possible, commensurate with ensuring the safety of road users and the workforce, thereby reducing impacts upon the movements of road users during the construction period.
- 2.5.4 In accordance with the DMRB, Volume 11, the following properties within 100m of the Scheme have been assessed to ascertain whether their occupants would experience nuisance or disruption during the construction period (see Chapter 5.7: Noise and Vibration):
- Tai'r Meibion;
 - Wig Farm;
 - No's. 1 and 2 Bryn Meddyg, and;
 - The Old School.

Phasing of Works⁴

Advance works

- 2.5.5 Advance works commenced within the scheme footprint in February 2017 to improve network resilience to flood risk. These are works which would have been carried out, subject to landowner agreement, irrespective of whether the Scheme proceeds but have been included in the environmental impact assessment of the Scheme. The works include:
1. Excavating the drainage channel and associated bund along the south side of the A55(T), and linking the channel to existing watercourses.
 2. The site clearance necessary for that work.
 3. Providing new fencing between the east side of the Tai'r Meibion cattle creep and the eastern end of the scheme at the boundary with The Old School.
 4. Translocating/planting a new hedge along this same length.
 5. Construction of the diverge and merge tapers for the new access to Y Glyn Farm (but not construction of the link to Bryn Meddyg), associated drainage, kerbing and a strip of carriageway construction to link it with the existing carriageway.
 6. Installing a new 1200mm diameter pipe under the A55(T) for Stream 8.
 7. Installing a new 450mm diameter pipe across the field between the A55(T) and Roman Road just west of The Old School, tying in to the pipe for Stream 8. Land drains would also feed into this pipe.
 8. Lining Stream 8 downstream for approximately 200m as far as the existing culvert under the main access track to the farm's fields, and installing weirs at the discharge outfall to reduce erosion.

Phase 1 (estimated commencement: spring 2018, estimated duration: six months)

- 2.5.6 The initial phase of the main works would probably commence with the widening of Roman Road (Henffordd) and associated hedgerow translocation, but this would depend on

⁴ The phasing of works is based on the current understanding of how the works are most likely to be constructed. The final phasing of works will be subject to confirmation at the detailed design stage once a main contractor has been appointed.

seasonal constraints for the translocation. Alternative access would be created along the north of the A55(T) to Wig Farm and Wig Crossing Cottages via the new county road/PMA, the new access track for Wig farm would be constructed, most of the utilities diversions carried out and the cattle underpasses and drainage culverts/pipes extended to the north. During this phase the existing traffic arrangement would be maintained with 2 lanes of traffic in each direction. A temporary speed limit may be applied.

Phase 2 (estimated duration: three months)

- 2.5.7 Phase 2 involves the widening of the existing carriageway utilising the verges adjacent to lane 1 in both directions, and following the existing profile of the carriageway. Activities carried out during this phase would be work to extend existing cattle underpasses and culverts/pipes to the south and a proportion of the accommodation works to the residential/commercial properties affected, plus construction of part of the new culvert for Afon Wig. During this phase two narrow lanes of traffic would generally be maintained in each direction. A temporary speed limit would be applied.

Phase 3 (estimated duration: four months)

- 2.5.8 Phase 3 involves the construction of the middle section of the new road. Activities undertaken during this phase would be the construction of the concrete central reserve barrier, together with temporary and permanent drainage works and construction of the central section of the new Afon Wig culvert. During this phase two narrow lanes of traffic would generally be maintained in each direction, utilising the temporary widening undertaken during Phase 2. A temporary speed limit would be applied.

Phase 4 (estimated duration: three months)

- 2.5.9 Phase 4 involves the construction of the permanent lane 1 and verges for each carriageway. Activities undertaken during this stage would involve completion of the permanent works, together with the removal of any temporary works. During this phase two narrow lanes of traffic would generally be maintained in each direction. A temporary speed limit would be applied.

Phase 5 (estimated duration: two months)

- 2.5.10 Phase 5 involves completion of the remaining works such as installation of the VMS, and possibly the improvement of the lay-by west of Tai'r Meibion, although the contractor may choose to build the lay-by during Phase 1. During this phase two standard width lanes of traffic would generally be maintained in each direction, with a temporary speed limit for at least part of this period.

Movement of Land Owners and Local Residents

- 2.5.11 The works would be managed to ensure that access to all properties within the study area would be maintained throughout the contract period, though limited disturbance to movements would be expected due to traffic speed restrictions through the construction site. The two cattle underpasses would also be maintained for use for as much as possible of the construction period. Agricultural and other vehicles which are too large for the existing underpasses would have to use the A55(T) as at present.

Contractor's obligations

- 2.5.12 Construction impacts would be kept to a reasonable level by imposing conditions on the Contractor and their working methods via the Contract Documents. The control of working practices would be important in limiting the short-term impacts of the Scheme on the environment. Compliance with these controls would be managed through the development and implementation of the Contractor's Environmental Management System (EMS). The Contractor would also be required to register the project with the Considerate Constructor's

Scheme. In addition, the Scheme would be subject to a CEEQUAL whole project award (see Chapter 5.6: Materials for further details).

Contractor's compound

2.5.13 The construction of the Scheme would require land for the contractor to site their compound. The contractor would be responsible for deciding on the compound location and on completion of the work the land would be appropriately reinstated. In some instances the contractor may need to seek and gain planning permission.

2.5.14 All environmental interests would need to be considered, in consultation with the relevant Statutory Environmental Bodies, prior to confirming a compound site.

Stockpiles

2.5.15 Stockpiles would be kept clear of existing trees and watercourses. The location of stockpiles in relation to watercourses would take account of any possible pollution and flooding risk during periods of spate.

Fencing and reinstatement of storage areas

2.5.16 All temporary storage areas would be reinstated to their existing ground profiles and surface finishes and boundary treatments reinstated unless otherwise agreed with the landowner and the LPA.

Imported and Exported Materials (see Chapter 5.6: Materials)

2.5.17 Imported material is expected to include road construction aggregates together with reinforcement steel, concrete, cement, pipes and fencing materials. It is estimated that approximately 52,000m³ of additional material would be required by the work. Surplus unsuitable material would be transported by road vehicles to a licensed disposal site. All acceptable waste material would be disposed of at a suitable location away from the site.

2.6 Long-term Management and Maintenance

2.6.1 The construction contract defects period would generally be for one to three years and the landscape and ecology aftercare period would generally be for a three to five year period following the completion of the Scheme; this would be confirmed at the detailed design stage.

2.6.2 During the operation of the Scheme, all future maintenance would be carried out from within the proposed highway boundary or within easements obtained for regular highway maintenance requirements. Any requirements for easements outside those already being sought at present would need to be discussed with the relevant Statutory Environmental Bodies.

2.6.3 On completion of the work it is envisaged that standard highway operation and maintenance procedures would be carried out during the lifetime of the Scheme on a suitably regular basis, as required by the highway authority. The anticipated design life of the Scheme is 120 years for the structures and earthworks. Typical maintenance activities during this period are likely to include, but are not limited to:

- winter maintenance, such as de-icing/gritting;
- line painting and resurfacing;
- dealing with traffic accidents and repairs to damage;
- maintenance of the highway drainage network;
- management and maintenance of roadside grass areas and roadside vegetation trimming to comply with the environmental objectives, and;
- management of nature conservation (habitat and protected species) measures.

2.7 Legislation, Policies and Plans Overview

2.7.1 The following legislation, policies and plans are considered to be of most relevance to the context of the Scheme at a national, regional and local scale. Legislation, policies and plans specific to environmental aspects of the Scheme are discussed in the relevant environmental topic chapters of this ES (Chapters 5.1 to 5.10). Due to the relatively restricted and mainly online nature of the work involved, the Scheme largely facilitates the strategies and policies established in national, regional and local planning frameworks. Account has been taken of the environmentally sensitive nature of the area, and the standards of design and the proposed mitigation measures are in accordance with the policies for conserving these values. Mitigation measures have been proposed to take account of any potential impacts, with the aim being to improve this section of the A55(T) without compromising the environment.

Legislation

Environment (Wales) Act, 2016

2.7.2 This Act creates the legislation needed to plan and manage Wales' natural resources in a more sustainable and joined-up way. The overarching aims of the Act are to put in place legislation that will enable Wales' resources to be managed in a more proactive, sustainable and joined-up manner and to establish the legislative framework necessary to tackle climate change. The Act supports the Welsh Government's wider work to help secure Wales' long term well-being, so that it benefits from a prosperous economy, a healthy and resilient environment and vibrant, cohesive communities.

2.7.3 Part 2 of the Act addresses climate change and provides the Welsh Ministers with powers to put in place statutory emission reduction targets, including at least an 80% reduction in emissions by 2050 and carbon budgeting to support their delivery. This is vital within the context of the Welsh Government's existing UK and EU obligations and sets a clear pathway for decarbonisation; it also provides certainty and clarity for business and investment.

2.7.4 The Act provides public authorities with a re-shaped requirement to seek to maintain and enhance biodiversity. The impacts of the Scheme on biodiversity within the scheme's footprint have been identified and assessed as part of the EIA process and reported in this ES (see Chapter 5.4), along with mitigation measures to avoid or reduce such impacts (*e.g.* replanting hedgerows and trees) and enhancement measures to support biodiversity (*e.g.* improved access underneath the carriageway).

Historic Environment (Wales) Act, 2016

2.7.5 This Act makes important changes to the two main UK laws that provide the legislative framework for the protection and management of the historic environment: the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990. The Act:

- gives more effective protection to listed buildings and scheduled ancient monuments;
- improves the sustainable management of the historic environment; and,
- introduces greater transparency and accountability into decisions taken on the historic environment.

2.7.6 The majority of the Act's measures will require further secondary legislation or other preparations before they are brought into effect later in 2016 or 2017. The Act will also form the core of an integrated suite of legislation, policy, advice and guidance. Together, these will give Wales flexible and effective systems for the sustainable management of the Welsh historic environment, reflecting current conservation principles and practice.

- 2.7.7 The Scheme has the potential to adversely affect heritage features including listed buildings, archaeological remains and Landscapes of Outstanding Historical Importance. These have been considered and assessed as part of the EIA and reported in chapter 5.2 of this ES. Mitigation measures include appropriate recording of heritage features in advance of destruction and the use of sympathetic landscaping/building materials in relation to the setting of heritage features and historic landscapes.

The Well-being of Future Generations Act, 2015

- 2.7.8 This Act strengthens existing governance arrangements for improving the well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. The Act:

- identifies goals to improve the well-being of Wales;
- introduces national indicators, that will measure the difference being made to the well-being of Wales;
- establishes a Future Generations Commissioner for Wales to act as an advocate for future generations, and;
- puts local service boards and well-being plans on a statutory basis and simplifies requirements for integrated community planning.

- 2.7.9 The Act requires public bodies to act “*in accordance with the sustainable development principle*”, which means that the body must act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs. The Act defines sustainable development as “*the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the well-being goals*”. The following five ways of working are identified in the Act, which public bodies need to consider to demonstrate that they have applied the sustainable development principle:

- 1) Long Term: The importance of balancing short-term needs with the need to safeguard the ability to also meet long-term needs.
- 2) Prevention: How acting to prevent problems occurring or getting worse may help public bodies meet their objectives.
- 3) Integration: Considering how the public body’s well-being objectives may impact upon each of the well-being goals, on their other objectives, or on the objectives of other public bodies.
- 4) Collaboration: Acting in collaboration with any other person (or different parts of the body itself) that could help the body to meet its well-being objectives.
- 5) Involvement: The importance of involving people with an interest in achieving the well-being goals, and ensuring that those people reflect the diversity of the area which the body serves.

- 2.7.10 Seven ‘well-being’ goals are identified in the Act and provide a shared vision for public bodies in Wales to work towards. The Scheme’s objectives would contribute to achieving some of these goals and long-term sustainable development in Wales by:

- improving the standards of a strategically important highway to ensure that it provides efficient future connectivity between communities and economic hubs (goal: a Wales of cohesive communities);
- alleviating flooding issues to ensure ongoing transport connectivity and resilience to climate change (goal: a resilient Wales);
- improving pedestrian and cycling access connections to provide alternative, healthier forms of travel (goal: a healthier Wales);
- enhancing biodiversity and future connectivity for wildlife at the locality (goal: a resilient Wales), and;

- considering the aims of sustainable development within the design, construction and operation of the Scheme (goal: a globally responsible Wales).
- the Scheme would also contribute to supporting an economy which generates wealth and provides employment opportunities through making the transport network and associated international links, more reliable and safer (goal: a prosperous Wales).

A Sustainable Development Report (YGC, 2016) has been prepared as a separate document to this ES, and describes how the Scheme would contribute to achieving the wider long-term sustainable development goals in Wales in consideration of the Wellbeing of Future Generations (Wales) Act (2015).

Planning (Wales) Act, 2015

2.7.11 This Act sets out a series of legislative changes to deliver reform of the planning system in Wales to ensure that it is fair, resilient and enables development. The act addresses 5 key objectives:

- a modernised framework for the delivery of planning services – the act introduces powers to allow planning applications to be made directly to Welsh Ministers in limited circumstances;
- strengthening the plan led approach – the act introduces a legal basis for the preparation of a National Development Framework and Strategic Development Plans
- improved resilience – the act will allow the Welsh Ministers to direct local planning authorities to work together and for local planning authorities to be merged;
- frontloading and improving the development management system – the act will introduce a statutory pre application procedure for defined categories of planning application, and;
- enabling effective enforcement and appeals – the act enables changes to enforcement procedures to secure prompt, meaningful action against breaches of planning control and increase the transparency and efficiency of the appeal system.

The Act, particularly the Sustainable Development aspect, is of relevance to the Scheme due to its links with the Well-being of Future Generations Act and the Environment (Wales) Act.

Active Travel (Wales) Act 2013

Active Travel (Wales) Act 2013 – Design Guidance (Welsh Government, 2014)

2.7.12 This Act is intended to enable more people to walk and cycle and generally travel by non-motorised transport. The Act requires local authorities to continuously improve facilities and routes for pedestrians and cyclists and to prepare maps identifying current and potential future routes for their use. The Act also requires new road schemes (including road improvement schemes) to consider the needs of pedestrians and cyclists at the design stage and is therefore directly relevant to the Scheme. Opportunities have been identified to improve walking/cycling facilities as part of the Scheme and incorporated within the design. In addition, an NMU audit has been completed in accordance with DMRB guidance.

Plans and Policies

Taking Wales Forward 2016 – 2020 (Welsh Government, 2016)

2.7.13 Taking Wales Forward sets out the Welsh Government's programme to drive improvement in the Welsh economy and public services, delivering a Wales which is prosperous and secure, healthy and active, ambitious and learning, united and connected. The document outlines the Welsh Government's key priorities for delivering the improvements, which are to be delivered in line with the Welsh Government's Well-being Objectives. Improvements to the A55 are one of the Transport priorities included within the United and Connected aspect of the programme.

Planning Policy Wales (Edition 9) (Welsh Government, 2016)

- 2.7.14 The PPW documents provide guidance on a wide range of topics in the form of 21 Technical Advice Notes (TANs). While these documents chiefly apply to local planning authorities in preparing their local development plans, it is considered good practice to apply their principles to Welsh Government projects. Therefore, because the Scheme could result in varying degrees of impact upon the natural and built environment consideration has been given at the design stage to limit such impacts to a minimum. Chapter 5.0 of this ES identifies the impacts for each environmental topic and describes the proposed mitigation measures to avoid or reduce their magnitude. The relevant Technical Advice Notes (TANs) have been identified in the individual environmental assessment topic chapters of this ES.

National Transport Finance Plan (Welsh Government, 2015)

- 2.7.15 The NTFP sets out the Welsh Government's investment plans for the transport and services that it is responsible for and how it proposes to deliver the outcomes set out in the Wales Transport Strategy from 2015. The purpose of the NTFP is to:

- provide the timescale for financing the schemes undertaken by the Welsh Government;
- provide the timescale for delivering these schemes;
- detail the estimated expenditure required to deliver the schemes, and;
- identify the likely source of financing to allow delivery to take place.

According to list 1(a) contained in Annex B of the NTFP, the rationale for the Scheme is to 'address journey time reliability and improve resilience on a TEN-T Core Route'. The Scheme is referred to in the NTFP (Annex A: Delivery Schedule - scheme reference: R20) to be delivered between 2015 and 2020. An indicative timetable for the proposals is provided and suggests that the Orders could be published by January 2017 with the works starting in Autumn 2017 and being completed by Autumn 2019.

Active Travel Action Plan (Welsh Government, February 2016)

- 2.7.16 The Active Travel Action Plan complements the Active Travel (Wales) Act 2013 and sets out a vision for active travel and how it relates to wider aims. It describes how to:

- work with others to achieve changes required;
- embed active travel across different portfolios;
- monitor progress against these actions, and;
- monitor the rates of active travel across Wales.

The Scheme has considered the need to provide and increase opportunities for active travel and includes a new non-motorised user link between Junctions 12 and 13.

The Wales Infrastructure Investment Plan (Welsh Government, 2012)

The Wales Infrastructure Investment Plan Annual Report 2015 and Project Pipeline (Welsh Government, 2015)

- 2.7.17 The Wales Infrastructure Investment Plan (WIIP) provides the context for national government infrastructure investment, ensuring that it delivers maximum benefits to Wales and sets out the Welsh Government's strategic investment priorities, provides a detailed account of investment plans and sets out the key elements of a new approach to infrastructure investment.

- 2.7.18 The WIIP is designed to prioritise, scope and coordinate delivery of major infrastructure investments, whilst making a significant contribution to the long term economic, social and environmental well-being of people and communities in Wales.

- 2.7.19 The plan presents a set of strategic investment priorities which will support delivery of future infrastructure investment and guide the investment of approximately £15 billion over the next decade. Of specific relevance to the Scheme "Improving transport networks, in particular east-west links in North and South Wales" is one of the strategic investment

priorities identified in the plan. The Scheme would contribute to improving east-west transport links in North Wales and this is underlined by its inclusion within the National Transport Finance Plan.

One Wales: One Planet – the Sustainable Development Scheme of the Welsh Assembly Government (Welsh Assembly Government, May 2009)

2.7.20 The Government of Wales Act 2006 (Section 79) requires the Welsh Ministers to set out how they propose, in the exercise of their functions, to promote sustainable development. Therefore, this document sets out the Welsh Government's vision and commitments for achieving sustainable development within Wales, and within a UK, EU and International context, stating that: "*sustainable development (the process that leads to Wales becoming a sustainable nation) will be the central organising principle of the Welsh Assembly Government, and we will encourage and enable others to embrace sustainable development as their central organising principle.*"

2.7.21 The Scheme will contribute to sustainable development in North Wales by improving a section of a road link of strategic economic and social importance for future use, while also providing for non-motorised means of transport, such as walking and cycling. Environmental impacts have been considered at the design stage and have either been avoided or minimised accordingly.

One Wales: Connecting the Nation – The Wales Transport Strategy (Welsh Assembly Government, April 2008)

2.7.22 The Wales Transport Strategy is a key tool in developing an effective transport strategy for Wales. The document outlines how transport policy approach is more responsive in its delivery of the Welsh Government's wider policy agenda, and attempts to be flexible to reflect different regional circumstances.

2.7.23 Prepared in accordance with The Transport (Wales) Act 2006, the stated goal of the Wales Transport Strategy is to promote sustainable transport networks that safeguard the environment while strengthening Wales' economic and social life. The WTS identifies a series of high-level outcomes and sets out the steps to their delivery, including:

- achieving a more effective and efficient transport system;
- achieving greater use of the more sustainable and healthy forms of travel;
- minimising demands on the transport system, and;
- reducing the impact of transport on greenhouse gas emissions.

2.7.24 The WTS seeks to achieve various social, economic and environmental outcomes through sustainable transport development and replaces The Transport Framework for Wales (Welsh Assembly Government, 2001). The following five key areas have been identified as requiring substantial progress:

- 1) Reducing greenhouse gas emissions and other environmental impacts;
- 2) Integrating local transport;
- 3) Improving access between key settlements and sites;
- 4) Enhancing international connectivity, and;
- 5) Increasing safety and security.

2.7.25 Social outcomes of particular relevance to the Scheme include: "*improving the actual and perceived safety of travel*" and "*encouraging healthy lifestyles*" as well as improving access to key facilities and public services. The Strategy also seeks to reduce transport casualties. Improving people's perceptions of safety for using sustainable transport modes and ensuring the safety of all travellers are important aspects of the Strategy, which contributes to meeting the aims of the Road Safety Strategy for Wales (Welsh Assembly Government, January 2003). The Scheme would facilitate these social outcomes by improving the

standard of this section of A55(T) carriageway and providing safer, alternative provisions for sustainable modes of transport such as walking and cycling.

- 2.7.26 Economic outcomes of the Strategy, supported by the Scheme, include: *“Improving connectivity within Wales and internationally [and] improving the efficient, reliable and sustainable movement of people [and] freight.”* The Strategy identifies the North Wales East-West Corridor (Dublin/Holyhead/Chester) as being one of the most important for international connectivity. The Scheme would facilitate these economic outcomes by contributing to improving the standards and safety of the A55(T) east-west transport link.
- 2.7.27 Environmental outcomes relevant to the Scheme include improving the positive impact of transport on the local environment, heritage and biodiversity. The Strategy aims to reduce the environmental impacts of transport by *“taking action to reduce the effects of transport on noise, severance, air and water pollution and biodiversity.”* The Scheme would hinder the outcomes relating to local environment, heritage and biodiversity in the short term (during and immediately following construction) due to the initial habitat loss and habitat/species disturbance. However, by minimising adverse impacts and identifying opportunities to improve negative impacts currently associated with the operation of the carriageway, the proposed design and mitigation measures would help to facilitate and enhance these in the long term. The Scheme would also contribute to the Outcome *“adapting to climate change”* by improving this section of the highway network’s resilience to flooding.

Wales Spatial Plan – People, Places, Futures (Welsh Government, 2004 - updated 2008)

- 2.7.28 The broad 20 year vision and role, purpose and principles of the Wales Spatial Plan are:
- making sure that decisions are taken with regard to their impact beyond sectoral or administrative boundaries and that the core values of sustainable development govern everything the Welsh Government do;
 - setting the context for local and community planning;
 - influencing where the Welsh Government spend money through understanding the roles of and interactions between places, and;
 - providing a clear evidence base for the public, private and third (voluntary) sectors to develop policy and action.
- 2.7.29 The Wales Spatial Plan aims to deliver sustainable development through its area strategies in the context of the Welsh Government’s Sustainable Development Scheme. It identifies 6 sub-regions in Wales without defining hard boundaries, reflecting the different linkages involved in daily activities.
- 2.7.30 The Scheme is located within the North-west Wales - Eryri a Mon Spatial Plan Area Strategy. One of the agreed priorities for the Area includes maximising the opportunities of the A55 and E22 Trans-European Networks route as a key transportation corridor, particularly between the prosperous economies of Ireland, North East Wales and beyond. The strategy identifies that facilitating the free movement of goods, people and information is of crucial importance to the future development of the region. It also highlights that the primary corridor for external connectivity into and out of the region is based along the North Wales coast and this Area benefits from the good connectivity offered on road by the A55 Expressway (part of the Trans-European Transport Network), underlining the importance of the links with Ireland via Holyhead and Europe via the Trans-European Network.
- 2.7.31 The Scheme would contribute to the Wales Spatial Plan by ensuring that this section of the A55(T) provides for free and safe flow of traffic in the future, that is also resilient to the effects of climate change, such as flooding.

TAN 18 - Transport (Welsh Assembly Government, 2007)

2.7.32 This Technical Advice Note describes how to integrate land use and transport planning and explains how transport impacts should be assessed and mitigated. It is therefore of direct relevance to the Scheme and its design, particularly by providing advice on:

- design of development;
- walking and cycling;
- planning for transport infrastructure, and;
- assessing impacts and managing implementation.

North Wales Joint Local Transport Plan (Taith, 2015)

2.7.33 The LTPs link with the relevant sections of the former Regional Transport Plans (RTPs) and consider what has changed in the intervening period since the publication of the RTPs. For example, an increasing emphasis on the need to address issues related to economic growth has since been identified. The North Wales JLTP therefore draws on the Taith Regional Transport Plan (Taith, 2009).

2.7.34 The North Wales JLTP covers a detailed programme from 2015-2020 and a framework for schemes until 2030. The JLTP is a statutory document that will sit alongside the Local Development Plans and other policies and plans of each of the Local Authorities.

2.7.35 While the JLTP identifies issues and opportunities for all aspects of transport, interventions and schemes are limited to those that are within a local transport authority's remit and therefore do not include schemes relating to the rail or trunk road network *e.g.* the Scheme. Trunk road aspects are contained in the National Transport Finance Plan (Welsh Government, 2015) and the JLTP serves as a complementary document to the NTFP.

2.7.36 The JLTP outcomes form a summary of what the Local Authorities want to achieve over the next five years and to 2030, from which to develop the interventions and schemes to deliver the outcomes.

2.7.37 Of particular relevance to the Scheme, the North Wales JLTP identifies the A55(T) as being designated a European Priority Network. It also acknowledges that one of the North Wales Ministerial Task Force's Strategic High Level Transport Interventions is: "*Transport network resilience improvements – improvements to the rail and road networks to increase resilience, particularly to the A55 corridor*".

The North West and Mid Wales Integrated Transport Network Technical Appendix (AECOM, 2014)

2.7.38 This report provides the evidence base required to inform the development of the LTPs and the regional elements of the NTFP from 2015.

2.7.39 The study considers the current level of accessibility and economic activity alongside proposed developments in the region and also presents the issues facing the transport network and its users within the region. All modes of transport are considered, particularly active travel (*e.g.* cycling, walking) following the Active Travel (Wales) Act.

Gwynedd Unitary Development Plan, 2001 – 2016 (Gwynedd Council, 2009)

2.7.40 Until the adoption of the Anglesey and Gwynedd Joint Local Development Plan (JLDP) the Gwynedd Unitary Development Plan (UDP) is the currently-adopted Development Plan for the Gwynedd Local Planning Authority Area. While the Scheme is not subject to a formal planning application it constitutes a large highway improvement within the UDP area and must consider the principles of sustainable development at the local level. Relevant UDP policies have therefore been considered and are discussed in the relevant topic chapters of this ES (see Chapters 5.1 – 5.10).

2.7.41 The main objectives of the UDP are:

- Effective protection of the environment;
- Careful use of natural resources;
- Ensuring social progress which reflects the needs of all, and;
- Promote appropriate economic growth and growth in employment.

2.7.42 The UDP includes several Strategic Policies to guide sustainable development within the plan area. Those considered to be most relevant to the Scheme are as follows:

- *Taking a Precautionary Approach - Strategic Policy 1*
“Development proposals that would have an adverse or uncertain impact on the environment, the economy or cultural character (including the Welsh language) of the Plan area will be refused unless it can be conclusively shown by an appropriate impact assessment that this can be negated or mitigated in a manner acceptable to the Planning Authority”.
Potential adverse environmental impacts have been identified and assessed during the design of the Scheme and steps proposed to either avoid or minimise these.
- *The Natural Environment - Strategic Policy 2*
“The area's natural environment and its landscape character, and views in and out of the Snowdonia National Park and the Anglesey and Llŷn Areas of Outstanding Natural Beauty, will be safeguarded, maintained or improved by refusing development proposals that significantly harm them.”
Adverse impacts on landscape, biodiversity and communities have been identified and assessed during the design of the Scheme and steps proposed to either avoid or minimise these.
- *Built and Historic Environment - Strategic Policy 3*
“The area's built and historic environment will be protected from development that would significantly harm it and new developments in historic areas will be expected to conform to particularly high design standards which will maintain or improve their landscape character.”
Potential impacts on the area's built and historic environment have been identified and assessed at the design stage and then either avoided or minimised.
- *Design Standards -Strategic Policy 4*
“Development will be expected to be of a good design in order to ensure that it makes a positive contribution, wherever possible, to the landscape, built environment and sustainable development.”
The Scheme has been designed to a high standard taking into account the potential impacts on the receiving landscape and the need for development to be sustainable.
- *Developments which create risk – Strategic Policy 5*
“Developments that are inconsistent with the need to safeguard floodplains or minimising flood risk and developments that create a risk of unacceptable damage to health, property or the environment will be refused”.
The Scheme has been designed to a high standard to identify, assess and avoid or mitigate any adverse impacts associated with flooding, pollution and nuisance, and where possible improve on the current situation; for example, by improving the existing drainage system and increasing the amount of low noise road surfacing.
- *Transport - Strategic Policy 12*
“Transport schemes that form part of the strategic and integrated transport network identified in the Key Diagram, extend the choice of travel modes, facilitate access for local people and show clear benefits as regards network safety and efficiency, will be approved,

provided they do not lead to an unacceptable increase in the need to travel and that they do not significantly harm the environment or the amenities of local residents”.

The key aim of the Scheme is to improve the standards and safety of the existing highway for all users. No significant increase in traffic volume is expected as a result. Impacts on the environment have been identified and assessed during the design stage and have either been avoided or minimised.

Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 – deposit plan (Isle of Anglesey County Council and Gwynedd Council, 2015)

2.7.43 The JLDP aims to guide sustainable development over a 15 year period (2011 – 2026) within the Anglesey and Gwynedd Local Planning Authority areas and will eventually replace the UDP. The JLDP is currently at the Independent Examination stage and is anticipated to be formally adopted in July 2017. While the JLDP has not been formally adopted at the time of writing a deposit draft has been prepared and this has been considered as a material planning policy document within this ES.

2.7.44 Of particular relevance to this scheme, Strategic Policy PS8 (Proposals For Large Infrastructure Projects) states that *“In their role as authorities giving permission for associated development or as a consultees for applications to other bodies, within the context of national policy statements and national planning policy, the Councils will aim to ensure that development makes a positive contribution to achieving the vision and strategic objectives set out in the Plan. In doing so, consideration will be given to the nature, scale, range and possible impact of any development”.*

2.7.45 As with the Gwynedd UDP, it is important that the Scheme considers the sustainable development objectives contained within the JLDP. Those considered to be of most relevance are:

SO3: *“Improve and maintain safe, efficient, high quality, modern and integrated transport networks to employment, services and education/ training facilities particularly by foot, bicycle and public transport, thus reducing where possible the number of journeys in private cars”.*

The Scheme is expected to facilitate this by improving the highway standards at this location and taking the opportunity to provide improved cyclist/pedestrian provision between Abergwyngregyn and Tal-y-Bont

SO4: *“Maximise the opportunities of Holyhead as a major international gateway and the A55, E22 Trans European network route and the A5025, A487, A470 as key transportation corridors”.*

The specific reference to the A55(T) as an E22 Trans-European route and its strategic links with Holyhead supports the case for an essential improvement to this section of the A55(T).

SO16: *“Protect, enhance and manage the natural and heritage assets of the Plan area, including its natural resources, wildlife habitats, and its landscape character and historic environment”.*

The potential adverse environmental effects associated with the Scheme have been identified as part of the EIA process and either avoided via iterative design measures or minimised by proposed mitigation measures.

Eryri Local Development Plan (2007 – 2022) – adopted version, July 2011, Snowdonia National Park Authority

2.7.46 Although the Scheme does not fall within the boundary of the Snowdonia National Park, the boundary is approximately 25m to the south of the Scheme at its closest point near

Abergwyngregyn. Therefore, the current Planning Policy of the Snowdonia National Park Authority (SNPA) has been considered.

- 2.7.47 The Eryri LDP identifies the A55(T) as “*a key transportation corridor linking the economies of Ireland, North East Wales and the West Cheshire region*”. Improvements to the A55(T) are considered beneficial to facilitating the free flow of traffic around the northern boundary of the Snowdonia National Park.
- 2.7.48 Consideration has been given to protecting and enhancing the landscape, biodiversity and cultural heritage along the length of the Scheme and it is therefore not expected to hinder the aims of the Eryri LDP.

Chapter 3.0: Alternatives Considered

This chapter provides a summary of the alternatives that have been considered and the reasons for deciding on the chosen option.

Background to the Scheme

- 3.1.1 When the issue of re-construction of the highway pavement initially arose the work was to be undertaken under the Welsh Government's Major Maintenance Programme. However, as the scheme was being developed it was decided that a full upgrade was required to bring this section up to the same standards as the remainder of the A55(T).
- 3.1.2 The Scheme is an 'on-line' highway improvement and does not therefore have any alternative 'route options' in the strict sense of this term. However, prior to publication of the draft Orders in 2008 alternative access provision was considered for the affected properties. One option involved a Private Means of Access/Non-motorised User route along the south side of the existing A55(T), which started from the new westbound-only junction (y Glyn) and headed west up to the Wig cattle underpass.
- 3.1.3 A PMA/NMU route with an underpass was also proposed. This would have involved constructing the PMA/NMU route through Tai'r Meibion farmland, from Roman (Henffordd) Road south of Tai'r Meibion north-east towards Wig farm. The underpass would then have connected this feature with the proposed PMA/NMU route along the northern side of the carriageway from the Wig underpass eastwards to the Abergwyngregyn interchange. These options were rejected in favour of the increased safety benefits afforded by the Scheme.

Do Minimum option

- 3.1.4 If the Scheme were not carried out a 'Do Minimum' scenario would be necessary in order to ensure the continued safety of road users along this section of the A55(T); this would involve addressing relevant items when the situation arose.
- 3.1.5 The items requiring attention immediately or in the very near future include:
- Reconstruction of the existing road pavement, which has reached the end of its operational life;
 - Upgrading the existing drainage to reduce the risk of flooding of the carriageway;
 - Ongoing maintenance (re-tensioning) of the existing central reserve safety barriers in accordance with the Welsh Government Trunk Road Maintenance Manual (WGTRMM); and,
 - Improvements to the junction with the county road to Wig Crossing Cottages and the access to the Bryn Meddyg properties.
- 3.1.6 Many of these items would require individual traffic management with associated delays. If they were to be carried out individually there would be unnecessary duplication of the traffic management costs and associated delays.
- 3.1.7 The Do Minimum option would not deliver the list of overarching scheme objectives described in section 1.1.3. Implementation of the Do Minimum items would not address some matters of safety, including the closure of all the individual field and private accesses and directing them to one junction in each direction.
- 3.1.8 None of the Do Minimum items would provide a wider verge, to accord with present-day standards. To accomplish this would necessitate land acquisition, as would the provision of 1m wide hardstrips and a NMU/PMA.

Current Considerations

- 3.1.9 A number of flooding events in recent years have led to a new culvert being included in the proposals, to accommodate the Afon Wig, in place of the existing pipe culvert; this affords an opportunity to provide mammal shelves/ledges in the new culvert.

Structural Alternatives

- 3.1.10 In considering the extension of the two existing cattle underpasses, the scheme proposals were reviewed⁵ to determine whether retention of these structures was the best option, or whether a new structure or structures would provide a better solution in terms of whole life performance. The results of this desk-top review are summarised in the following text.

- 3.1.11 Apart from the through traffic on the trunk road, the key movements affected by the scheme are:

- residents of Wig Crossing Cottages, Wig Farm and Bryn Meddyg dwellings;
- agricultural operations at both Wig and Tai'r Meibion farms;
- public footpaths 9, 43, 42, 1 and 2, and;
- bats and other wildlife.

- 3.1.12 The principal options for provision of access to meet the required needs are:

- Option 1 – new county road along the northern side of the A55(T) as in the previously-published scheme;
- Option 2 – new bridge under the A55(T), or;
- Option 3 – new bridge over the A55(T).

- 3.1.13 Option 1 avoids the need for the agricultural operations at Tai'r Meibion and Wig farms to involve crossing the A55(T) at grade, but instead involves quite lengthy diversions for this traffic, via the existing Tal-y-Bont interchange. Option 2 or 3 avoid the need for at-grade crossing of the A55(T) and also avoid the lengthy diversions.

- 3.1.14 With Option 1, a direct NMU route would be created along the northern side of the A55(T) from the Tal-y-Bont interchange in the west to Abergwyngregyn in the east, linking with National Cycle Route 5 at each end.

- 3.1.15 Option 2 and 3 include the following three sub-options for NMU provision:

- Sub-option A – leave the provision largely as at present, with National Cycle Route 5 following the Roman Road (Henffordd) between Tal-y-Bont and Abergwyngregyn. Part of Roman Road (Henffordd) would be widened, as far as the point where the new county road would branch off to the north, but the rest of it would remain unchanged; this route is identified on Sustrans information relating to National Cycle Route 5 as being a very narrow lane on which cyclists need to take particular care to beware of oncoming traffic. The previously-published scheme included a new NMU route so this sub-option would be likely to give rise to objections from organisations such as Sustrans, and would arguably be contrary to the Active Travel (Wales) Act.
- Sub-option B – provide a new cycle path along the northern side of the A55(T) from the new county road at Wig, eastward to Abergwyngregyn. This would mean that National Cycle Route 5 would continue to use Roman Road (Henffordd) as far as the point where the new county road would branch off to the north, but would then follow the new county road over or under the A55(T), follow the new private access to Wig Farm, and finally run as a cycle path along the north side of the trunk road - this would avoid the existing narrow section identified on Sustrans information.

⁵ A55 Abergwyngregyn to Tai'r Meibion Improvement, Structures Options Report (YGC, 2016)

- Sub-option C – provide a new cycle path along the northern side of the A55(T) between Tal-y-Bont and Abergwyngregyn, as proposed with Option 1, but shared with vehicular traffic only over a short length near Wig Farm and possibly another length through Tai'r Meibion Farm.

- 3.1.16 A key development with regard to structures options on the scheme has been the results of the bat surveys, which confirmed that lesser horseshoe bats are flying through both cattle underpasses, as well as myotis species, pipistrelles, noctules and brown long-eared bats. The conservation status of these animals, and the difficulties experienced on other road schemes with provision of effective mitigation, suggest that removal of the existing underpasses would be problematical. Other wildlife relevant to consideration of options for structures includes badgers and otters. It is intended that the new Afon Wig culvert will include shelves/ledges to accommodate these and other animals, and provision will also be made by means of new dry pipes at other locations along the scheme length.
- 3.1.17 It was concluded that Option 2 (underbridge) not only had a higher capital cost than Option 3 (overbridge), but had ongoing operational costs. For this reason, it was recommended that Option 2 be discarded. Furthermore, because of recently discovered bat activity at the Tai'r Meibion cattle underpass, it was considered unlikely that this structure could be demolished/infilled, even if a new bridge were built over the A55(T) at the boundary between the Wig and Tai'r Meibion holdings.
- 3.1.18 Option 3 would probably have advantages over Option 1 in terms of a reduced impact on ecology (by virtue of avoiding a badger sett), trees/hedgerows and agriculture. It would also be less visually intrusive overall, but the effect on the Wig locality would be greater. For cyclists, the route under Option 3B would be longer than Option 1, but would still constitute a significant improvement over the existing situation.
- 3.1.19 The most significant factor weighing against Option 3 was however the extra £0.5 - 1.0m estimated cost over Option 1, with rather modest advantages in terms of environment and agriculture. Option 3 was therefore ruled out on grounds of capital cost and Option 1 confirmed as the preferred option.

Alternatives to widening of Roman Road (Henffordd)

- 3.1.20 The Scheme involves widening of the unclassified Roman Road (Henffordd) eastwards from Tai'r Meibion Farm, in order to enable it to cope with the increased use, particularly by large agricultural vehicles, that would result from the closure of the central reserve gaps and field accesses on the A55(T), and provision of alternative access to the fields to the south of the A55(T) that form part of the Wig Farm holding. This road has hedges on each side which are identified as having significant environmental importance.
- 3.1.21 When the statutory Orders for the scheme were published in 2008 it was identified that, due to the presence of the Capel Gilfach property close to the southern highway boundary, it would be necessary to widen on the north side past that property, and therefore it was probably best to widen on that side throughout the section to be widened. Following publication of the draft Orders objections were received from the tenants at Tai'r Meibion and Wig farms, and the owners of Tai'r Meibion Farm, regarding the proposal to provide part of the new access track to Wig land over part of the Tai'r Meibion holding, and a modification was therefore made.
- 3.1.22 As part of the process of updating environmental baseline information, bat surveys were commissioned, and the surveyor's report included the following:

“The latest transects recorded foraging activity for three species of bat along the road. It has been found that smaller prey species, particularly weak fliers are to be found on the leeward side of hedgerows in adverse conditions. It is considered that if the entire northern hedgerow is removed this will open up the road structure considerably and that the retained latent heat within the road structure will be lost more quickly. It is recommended that the top eastern section of the road which recorded most activity has the southern hedgerow removed. Even when the hedge has been removed the field embankment will protect the road to a degree reducing the impact.”

- 3.1.23 Therefore the options of widening part of Roman Road to the north or to the south have been compared. The design of the road widening, whether to north or south, is based on maintaining the existing road level wherever possible, in order to minimise the effect on whichever hedge boundary is to remain intact. This section of Roman Road runs along the lower slope of the foothills of the Carneddau, with the surrounding land falling from south to north. The existing hedge boundaries tend to form hedge banks and the land immediately to the north is sometimes a metre or so lower than the carriageway level, and in other locations is broadly at the same level as the carriageway. The land immediately to the south of the hedgerow, however, tends almost always to be around a metre higher than the existing carriageway.
- 3.1.24 Widening to the north would require an embankment along the eastern section of the widened Roman Road, extending in general around 2m from the field side of the translocated hedgerow. Due to the higher level of the land immediately to the south of the existing hedgerow, the option of widening to the south would require a cutting that extends on average around 4m from the field side of the translocated hedgerow.
- 3.1.25 Widening on the northern side would mean the loss of a mature category A oak, and it is highly likely that the works would result in the loss of another mature category A oak. Widening on the south would result in the loss of a mature category A oak and a semi-mature category B oak. On balance, therefore, widening to the south would be marginally preferable in terms of the effect on trees.
- 3.1.26 In terms of land take and the overall landscape impact, however, widening to the south has considerably greater impact. This impact could be reduced by constructing a retaining wall along the south side of the road, but this would have a significant capital cost and result in greater ongoing maintenance costs. It should also be noted that new means of access need to be constructed at the eastern end of the widened section, into fields both to the north and south of the existing road. Because of the level differences noted above, if the road is widened to the south then the construction of the access into the field to the south would require significant earthworks within the field, while this would not be the case if the road was widened on the northern side.
- 3.1.27 On balance therefore, it was considered that the broader environmental impact of widening on the south side out-weighs the impact of widening on the north side. The translocation of the hedgerow is also intended to maintain the barrier effect. Whilst the wider road corridor may result in a quicker loss of latent heat, such effects would be the same irrespective of which side the widening takes place. It is therefore proposed that the road be widened on the north side, and that the translocation is monitored in terms of establishing and maintaining the barrier effect. If the barrier effect were to be lost then temporary measures would need to be taken to maintain such an effect, until new planting becomes sufficiently established.

Environmental design alternatives

- 3.1.28 The following design measures to improve on the current situation for ecology and other environmental aspects at the site have also been considered during the design phase:
- Dry pipes for mammals (including otters and badgers) have been considered at various locations adjacent to existing watercourses. Some locations have had to be ruled out due to topographical constraints (the ground being higher on the southern side of the A55(T) than the northern side). However, dry pipes are considered to be feasible at two of the watercourses affected by the scheme (numbers 2 and 6, in the vicinity of westbound Junction 12 and at the site of Wig Bach respectively).
 - Enhancements to the new verges: A request from NMWTRA to consider enhancing the new verges for wildflowers instead of grassland has been incorporated within the design of the scheme.
 - Detention pond location: The previous scheme included such a pond on farmland adjacent to the Wig Bach property. Since the Wig Bach property was demolished in 2011 it is proposed to locate the pond on that site in order to reduce agricultural land take and provide better connectivity with Stream 6.
 - In order to minimise the loss of mature trees with bat roosting potential along the proposed route of the new PMA between Roman Road (Henffordd) and the A55(T), the route has been aligned to utilise the location of the existing fording point where it crosses the Afon Wig (Stream 5) and mature trees would be retained where possible throughout the corridor of the Scheme.
- 3.1.29 Hydraulic modelling has confirmed that there would be an increase in flood risk to the Wig Crossing Cottages during a 1 in 1000yr event (due to increased flow being conveyed along the Afon Wig to the downstream railway culvert); the full results can be found in the Flood Consequence Assessment (see Technical Report D, Volume 2) and are summarised in Chapter 5.10 of this ES.
- 3.1.30 Mitigation of this increased flood risk would include a wall/bund (up to 1m high) along the Wig Crossing Cottages' eastern and southern boundaries and increased outfall points surrounding the properties; with the detailed design aspects to be agreed with the property owners and NRW. The final location and height of the wall would also be determined at the detailed design stage and with agreement from NRW. The following principles would be adopted for the detailed design and construction of this feature in order to reduce its environmental impact, particularly to landscape and ecological receptors:
- 1) Consideration would be given to the nature of the wall, and whether soft construction could be used (*i.e.* cloddiau or earth bank) to reduce the visual intrusion of a 'hard finished' wall (*e.g.* a clawdd, with a concrete flood-proof core, surrounded by earth and faced with masonry with a hedge on top so that a vegetative screen is created within a few years of construction);
 - 2) The flood wall would avoid removal of existing boundary vegetation, particularly to the southern and eastern boundaries where hedges and trees interrupt/filter views of the wider countryside. The detailed design would consider how the wall is constructed, avoiding disturbance to the tree root protection area where possible by adopting non-invasive construction techniques. Hand digging techniques would be employed where excavation is required within the tree root protection area and roots pruned to reduce impacts;
 - 3) Any works associated with the boundary treatments, and in particular the eastern boundary would seek to prune vegetation back to facilitate construction and retain existing root balls in-situ to give retained vegetation an opportunity to recover, and;
 - 4) Proposals would include the planting of a hedge along the eastern boundary, using feathered nursery stock and pruned back to the height of the wall following planting in order to restore a boundary feature.

Chapter 4.0: Environmental Impact Assessment Methods

This chapter summarises the review and scoping that was completed to determine the assessment methods and topics to be included within the Environmental Impact Assessment. The types of surveys and predictive techniques used to inform the ES and the generic significance criteria are also explained. Note that topic-specific survey and assessment methods are described in further detail in each relevant topic chapter where applicable (see Chapter 5.0).

4.1 Scoping

4.1.1 An Environmental Statement for the Scheme was previously published along with draft Orders in July 2008 and the design and location of the Scheme have not changed significantly since then. Therefore, the initial scoping phase involved a review (gap analysis) of the previous ES and supporting information to verify whether it still satisfied the current requirements and accurately addressed the latest proposed design.

4.1.2 The DMRB, Volume 11 and Interim Advice Note 125/09(W) were initially consulted to identify the environmental topics that should be considered for the current scheme and the most suitable methods to use in assessing and reporting the information obtained. In accordance with this guidance the following general changes since 2008 were identified:

- The individual chapters that previously covered 'Effects of Road Schemes on Policies and Plans' and 'Disruption due to Construction' are omitted as these topics are now absorbed within the other specific topic chapters, where relevant.
- A new topic of 'Materials' has been introduced (see Chapter 5.6).
- A new chapter called 'Effects on All Travellers' incorporates the previous 'Vehicle Travellers' and 'Pedestrians, Cyclists and Equestrians' topics (see Chapter 5.8).
- A new chapter called 'Community and Private Assets' incorporates the previous 'Community Effects' and 'Land Use' topics (see Chapter 5.9).

4.1.3 From the scoping exercise it was determined how much further work was required to update information about each topic's baseline condition and to update previous data that were no longer representative of current conditions *e.g.* traffic flow data and ecological features. Table 4.1 summarises the key updates that were identified for the current project compared with the 2008 project following the initial scoping review of current individual topic guidance.

4.1.4 A review of the baseline conditions within the study area was also completed to determine any material changes since 2008 that would need to be considered for the updated assessments. The following changes have occurred since the 2008 ES was published and have therefore been considered within the current EIA:

- Demolition of Wig Bach: Following the Welsh Government's acquisition of this property it was demolished in 2011 following the completion of a bat and breeding bird survey, asbestos survey and archaeological report. The bat survey report⁶ concluded that the property was not used by roosting bats but that the foraging habitat should be considered within any future highway improvement scheme and that additional surveys should be completed to ascertain the effect of increasing the paved width on Noctule bats.

4.1.5 The results of the scoping exercise, including the methods and scope of further assessment, are summarised in the Scoping Report⁷. The Scoping Report was completed with regard to the guidance provided by the Design Manual for Roads and Bridges (DMRB), Volume 11,

⁶ Wig Bach, Abergwyngregyn, Gwynedd Bat Survey, Green Man Ecology, April 2011.

⁷ A55(T) Abergwyngregyn – Tai'r Meibion Improvement, EIA Scoping report, YGC 2016

Section 2, Part 4, HA204/08: Scoping of Environmental Impact Assessments and Part 6, HD48/08: Reporting of Environmental Impact Assessments (Highways Agency, 2008).

4.1.6 The main potential environmental effects that have been identified in relation to the scheme are:

- **Air Quality:** Short-term impacts from dust and PM10 emissions during the construction phase. Potential long-term impacts from changes to traffic flows.
- **Cultural Heritage:** Medieval, Roman and Iron Age archaeological features are likely to be destroyed. Potential adverse impacts on the setting of listed buildings and two Landscapes of Outstanding Historical Importance.
- **Landscape:** Loss of existing landscape features (*e.g.* hedgerows and mature trees). Visual impacts to local sensitive receptors due to changes to the existing road corridor and local access roads.
- **Ecology:** Permanent habitat loss and temporary disturbance for protected species such as badgers, otters, bats, reptiles and nesting birds until replacement habitats re-establish. Potential accidental water pollution and site drainage runoff affecting the Y Fenai a Bae Conwy SAC and Traeth Lafan SPA/SSSI/LNR. Approximately 600m² of habitat is anticipated to be lost from Railway Line Wood 2 Local Wildlife Site.
- **Geology and Soils:** Permanent adverse impacts to local soil characteristics if any soil disturbed is not stored and reinstated appropriately. The soil within all areas of land required temporarily could suffer from compaction and disturbance. The apparent lack of any current contamination means that any contamination would have a major adverse impact on the area affected.
- **Materials:** Extraction and transport of primary raw materials, the manufacture of products and their subsequent transport to and use on site. Construction waste generated from surplus materials.
- **Noise and Vibration:** Varying temporary adverse impacts from construction noise and vibration and increased level of road surface affecting a small number of residential receptors. Low-noise surfacing could reduce noise levels.
- **All Travellers:** Four PRoWs would be closed where they currently meet the A55(T) and require diversions. NMU access would be improved via a new access link between Junctions 12 and 13. Traffic disruption during the construction period would require effective construction sequencing to minimize this. Long-term benefits are envisaged for vehicle travellers due to the improved highway.
- **Land Use:** Permanent and temporary loss of mainly agricultural land; at least 5.7ha of agricultural land is anticipated to be permanently lost, around half of which is Grade 3a quality.
- **Road Drainage and the Water Environment:** Several watercourses that flow underneath the carriageway are at risk of pollution during the construction period. The incorporation of the revised drainage system for the Scheme creates very effective preferential pathways for the transport of pollutants to watercourses. Furthermore, the relatively low flow of the streams makes them more vulnerable to pollution as they have little volume to dilute harmful substances.

Table 4.1: Summary of scoping review of 2008 topic assessments and updates for current ES		
ES Assessment Topic	ES Chapter	Summary of changes made for the current ES following scoping review of the 2008 ES, current guidance and scheme design
Air Quality	5.1	The 2008 published ES included traffic flow data based on a 2007 base year, 2010 opening year and 2025 design year. This is now outdated and was therefore revised using updated assessment years and traffic data to ensure that the assessment is valid for the current ES. HA205/07 ⁸ was used for the 2008 ES and is still valid for the current ES. However, Interim Advice Note 170/12v3 ⁹ has been published since 2008. While this currently applies to England only it has been considered within the current Air Quality assessment as good practice.
Cultural Heritage	5.2	The 2008 published ES included the most recent guidance (HA208/07 ¹⁰) and it was considered unlikely that there have been any significant changes to the archaeological baseline since publishing the ES in 2008. Nevertheless, a review was completed (including the ASIDOHL) to ensure that the assessment was still valid against the current proposed design.
Landscape	5.3	The DMRB guidance ¹¹ has not been updated since the 2008 ES was published. However, IAN 135/10(W) ¹² has since been published and a later version of the GLVIA is available (GLVIA3 ¹³). Therefore, the current Landscape assessment has been revised to include the requirements of the updated guidance.
Nature Conservation	5.4	The DMRB guidance ¹⁴ has not been updated since the 2008 ES was published. However, the Guidelines for Ecological Impact Assessment in the United Kingdom ¹⁵ , HA205/08 ¹⁶ and IAN130/10 ¹⁷ have since introduced updated provisions and have therefore also been used to inform the current ES. Since publishing the 2008 ES the ecological survey data were at least six years old and considered to be outdated. These were reviewed in consultation with NRW, NMWTRA and the LPA to determine the scope of the surveys to be completed.
Geology and Soils	5.5	The DMRB guidance ¹⁸ has not been updated since the 2008 ES was published and it was considered unlikely that there have been any significant changes to the geological baseline since 2008. Nevertheless, a review was completed to ensure that the assessment was still valid against the current design.

⁸ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1: HA207/07 'Air Quality', Highways Agency, May 2007.

⁹ Interim Advice Note 170/12 v3, 'Updated air quality advice on the assessment of future NOx and NO2 projections for users of DMRB Volume 11, Section 3, Part 1: Air Quality', Highways Agency, November 2013.

¹⁰ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 2: HA208/07 'Cultural Heritage', Highways Agency, August 2007.

¹¹ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 5: 'Landscape Effects', Highways Agency, June 1993.

¹² Interim Advice Note 135/10 (W), Landscape and Visual Effects Assessment (Wales Only), Welsh Government, April 2014.

¹³ Guidelines for Landscape and Visual Impact Assessment, 3rd edition, Landscape Institute, April 2013.

¹⁴ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 4: 'Ecology & nature Conservation', Highways Agency, June 1993.

¹⁵ Guidelines for Ecological Impact Assessment in the United Kingdom, Institute of Ecology and Environmental Management, 2006.

¹⁶ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5 (HA 205/08): 'Assessment and Management of Environmental Effects' (Highways Agency, August 2008).

¹⁷ Interim Advice Note 130/10, Ecology and Nature Conservation: Criteria for Impact Assessment, Highways Agency, September 2010.

¹⁸ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 11: 'Geology and Soils', Highways Agency, June 1993.

Materials	5.6	IAN 125/09(W) ¹⁹ requires an assessment of Materials use and an accompanying chapter to be included within the ES. A Materials assessment has therefore been completed following the requirements of IAN153/11 ²⁰ and presented in Chapter 5.6 of this ES.
Noise and Vibration	5.7	The 2008 published ES was based on DMRB guidance from 1994 that was superseded in February 2011 ²¹ . Therefore, the current assessment has been revised to follow the 2011 guidance. Additionally, the 2008 published ES was based on noise assessments from 2003. Traffic flows for a 2006 base year, 2010 opening year and 2025 design year were also used. These are now outdated and were therefore revised using updated assessment years and traffic data to ensure that the assessment is valid for the current ES.
Effects on All Travellers	5.8	IAN125/09(W) ²² requires Vehicle Travellers and Pedestrians, Cyclists and Equestrians to be considered together within the new Effects on All Travellers chapter. Therefore, the assessment was reviewed to consider any changes since publishing the 2008 ES and revised to ensure that it complies with current DMRB guidance.
Community and Private Assets	5.9	IAN125/09(W) ²³ requires Land Use to be considered with Community Effects in the new Community and Private Assets chapter. Therefore, the assessment was reviewed to consider any changes since publishing the 2008 ES and revised to ensure that it complies with current DMRB guidance. As much of the land affected is agricultural and farming practices could have changed since the publication of the 2008 ES a baseline agricultural land use review has been completed.
Road Drainage and the Water Environment	5.10	The 2008 published ES was based on DMRB guidance (2006) that was superseded in November 2009 ²⁴ . Therefore, the current assessment and ES chapter have been updated to ensure that they follow the most recent guidance.

¹⁹ Interim Advice Note 125/09(W), Supplementary guidance for users of DMRB, Volume 11 'Environmental Assessment' (Wales only), Welsh Government, July 2010.

²⁰ Interim Advice Note 153/11, Guidance on the Environmental Assessment of Material Resources, Highways Agency, October 2011.

²¹ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7: HD 213/11 – revision 1, Noise and Vibration, Highways Agency, November 2011.

²² *Ibid.* 19.

²³ *Ibid.* 19.

²⁴ The Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10: HD45/09 'Road Drainage and the Water Environment', Highways Agency, November 2009.

Consultation

- 4.1.7 Consultation was initiated with statutory environmental bodies and other key stakeholders to help inform the scoping process. This aimed to determine matters for further investigation and identify key issues to be addressed. The consultation process involved inviting comment on the Scheme from relevant interested parties and obtaining background information relevant to the area of the Scheme.
- 4.1.8 The following Statutory Environmental Bodies (SEBs) and stakeholders were invited to provide information and comments at the initial screening and scoping stage:
- Cadw (Welsh Historic Monuments),
 - Gwynedd Archaeological Planning Service (GAPS),
 - Gwynedd Council (Planning and Environment Service),
 - Natural Resources Wales (NRW),
 - North and Mid Wales Trunk Road Authority (NMWTRA), and;
 - Snowdonia National Park Authority (SNPA).
- Gwynedd Council, NRW and NMWTRA were also invited to provide comment on the scope of the proposed ecological surveys, including the features included, methods adopted and guidance used. Table 4.2 summarises the key issues raised by the SEB's and stakeholders that responded.
- 4.1.9 The comments and information received were considered within the scoping process and contributed to the assessment and design of the Scheme, particularly regarding the Cultural Heritage, Landscape, Nature Conservation and Road Drainage and Water Environment assessments.
- 4.1.10 A draft version of this ES and associated supporting documents were submitted to the stakeholders listed above to ensure that any comments received could be considered before the documents were finalised and published with the draft Orders. An Environmental Liaison Group meeting was also arranged at the same time to ensure that comments and concerns were identified and addressed. Comments were received regarding cultural heritage, landscape, ecology and road drainage and are summarised in Table 4.3.
- 4.1.11 Subject to statutory approval of the draft Orders and associated documents, further consultation and liaison with the Statutory Environmental Bodies would be required during the detailed design stage, particularly with regard to the locations of site compounds and any works that may require a licence or consent *e.g.* working in or near to watercourses and works that may affect protected species.

Table 4.2: Summary of responses received from SEB's/Stakeholders at the scoping stage

SEB/Stakeholder	Summary of key issues raised
Cadw (Welsh Historic Monuments)	<ul style="list-style-type: none"> Recommended that, as part of the review process, the potential impact on nationally important historic assets (scheduled monuments and listed buildings) and registered landscapes, parks and gardens of special historic interest is carefully considered. Advised that Gwynedd Archaeological Planning Service should be consulted on the wider archaeological implications of the proposed scheme.
Gwynedd Archaeological Planning Service (GAPS)	<ul style="list-style-type: none"> Explained that the archaeological assessments undertaken in 2008 will need updating with reference to the current scheme, current site conditions and any new information that has emerged in the interim. Anticipated some further work being necessary, as localised investigation and/or more extensive mitigation.
Gwynedd Council (Planning and Environment Service)	<ul style="list-style-type: none"> No comments from Planning Control. Biodiversity Unit were concerned that a significant number of trees could be affected, so requested a tree survey to inform the impact assessment on this feature.
NRW	<ul style="list-style-type: none"> Mitigation ensuring no adverse impact to protected species to be built into the scheme and to be shaped by the planned ecology surveys. Satisfied with the scope of the surveys proposed. However, Otters are expected to use the site and appropriate mitigation / fencing to be incorporated into the scheme. Requirement for 3 nights of 'static loggers' at the cattle underpasses rather than 2, to ensure consistency with the recommendations within the 'Bat Surveys Good Practice Guidelines'. The stream crossing at SH63438 71928 (Afon Wig) is likely to have salmonid and eel presence. Any permanent or temporary diversion / de-watering proposals to be discussed with the local NRW Natural Resources Team (North Gwynedd & Anglesey) and a fish rescue would be required before any works affecting the stream. It is also very likely that otters use that watercourse. Pollution Prevention Guidelines should be followed at all times when construction phase begins. For any new culverting proposals it was recommended that a survey is carried out on the watercourses to determine the correct hydraulic gradient for the watercourses. There is only one main river which is likely to be affected, at NGR SH 63428 71951. A Flood Defence Consent (FDC) would be required for this crossing from NRW under the terms of s.109 of the Water Resources Act 1991. All other culverting works on other watercourses would require Ordinary Watercourse Consent from Gwynedd Council's Floods and Coastal Risk Management Unit under s.23 of the Land Drainage Act 1991. Surface water drainage arrangements should use sustainable drainage (SUDS) principles and outfalls into watercourses should follow existing drainage catchments along this section of the A55(T). Ideally greenfield run-off rates should be maintained for a range of rainfall events.
SNPA	<ul style="list-style-type: none"> Although the proposals are outside the SNP boundary, the SNPA will appreciate the opportunity to comment on the Environmental Statement, updated and detailed plans, and improvements to the Roman Road (Henffordd).

Table 4.3: Summary of responses received from SEB's/Stakeholders on the draft ES

SEB/Stakeholder	Summary of key issues raised
Cadw (Welsh Historic Monuments)	<ul style="list-style-type: none"> The study area of 300m was considered to be too restricted. It was therefore recommended that an appraisal was carried out to identify if the Scheme would have an impact on the setting of any scheduled monuments (and/or listed buildings) and registered historic parks and gardens within 2km.
Gwynedd Archaeological Planning Service (GAPS)	<ul style="list-style-type: none"> Satisfied with the Cultural Heritage assessments.
Gwynedd Council (Planning and Environment Service)	<ul style="list-style-type: none"> Satisfied that comments regarding the Roman Road hedge translocation, loss of mature trees and provision for passage of mammals through the central reserve had been addressed within the ES. Hedgerows should be considered as 'medium' value.
NMWTRA (Ecologist)	<ul style="list-style-type: none"> Provided further advice about the provision of safe crossing points in the central reserve <i>e.g.</i> where possible the 200mm central reserve holes should be located so they are in line with any crossing landscape features such as transverse hedges or ditches where it hasn't been possible to provide other wildlife crossing provisions. Concerned that the provision of safe crossing points and wildlife fencing along the scheme length were still inadequate, particularly on Streams 1, 3, 7 and 8. Therefore, difficult to conclude the neutral significance of impacts on badgers and otters due to the increased risk of them becoming trapped on the carriageway. Provided advice on the need to remove the Daffodils from the central reserve and cultivate the new verges for successful wildflower, tree and hedgerow establishment. Reiterated the need to carefully consider amphibian egress from drainage provisions on A55 and county road as part of the detailed design. Are the s42 NERC Act species lists now known as s7 Environment Act species? If so, perhaps text that refers to these needs amending. Or do we still refer to them as s42 until s7 lists officially published? Disagreed with some of the values assigned to ecological receptors in Table 5.4.5. Explained that hedgerow translocation would be favoured over new hedgerow planting. It is not clear how many of the 14 mature trees identified as having >1m dbh (potential veteran trees) would be lost or "directly affected". Are there also other tree species (such as hawthorn) that show veteran tree characteristics but are unlikely to be >1m dbh? Enquired about mitigation/compensation/enhancement that could be implemented for veteran trees (<i>e.g.</i> management of other trees in area, translocation/retention of stumps) and explained that saplings are preferred over standards as replacements for mature trees. Asked whether there would be any proposals to manage Rhododendron and that measures to enhance existing woodland should be included. Concerned that it was unclear from the text/plans about the locations of where the affected watercourses originate from and drain to on either side of the highway. Requested that standard mammal-resistant fencing (with a crank) is used, rather than the crank-less version that had been proposed. It would be useful to know the existing levels of pollutants such as heavy metals and hydrocarbons from combined drainage systems and how these discharge into the protected sites. Asked whether consideration had been given to installing vortex separator gullies in key locations, rather than specific pollution interceptors and their consequential maintenance issues.

	<ul style="list-style-type: none"> • Assurance needed that there are no hydrological changes likely to the fields to the north and changes to existing drainage patterns.
<p>NRW</p>	<ul style="list-style-type: none"> • The ES should refer to and describe measures to comply with The Eels (England and Wales) Regulations 2009, including Regulation 12. • Would like to see further mitigation investigated due to the expected level of lost connectivity across the carriageway. • The ES should acknowledge risk to various species including Section 7/Section 42 species and the need to look at mitigation options. 125mm holes in the barrier would be expected to be of value to some species but not of significant benefit to otter. • On the Afon Wig at least, provision for passage should be made on both banks through the culvert, as animals are unlikely to cross the river to access a ledge on the opposing bank during spate conditions. • Robust mechanisms are required to ensure mitigation measures for pollution prevention (risks to Traeth Lafan SPA/ Menai Strait and Conwy Bay SAC) are fully implemented by the appointed contractors. • No reference is sited in respect of consideration of Current Conservation Status (CCS) and Favourable Conservation Status (FCS). • Limited consideration appears to have been given to Article 4 (4) of the Birds Directive. This refers to habitats of Annex 1 bird species within and outside statutory sites. • Considered it incorrect to scale AONB landscapes with those of Regional and Locally recognised areas. • Recommended the inclusion of scattered standard tree planting within the native hedgerow mix (LE4) that lines the A55 and new county road, and in locations where the removal of existing trees would result in a very open landscape. • As well as PPW Edition 8 (2016), Technical Advice Note 12: Design (March 2016) is also relevant to the Landscape assessment. • The ASIDOHL concluding statement would benefit from including a summary of areas/features impacted by the proposal. • Cross reference between the cultural heritage and ASIDOHL is required as they both cover historic landscapes. • The cultural heritage report should include a statement on mitigation proposals for historic landscapes. Co-ordination with detailed landscape mitigation proposals would be good to see confirmed. • Clarification required in the ASIDOHL regarding the likely residual effect on historic landscapes following mitigation measures. • The implementation of soft SuDS should be revisited and enhanced wherever possible through the use of filter strips, filter drains, swales, over edge drainage, retention ponds and detention basins or possibly a combination of these. • The replacement drainage should wherever possible utilise best practice in the management and treatment of runoff as close to source as possible. • Where possible cattle creeps should be designed to allow drain over or to ground and where located close to a watercourse directed away from the watercourse. • New or revised accesses to farms should be assessed as to whether they may impact on any farm effluent management requirements. • Due to the sensitivity of downstream receptors from this scheme the drainage system must include pollution containment as part of the primary design. • Access to containment locations in the event of an incident and for maintenance purposes should be considered as part of the primary design process. • A full pollution prevention and mitigation plan must be produced, agreed with NRW and implemented prior to commencement of the main construction works for the scheme. • Any oil and chemical storage must be securely stored and banded to contain 110% of the contents of the largest tank or 25% of the total

	<p>storage capacity, whichever is greater.</p> <ul style="list-style-type: none">• Storage of materials during the construction period must be planned and properly managed to ensure that any silt laden runoff does not enter any watercourse.
SNPA	<ul style="list-style-type: none">• The proposals are outside the SNP boundary. No comments received.

4.2 Surveys, predictive techniques, methods and constraints

- 4.2.1 As previous environmental surveys have been carried out for the Scheme in the past the level of baseline information for each topic within the study area was reviewed as to whether it was still current and robust for use in the current EIA process. Following this it was determined which topics required further specialist survey to obtain or update information about their baseline condition. The results of the previous surveys helped to confirm where further detailed assessment was necessary and contributed to the existing level of baseline information.
- 4.2.2 Following the review of previous data it was decided to carry out field surveys and update baseline information for many of the DMRB, Volume 11 topics since most of the data used for the 2008 ES were seven years old or more. Field surveys were therefore organised in 2015 and 2016 for: Cultural Heritage; Nature Conservation; Landscape, and Road Drainage and the Water Environment. Further details about these surveys are provided in the relevant topic chapters (see Chapter 5.0 of this ES).
- 4.2.3 For the other topics it was considered that desk studies were the most appropriate method of obtaining the necessary baseline information. These included: Air Quality; Geology and Soils; Materials; Noise and Vibration; All Travellers, and Community and Private Assets. Further details are provided in the relevant topic chapters (see Chapter 5.0 of this ES).
- 4.2.4 The general format and content of the ES are as previously described in Section 1.4 of this ES. The methods outlined in the DMRB, Volume 11, Section 3; Environmental Assessment Techniques (August 2008) were followed where relevant for each topic, unless where stated otherwise in the relevant topic chapter (see Chapter 5.0). Since the method of evaluation and assessment for each topic varies, a description of each adopted method is provided within the relevant topic chapter. Any constraints or limitations to carrying out each assessment are also outlined within each relevant topic chapter (see Chapter 5.0).
- 4.2.5 In accordance with HD48/08 *Reporting of Environmental Impact Assessments*²⁵ the individual topic chapters presented in Chapter 5.0 follow the same reporting format, as follows:
- Introduction
 - Methodology (including study area and any limitations)
 - Baseline Information (including regulatory/policy Framework and value/sensitivity of resources)
 - Magnitude of Impacts and Significance of Effects (before mitigation) - including construction and operational phase impacts separately
 - Proposed Mitigation Measures (including enhancement measures and monitoring requirements where relevant)
 - Magnitude of Impacts and Significance of Effects (after mitigation)
 - Summary
- 4.2.6 Professional judgement has been used in the interpretation of the results obtained in relation to the potential impacts, mitigation and significance of any residual impacts. Where insufficient information is known relating to the circumstances of an impact, the approach has been to identify risks on the basis of the precautionary principle.

²⁵ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 6, HD48/08, Highways Agency, August 2008.

4.2.7 When considering the magnitude and extent of likely impacts and significant effects associated with the Scheme the following factors, from HA 204/08²⁶, were considered where relevant:

- the characteristics of the project in terms of its size and activities, use of natural and man-made resources, production of waste, risk and consequence of pollution incidents, and risk of accidents;
- the importance of the receiving environment, *i.e.* of international, national, regional, county or local importance, or sensitivity or value;
- the likely scale of the change following mitigation *e.g.* the land area, number of people affected and degree of change from the existing situation;
- the duration of any potential significant effects, whether permanent or temporary, and positive or negative, as a result of direct, indirect, secondary, cumulative, short, medium and long term effects;
- the study area, particularly in considering the boundaries for cumulative effects, and also the spatial boundary of the valued receptor/resource with potential to be affected directly or indirectly;
- the time period within which significant effects may arise, and;
- consideration of past, present and reasonably foreseeable actions and trends that are having or will have a major influence on a valued receptor/resource.

4.3 Significance criteria

4.3.1 The level of significance that an impact generates can be difficult to judge objectively. In order to reach robust and objective conclusions regarding the significance of environmental effects associated with the Scheme the following criteria (see Tables 4.4 to 4.7) taken from HA 205/08²⁷ were therefore used to assist in assigning environmental value (or sensitivity), the magnitude of impacts and the level of significance of effects, unless where specified otherwise in Chapter 5.0.

4.3.2 Typical descriptors for assigning the value (or sensitivity) of environmental attributes are shown in Table 4.4. However, the value categories and typical descriptors can vary depending on individual topics and, if applicable, this is explained in the relevant topic chapters (see Chapter 5.0).

Table 4.4: Environmental Value (or Sensitivity) and Typical Descriptors

Value (sensitivity)	Typical descriptors
<i>Very High</i>	Very high importance and rarity, international scale and limited potential for substitution.
<i>High</i>	High importance and rarity, national scale, and limited potential for substitution.
<i>Medium</i>	High or medium importance and rarity, regional scale, limited potential for substitution.
<i>Low (or Lower)</i>	Low or medium importance and rarity, local scale.
<i>Negligible</i>	Very low importance and rarity, local scale.

²⁶ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 4, HA 204/08: 'Scoping of Environmental Impact Assessments', Highways Agency, August 2008.

²⁷ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5, HA 205/08: 'Assessment and Management of Environmental Effects', Highways Agency, August 2008.

4.3.3 The typical descriptors and criteria for defining the magnitude of an impact (degree of change from the baseline) are shown in Table 4.5.

Table 4.5: Magnitude of Impact and Typical Descriptors

Magnitude of impact	Typical criteria descriptors
<i>Major</i>	<i>Adverse:</i> Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
	<i>Beneficial:</i> Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
<i>Moderate</i>	<i>Adverse:</i> Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	<i>Beneficial:</i> Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
<i>Minor</i>	<i>Adverse:</i> Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	<i>Beneficial:</i> Minor benefit to, or addition of, one (maybe more) key characteristics, some beneficial impact on attribute or a reduced risk of negative impact occurring.
<i>Negligible</i>	<i>Adverse:</i> Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	<i>Beneficial:</i> Very minor benefit to or positive addition of one or more characteristics, features or elements.
<i>No change</i>	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

4.3.4 The five significance categories used within this ES and their descriptors (unless where specified otherwise) are summarised in Table 4.6.

Table 4.6: Descriptors of the Significance of Effect categories

Significance category	Typical descriptors of effect
<i>Very large</i>	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
<i>Large</i>	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
<i>Moderate</i>	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor.
<i>Negligible</i>	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
<i>Neutral</i>	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

4.3.5 The significance of an effect (adverse or beneficial) is assigned by combining the value (or sensitivity) of an environmental attribute with the magnitude of impact (degree of change)

affecting it as a result of a project. The potential outcomes of significance, assigned before and after the consideration of design and mitigation measures, are shown in Table 4.7.

Table 4.7: Arriving at the Significance of Effect categories

		Magnitude of Impact (Degree of Change)				
		<i>No Change</i>	<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Environmental Value (Sensitivity)	<i>Very High</i>	Neutral	Slight	Moderate or large	Large or very large	Very large
	<i>High</i>	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	<i>Medium</i>	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	<i>Low</i>	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	<i>Negligible</i>	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

4.4 Mitigation, Monitoring and Enhancement

4.4.1 Proposed mitigation, monitoring and enhancement measures are detailed within each topic chapter where relevant (see Chapter 5.0). The mitigation measures proposed are those considered to be essential measures that have been agreed. Where uncertainty exists as to whether mitigation measures could be delivered (*e.g.* accommodation works) this is made clear in the relevant topic chapters. A summary of all proposed mitigation measures is provided within Chapter 8.2.

4.4.2 Where it has not been possible to avoid significant effects via the design process in the first instance the approach to developing mitigation has been to incorporate measures into the design of the Scheme (*e.g.* enlarged culvert for Afon Wig, holes in the central reserve). Additional mitigation measures are proposed where this was not possible. Proposals for monitoring and managing mitigation measures are specified in the topic chapters where relevant. These proposals constitute scheme commitments published within the ES that are to be fulfilled during the construction of the scheme.

4.4.3 In accordance with HA 205/08²⁸ the significance of the likely environmental effects for the construction and operation phases of the Scheme is assigned both before and after the consideration of the effectiveness of the design and mitigation measures. This allows for the case or reason for, and the effectiveness of, mitigation to be described.

²⁸ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5: HA 205/08, August 2008.

Chapter 5.0: Environmental Impact Assessment

5.1 AIR QUALITY

Introduction

- 5.1.1 This chapter describes the air quality impacts associated with the Scheme. In particular, it considers the potential impacts of the construction phase on existing receptors associated with particulate matter (PM₁₀) and dust emissions. The assessment quantifies the potential impacts of the completed scheme on local nitrogen dioxide (NO₂) and particulate matter (PM₁₀) concentrations - the two pollutants of principal concern in the UK with regards to emissions from road traffic.
- 5.1.2 Additionally, carbon emissions associated with road traffic exhaust emissions are considered in the context of the threat posed by climate change and the UK Government's international commitments to cut the national emissions of Greenhouse Gases (GHG's).
- 5.1.3 This chapter describes:
- The methods used to assess the air quality impacts;
 - The baseline air quality conditions at the site;
 - The potential air quality impacts of the Scheme arising from emissions to air during the construction and operation phases;
 - The mitigation measures required to prevent, reduce, or offset the air quality impacts, and;
 - The residual air quality impacts.

Scoping

- 5.1.4 The construction phase of the Scheme has been considered as it has the potential to cause short-term impacts, largely in relation to dust and PM₁₀ emissions generated by construction and demolition activities.
- 5.1.5 The operational phase of the Scheme has been considered as the day-to-day emissions from road traffic have the potential to cause long-term impacts. Gwynedd Council's latest assessment²⁹ has shown that road traffic emissions are the main concern with respect to air quality within the area, and the results of the Local Air Quality Management (LAQM) process to date highlight that road traffic emissions represent a significant proportion of the total annual emissions of fine particulates (PM₁₀) and oxides of nitrogen (NO_x) within the UK. The pollutants NO₂ and PM₁₀ have therefore been the subject of detailed consideration as part of the operational assessment.
- 5.1.6 The 2014 Progress Report concludes that whilst there are currently no exceedences for Air Quality Standards objectives for NO₂, the concentrations for PM₁₀ have seen occasional 15-minute readings in excess of 50µg/m³, but no daily mean above this level was recorded.
- 5.1.7 Whilst other pollutants such as benzene, 1,3-butadiene and carbon monoxide are also associated with vehicle exhaust emissions, the current national level of emissions of these pollutants highlights significant reductions between 1970 and 2009³⁰ to the extent that they

²⁹ Gwynedd Council, Local Air Quality Management – Review and Assessment of Air Quality, Progress Report for 2014, August 2014

³⁰ UK Emissions of Air Pollutants 1970 to 2009, UK Emissions Inventory Team, AEA Energy & Environment, August 2011

are no longer perceived to be a problem. Therefore, existing national measures already enable compliance with the relevant air quality standards and objectives for these pollutants. Additionally, the reporting undertaken by Gwynedd Council under its LAQM obligations has not identified any issue with regard to these pollutants; they have therefore been scoped out of this assessment.

- 5.1.8 Outside the context of the current assessment and also scoped out are sulphur dioxide (SO₂) emissions, which emanate largely from power stations and are therefore not relevant with respect to vehicle exhaust emissions. Additionally, since the agreement between the European Parliament and the Environment Council on the Directive on the Quality of Petrol and Diesel Fuels the sale of leaded petrol in the UK is banned (effective from 1st January 2000). Consequently, emissions of lead are now restricted to a variety of industrial processes only, none of which are present within the study area or considered likely to affect the study area and were therefore scoped out of this assessment.
- 5.1.9 In line with the Highways Agency's Design Manual for Roads and Bridges (DMRB) guidance³¹, air quality impacts at designated ecological sites³² need only be considered where the designated sites are within 200m of the affected road network. IAQM guidance³⁴ suggests that potential dust effects on designated ecological sites should be considered if they are within 50m of the site boundary. Beyond these distances there is deemed to be no risk of adverse air quality impacts. Given that there are no such sites within 200m of the section of the A55(T) that constitutes the Scheme, nor within 50m of any of the construction working areas, potential impacts at designated ecological sites do not require further consideration as part of this assessment.

Methodology

- 5.1.10 The approach applied to this assessment is based on:
- Qualitative assessment of impacts of the construction phase on air quality through emission of dust and particulates; and
 - Prediction of ambient NO₂ and PM₁₀ concentrations from road traffic, to which receptors may be exposed upon completion of the Scheme, and comparison with the relevant AQS objectives.
- 5.1.11 The following guidance documents have been used to inform the approach to this assessment:
- Local Air Quality Management Technical Guidance LAQM.TG(16)³³;
 - Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction³⁴;
 - Highway's Agency Design Manual for Roads and Bridges (DMRB) guidance HA207/07³¹;
 - Highway's Agency Interim Advice Note IAN 170/12v3³⁵;
 - Highway's Agency Interim Advice Note IAN 174/13³⁶;

³¹ Highways Agency DMRB Volume 11, Section 3, Part 1, HA207/07 Air Quality, May 2007

³² Defined as Special Areas of Conservation (SACs), Special Protection Areas (SPAs), potential Special Protection Areas, Sites of Special Scientific Interest (SSSIs) and Ramsar sites

³³ Local Air Quality Management Technical Guidance LAQM.TG(16). April 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

³⁴ Institute of Air Quality Management (IAQM) (2014) Guidance on the assessment of dust from demolition and construction

³⁵ Highways Agency Interim Advice Note 170/12 version 3. Updated air quality advice on the assessment of future NO_x and NO₂ projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality.

³⁶ Highways Agency Interim Advice Note 174/13. Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07).

- Highway's Agency Interim Advice Note IAN 175/13³⁷; and
- Highway's Agency Interim Advice Note IAN 185/15³⁸.

Construction Effects

- 5.1.12 The assessment of potential dust/PM₁₀ effects in relation to the Scheme's construction phase has been undertaken qualitatively in accordance with IAQM guidance³⁴. The guidance proposes a method to assess the significance of construction dust impacts by considering the annoyance due to dust soiling as well as harm to designated ecological sites and the risk of health effects due to significant increases to PM₁₀.
- 5.1.13 Following the IAQM guidance³⁴, construction site activities are divided into four types to reflect their different potential impacts. These activities are:
- Demolition – an activity involved with the removal of an existing structure or structures;
 - Earthworks – the processes of soil-stripping, ground-levelling, excavation and landscaping;
 - Construction – an activity involved in the provision of a new structure; and,
 - Trackout – the transport of dust and dirt from the site onto the public road network; this arises when lorries leave site with dusty materials or transfer dust and dirt onto the road having travelled over muddy ground on-site.
- 5.1.14 A detailed assessment is required where a human receptor is located within 350m from the boundary of any construction works (defined at present as the extent of the Scheme) and/or within 50m of the route(s) used by vehicles on the public highway, up to 500m from the site entrance(s), or where designated ecological sites are within 50m from the site boundary. These criteria have therefore been used to define the study area for the construction assessment, as defined by the 50m and 350m buffers presented in Figure 5.1.1.

³⁷ Highways Agency Interim Advice Note 175/13. Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07)).

³⁸ Highways Agency Interim Advice Note 185/15. Updated traffic, air quality and noise advice on the assessment of link speeds and generation of traffic data into speed-bands for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07) and Volume 11, Section 3, Part 7 Noise (HD213/11).

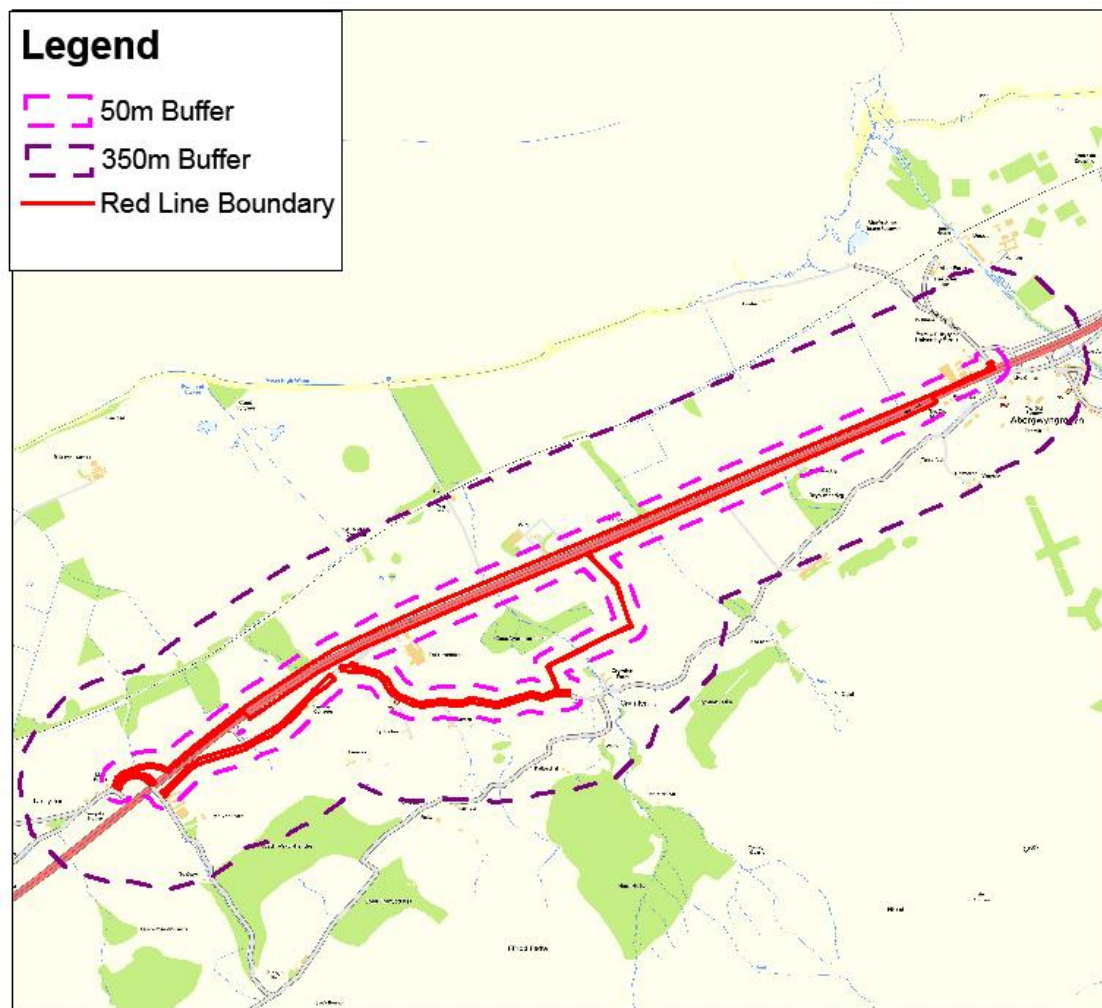


Figure 5.1.1 – Study Area for the Assessment of Construction Impacts

5.1.15 As can be seen in Figure 5.1.1, there are a number of residential farm buildings and properties located along the A55(T) Chester to Bangor Trunk Road between Tai'r Meibion and Abergwyngregyn and the wider study area for the construction assessment, which are within 350m of the construction works boundaries. Additionally, there are a number of existing residential properties within 50m of the public highway within 500m from the site entrance(s). There are no designated ecological sites within the 50m of the site construction boundaries and there is therefore no need to consider potential dust effects on designated ecological sites further as part of this assessment. As there are human receptors within the study area as defined for the construction assessment, a detailed assessment of potential air quality impacts during the construction phase is therefore required.

5.1.16 The first step of the detailed assessment is to assess the risk of dust impacts. This is undertaken separately for each of the four activities (demolition, earthworks, construction and trackout) and takes account of:

- The scale and nature of the works, which determines the potential dust emission magnitude; and
- The sensitivity of the area.

5.1.17 These factors are combined to give an estimate of the risk of dust impacts occurring. Risks are described in terms of there being a low, medium or high risk of dust impact for each of the four separate potential activities. Where there are low, medium or high risks of an impact site-specific mitigation would be required, proportionate to the level of risk.

5.1.18 Based on the threshold criteria and professional judgment, one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

5.1.19 Site-specific mitigation for each of the four potential activities is then determined based on the risk of dust impacts identified. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites these should also be taken into account. Professional judgement is then employed to examine the residual dust effects assuming mitigation to determine whether or not they are significant.

Operational Effects

5.1.20 The Highways Agency's DMRB guidance³¹, associated Interim Advice Notes (IANs) and accompanying screening method spreadsheet version 1.03c³⁹ have been used to assess the air quality impacts of the Scheme. This has been achieved by predicting pollutant concentrations (NO_x/NO₂ and PM₁₀) associated with road traffic emissions at identified receptor locations under the baseline year (2016), opening year (2018) and future year (2033) scenarios. The DMRB local assessment method was used for this purpose.

5.1.21 The emissions of carbon (C) associated with the Scheme have been estimated according to the latest DMRB guidance note³¹. The regional assessment method provided in the DMRB screening spreadsheet³⁹ has been employed for this purpose.

Study Area

5.1.22 The study area for the assessment of operational impacts is defined by the 200m buffer as presented in Figure 5.1.2. This has been set with regard to the criteria set out in the DMRB guidance³¹ for determining affected links for the local air quality assessment and the 200m corridors either side of those links, namely:

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

³⁹ Highways Agency DMRB Spreadsheet Version 1.03c, July 2007

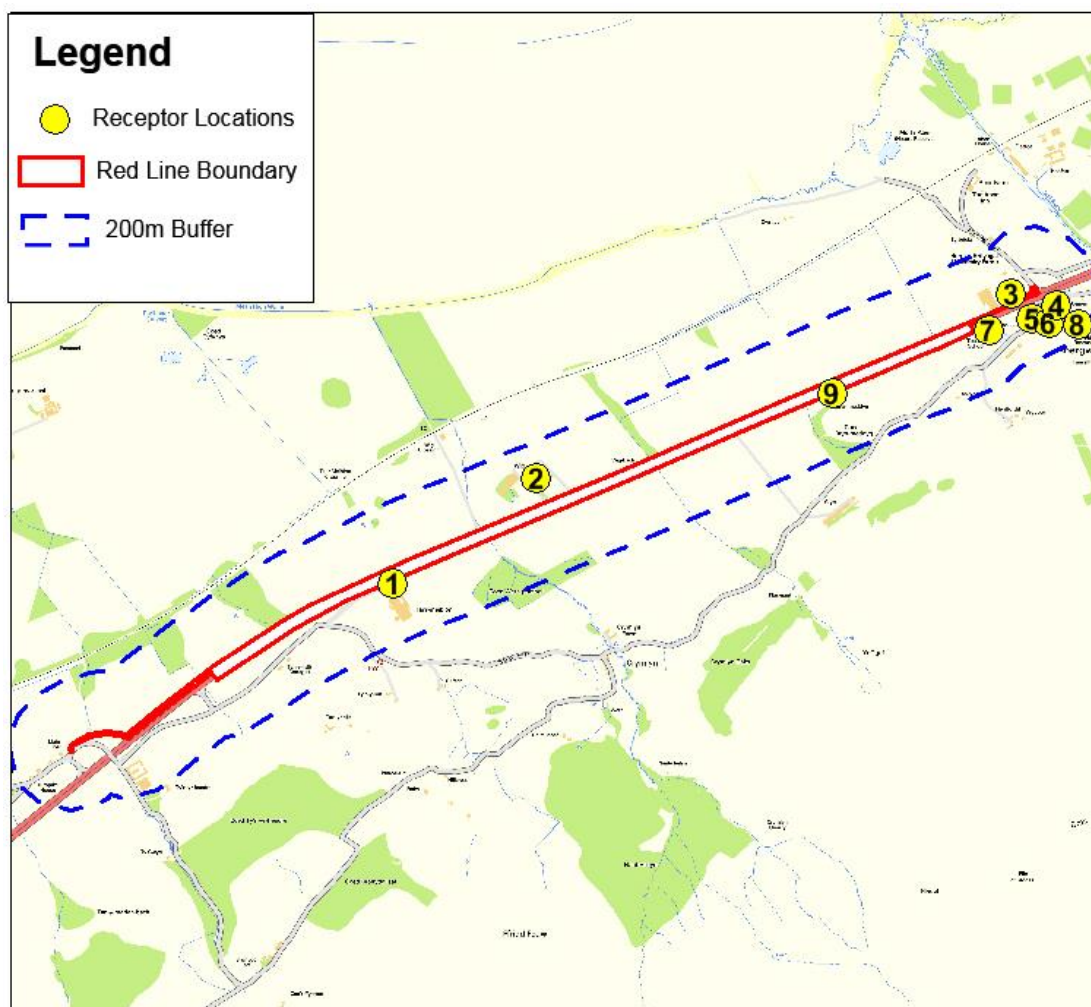


Figure 5.1.2 – Study Area for the Assessment of Operational Impacts

Modelled Scenarios

5.1.23 The prediction of pollutant concentrations has been carried out to assess the existing and future conditions, both with (Do-Something) and without (Do-Minimum) the Scheme, in accordance with the methodology prescribed in the DMRB guidance³¹. The assessment takes into consideration the growth in traffic in the future assessment years.

5.1.24 Concentrations of pollutants (NO_x/NO₂ and PM₁₀) have been predicted at the identified receptor locations for the following scenarios:

- Baseline Year 2016 (2016 BC⁴⁰);
- Projected Base Years 2018 and 2033: these are additional scenarios only required as part of the DMRB Gap Analysis methodology³⁵ (see paragraphs 5.1.34 to 5.1.39) that use traffic data for baseline year, assessment year emission factor and assessment year background concentration (see Tables 5.1.3 and 5.1.4);
- Do-Minimum Opening Year 2018 (2018 DM): this is the existing scenario, but the traffic growth between 2016 and 2018 has been taken into account;
- Do-Something Opening Year 2018 (2018 DS): assumes that the Scheme takes place, and the normal traffic growth between 2016 and 2018 has been taken into account;
- Do-Minimum Future Design Year 2033 (2033 DM): this is the existing scenario, but the traffic growth between 2016 and 2033 has been taken into account; and,

⁴⁰ Base Case, with reference to the 2016 Baseline scenario.

- Do-Something Future Design Year 2033 (2033 DS): assumes that the Scheme takes place, and the traffic growth between 2016 and 2033 has been taken into account.

Model Input

- 5.1.25 The DMRB assessment incorporates numbers of road traffic vehicles, vehicle speeds on the roads and the breakdown of the traffic composition. An average traffic speed of 98kph (61mph) has been used in the modelling for the baseline scenario (2016 BC) and both of the Do-Minimum scenarios (2018 DM and 2033 DM), as provided by YGC. The Scheme is expected to result in a slight increase in average speed, so an average traffic speed of 113kph (70mph) has been used for modelling the Do-Something scenarios (2018 DS and 2033 DS). The increase in average vehicle speed introduced by the Scheme has the potential to affect air quality at the identified receptor locations, hence the need to consider the change in average speeds as part of this assessment.
- 5.1.26 A vehicle split of 10.8% for Heavy Duty Vehicles (HDVs) and 89.2% for Light Duty Vehicles (LDVs) has been assumed for all modelled scenarios, as advised by YGC. The Annual Average Daily Traffic (AADT) flows, vehicle split percentages and average speed data provided by YGC are shown in Table 5.1.1.
- 5.1.27 As part of the Scheme, a new access road is to be constructed linking Wig Farm and Junction 12 of the A55(T). Although not explicitly included in the traffic flows used for the purposes of this assessment (see Table 5.1.1), operation of this new access road would lead to an increase of approximately 20 AADT on the A55(T) in 2018/2033. Given that this constitutes an increase of <0.1% when compared to the 2018 DM and 2033 DM flows of 31,244 and 34,458 respectively, the operational effect of these additional vehicle movements is considered to be negligible. Therefore, omission of these movements from the assessment of traffic flows is considered to be of negligible significance.

Table 5.1.1 – Traffic Data for Baseline Year (2016), Opening Year (2018) and Future Year (2033) on the A55(T) between Tai'r Meibion to Abergwyngregyn

Traffic Data	2016 BC	2018 DM	2018 DS	2033 DM	2033 DS
AADT	30622	31244	31244	34458	34458
% HDV	10.8	10.8	10.8	10.8	10.8
Average Speed (Mph)	61	70	70	70	70

- 5.1.28 There are a number of human receptors located within the study area that may potentially be affected by the operation of the Scheme. The locations of the modelled receptors are provided in Table 5.1.2 and illustrated in Figure 5.1.2. These receptors represent residential locations where people could be exposed to air pollutant concentrations over prolonged periods, and includes the most affected locations (whether adverse or beneficial) as well as locations representative of typical roadside impacts. There are no other sensitive receptor groups (e.g. schools or hospitals) within the study area.

Table 5.1.2 – Receptor Locations included in the Assessment of Emissions from Road Traffic

Receptor ID	Receptor Location	Co-ordinates		Distance from Road Link (m) ^a	Road Link Affected By
		X	Y		
1	N Wales Expressway, Bangor, Gwynedd LL57 3YR	263123	371765	27	A55(T) carriageway
2	Wig Farm, N Wales Expressway, Llanfairfechan, Gwynedd LL33 0LS	263604	372118	113	A55(T) carriageway
3	International Rescue Training Centre, N Wales Expressway, Llanfairfechan, Gwynedd LL33 0LR	265200	372737	41	A55(T) carriageway
4	N Wales Expressway, Llanfairfechan, Gwynedd LL33 0LD	265353	372700	51	A55(T) carriageway
5	N Wales Expressway, Llanfairfechan, Gwynedd LL33 0LR	265269	372655	57	A55(T) carriageway
6	N Wales Expressway, Llanfairfechan, Gwynedd LL33 0LR	265325	372640	86	A55(T) carriageway
7	The Old School, Abergwyngregyn, Llanfairfechan, Gwynedd LL33 0LR	265124	372616	26	A55(T) carriageway
8	N Wales Expressway, Llanfairfechan, Gwynedd LL33 0LD	265423	372637	126	A55(T) carriageway
9	2 Bryn-Meddyg, Abergwyngregyn, Llanfairfechan, Gwynedd LL33 0LR	264598	372403	16	A55(T) carriageway

^a Distance is measured from the receptor to the centre of the road link.

5.1.29 As discussed in paragraph 5.1.9, there are no designated ecological sites within the operational phase study area that warrant consideration with regards to potential air quality impacts. The assessment therefore focuses on potential impacts at those human receptors located within the study area, as discussed above.

Model Output

5.1.30 For the prediction of annual mean NO₂ concentrations for all of the modelled scenarios, the output of the DMRB model for NO_x has been converted to NO₂ following the methodology provided in LAQM.TG(16) and using the NO_x to NO₂ conversion tool⁴¹ developed on behalf of Defra. This tool also utilises the total background NO_x and NO₂ concentrations, but using a different method to the DMRB methodology. This assessment has utilised version 4.1 (June 2014) of the NO_x to NO₂ conversion tool. The road NO₂ contribution is then added to the appropriate NO₂ background concentration value to obtain an overall total NO₂ concentration.

5.1.31 For the prediction of short-term NO₂ impacts, LAQM.TG(16) advises that it is valid to assume that exceedences of the 1-hour mean AQS objective for NO₂ are only likely to occur where the annual mean NO₂ concentration is 60µg/m³ or greater. This approach has thus been adopted for the purposes of this assessment.

5.1.32 For the prediction of short-term PM₁₀ impacts, LAQM.TG(16) provides an empirical relationship between the annual mean and the number of exceedences of the 24-hour mean AQS objective for PM₁₀ that can be calculated as follows:

⁴¹ <http://laqm.Defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc>

$$\text{Number of 24-hour Mean Exceedences} = -18.5 + 0.00145 \times \text{annual mean}^3 + \frac{206}{\text{annual mean}}$$

5.1.33 This relationship has thus been adopted to determine whether exceedences of short-term PM₁₀ AQS objective are likely in this assessment.

Uncertainty in Future Year NO_x and NO₂ Trends

5.1.34 Recent studies have identified analyses of historical monitoring data within the UK that show a disparity between measured concentration data and the projected decline in concentrations associated with emission forecasts for future years⁴². The report identifies that trends in ambient concentrations of NO_x and NO₂ in many urban areas of the UK have generally shown two characteristics; a decrease in concentration from about 1996 to 2002-2004, followed by a period of more stable concentrations from 2002-2004 up until 2009. This trend of more stable recent years is expected to continue. More rural, less densely-trafficked areas tend to show downward trends in either NO_x or NO₂, which are more in line with those expected.

5.1.35 The reason for this disparity is currently not fully understood, but it is thought to be related to the actual on-road performance of vehicles, in particular diesel cars and vans, when compared with calculations based on the Euro emission standards. Preliminary studies suggest the following:

- NO_x emissions from petrol vehicles appear to be in line with current projections and have decreased by 96% since the introduction of 3-way catalysts in 1993;
- NO_x emissions from diesel cars, under urban driving conditions, do not appear to have declined substantially, up to and including Euro 5. There is limited evidence that the same pattern may occur for motorway driving conditions; and,
- NO_x emissions from HDVs equipped with Selective Catalytic Reduction (SCR) are much higher than expected when driving at low speeds.

5.1.36 This disparity in the historical national data highlights the uncertainty of future year projections of both NO_x and NO₂.

5.1.37 Defra and the Devolved Administrations have investigated these issues and have since published an updated version of the Emissions Factor Toolkit (EFT Version 7.0)⁴³ utilising COPERT 4 (v11)⁴⁴ emission factors, which may go some way to addressing this disparity, but it is considered likely that a gap still remains. These factors are available for use in detailed dispersion modelling assessments. However, at the time of writing the DMRB screening tool used in this assessment has not been updated to take account of the currently adopted COPERT 4 (v11) emission factors.

5.1.38 To take account of this uncertainty, modelling results have been adjusted using the Highways Agency Long-Term Gap Analysis Calculator v1.0⁴⁵ released in conjunction with the Highways Agency IAN 170/12v3³⁵.

⁴² Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Steadman, J, Li, Y, Grice, S, Kent, A and Tsagatakis, I. 2011. Trends in NO_x and NO₂ emissions and ambient measurements in the UK. Prepared for Defra, 18th July 2011

⁴³ <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

⁴⁴ COPERT 4 is a software tool used to calculate air pollutant and greenhouse gas emissions from road transport.

⁴⁵ Highways Agency Long-Term Gap Analysis Calculator v1.0 <http://www.dft.gov.uk/ha/standards/ians/index.htm>

5.1.39 An additional scenario (hereafter referred to as Projected Base Year) is required to enable the Gap Analysis to be completed. The Projected Base Year scenario uses the baseline year traffic data and should be modelled using the opening and future design year vehicle emission factors as well as opening and future design year background concentrations. Table 5.1.3 and 5.1.4 show which data is required for each scenario. Results for each scenario are then input to the Gap Analysis Calculator⁴⁵, which provides adjusted results for the development scenarios.

Table 5.1.3 – Data Requirements for Highways Agency Long-Term Gap Analysis Calculator for 2018

Scenario	Traffic Data	Vehicle Emissions	Background Concentrations
Base Year	2016	2016	2016
Projected Base Year	2016	2018	2018
Do-Minimum	2018	2018	2018
Do-Something	2018	2018	2018

Table 5.1.4 – Data Requirements for Highways Agency Long-Term Gap Analysis Calculator for 2033

Scenario	Traffic Data	Vehicle Emissions	Background Concentrations
Base Year	2016	2016	2016
Projected Base Year	2016	2033	2033
Do-Minimum	2033	2033	2033
Do-Something	2033	2033	2033

Limitations

5.1.40 The Highways Agency’s IAN 185/15³⁸ provides updated advice to support Highways Agency scheme assessments, in order to:

- Analyse the performance of modelled traffic speeds on individual road links compared against observed speeds on the same road links;
- Adjust, where required, modelled traffic speeds on individual road links to better reflect observed speeds; this is known as the “Speed Pivoting” approach;
- Assign individual road links into a speed-band category and identify the corresponding NO_x, PM₁₀ and CO₂ emission rates; and,
- Enable use of the speed-band categories within air quality modelling and assessment.

5.1.41 The speeds advised by YGC for use in the DMRB modelling are 98kph (for the baseline year 2016) and 113kph (for both the opening year 2018 and the future design year 2033). Therefore, application of the methodology provided in IAN 185/15 to this assessment would result in the ‘Motorway free flow’ speed band being applied to all the modelled scenarios considered as part of this assessment. Consequently, there would be no resultant impact assessment to report, as the results obtained for the DM and DS scenarios would be identical to one another for the same assessment year (as only the average vehicle speed on the A55(T) is predicted to change due to the Scheme, i.e. both the total traffic volume and composition on the A55(T) remain unchanged due to the Scheme).

5.1.42 Given this potential limitation, the methodology provided in IAN 185/15 has not been applied to this assessment and all results are those obtained without applying the Highways Agency’s approach to speed banding.

Significance Criteria

5.1.43 In order to evaluate the impacts on local air quality from the Scheme operations, the approach set out in IAN 174/13³⁷ was followed. The criteria in Table 5.1.5 present the classification of the magnitude of change of annual mean NO₂ and PM₁₀ concentrations. These criteria have been applied to pollutant concentrations predicted at the human receptors; as per paragraph 5.1.9, there are no designated ecological sites that warrant consideration as part of this assessment.

Table 5.1.5 – Impact Descriptors for Changes in Pollutant Concentrations at Receptor

Classification of Magnitude	Change in Concentration (as a percentage of the relevant objective)
Large	>10%
Medium	5-10%
Small	1-5%
Imperceptible	<1%

5.1.44 IAN 174/13³⁷ specifies that where concentrations at receptor locations do not exceed the relevant objective (either in the Do Minimum or Do Something scenarios), or where the change in concentration is imperceptible (as defined in Table 5.1.5), these can be scoped out of any further assessment of the significance of effects, with the impact defined as negligible. Where receptor locations exceed the air quality objective, the overall significance of the Scheme is assessed in relation to the numbers of affected receptors and the balance between receptors experiencing beneficial or adverse effects. Table 5.1.6 presents the guidelines provided in IAN 174/13³⁶ whereby the number of properties within the specified magnitude categories may constitute a significant air quality effect.

Table 5.1.6 – Guideline to Number of Properties Constituting a Significant Effect

Magnitude of Change in Annual Mean NO ₂ / PM ₁₀ (µg/m ³)	Number of Receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (≥2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

5.1.45 Where the total number of receptors compiled in Table 5.1.6 is less than the lower guideline band in all the six magnitude categories, a consideration of the overall direction of change should be provided. The outcome of the professional judgement of the Scheme effects is likely to be not significant. This information should be used in conjunction with the following key factors in order to inform the overall significance of the Scheme:

- If annual average NO₂ is the key pollutant alone or if other short term averaging periods and/or pollutants also need to be taken into account;
- Whether any adverse large, medium, or small changes are predicted;
- Whether any beneficial large, medium, or small changes are predicted;
- Whether any of these exceed lower or upper guideline bands;
- The Scheme's ability to detract or support measures set out in Air Quality Action Plans;
- If the Scheme represents a low or high compliance risk;
- The effects on any designated site(s) affected; and
- Whether, if required, mitigation can be incorporated in to the scheme design, and the effectiveness of the specified mitigation measure.

Baseline Information

Regulatory/Policy Framework

- 5.1.46 The significance of existing and future pollutant levels can be assessed in relation to the national air quality standards and objectives established by Government. The Air Quality Strategy⁴⁶ (AQS) for the UK provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations to protect human health. The air quality objectives incorporated in the AQS and UK legislation are derived from the Limit Values prescribed in the EU Directives transposed into national legislation by member states.
- 5.1.47 The CAFE (Clean Air for Europe) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The CAFE Directive⁴⁷ has been adopted and replaces all previous air quality Directives, except the Fourth Daughter Directive. The CAFE Directive introduces new obligatory standards for PM_{2.5} for Government but places no statutory duty on local government to work towards achievement of these standards.
- 5.1.48 The Air Quality Standards (Wales) Regulations 2010⁴⁸ incorporate the CAFE Directive and the Fourth Daughter Directive into Welsh law, and replace the Air Quality Standards (Wales) Regulations 2007.
- 5.1.49 Defra use their Pollution Climate Mapping (PCM) model for the assessment of compliance with the EU CAFE Directive limit values. Owing to on-going non-compliance for a number of EU reporting zones and agglomerations, in December 2015 the UK Government published an updated plan to reduce nitrogen dioxide concentrations in our towns and cities as part of its commitment for cleaner air⁴⁹. These plans showed that as part of the 2013 assessment, the North Wales zone (that which the Scheme is located within) had 7.7km of road exceeding the annual mean NO₂ limit value, with a maximum concentration of 55µg/m³ predicted (there was no exceedance of the hourly NO₂ limit value). Baseline projections showed that compliance is expected to be realised in the North Wales zone by 2020, with a maximum annual mean NO₂ concentration of 35 predicted.
- 5.1.50 Highways England has produced IAN 175/13³⁷ to assess the impact of individual schemes on compliance with the EU Directive. However, IAN175/13 has been withdrawn and is currently pending update. Therefore, no assessment has been undertaken following the IAN175/13 assessment methodology in this study.
- 5.1.51 The objectives for seven pollutants (benzene, 1,3-butadiene, carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and particulates (PM₁₀) have been prescribed within The Air Quality Regulations (Wales) 2000⁵⁰ and Air Quality (Wales)

⁴⁶ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, published by Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007.

⁴⁷ <http://ec.europa.eu/environment/air/cafe/index.htm>

⁴⁸ <http://gov.wales/topics/environmentcountryside/epg/airqualitypollution/airquality/legislation/airstandards/?lang=en>

⁴⁹ Defra (December 2015). Improving air quality in the UK - Tackling nitrogen dioxide in our towns and cities. <https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions>

⁵⁰ <http://www.legislation.gov.uk/wsi/2000/1940/signature/made>

(Amendment) Regulations 2002⁵¹ based on earlier versions of the AQS. Table 5.1.7 details those air quality objectives applicable in Wales for the purpose of LAQM.

Table 5.1.7 – Air Quality Objectives included in Regulations for the purpose of LAQM in Wales

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m ³	Running annual mean	31.12.2003
	5.00 µg/m ³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m ³	Running 8-hour mean	31.12.2003
Lead	0.5 µg/m ³	Annual mean	31.12.2004
	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m ³	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

5.1.52 The EU limit values are considered to apply everywhere with the exception of the carriageway and central reserve of roads and any location where the public do not have access (*e.g.* industrial sites). The AQS objectives apply at locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period of the AQS objective. Typically these include residential properties and schools/care homes for longer period (*i.e.* annual mean) pollutant objectives and high streets for short-term (*i.e.* 1-hour) pollutant objectives.

5.1.53 The AQS also proposed to adopt an exposure-based approach for fine particles (PM_{2.5}), as summarised in Table 5.1.8. These objectives are provided by the UK Government and the Devolved Administrations, but these are not included in Regulations and there is no obligation upon local authorities to review and assess against them.

Table 5.1.8 – AQS Objectives for PM_{2.5}

Pollutant	Objective	Concentration measured as	Date to be achieved by and maintained thereafter
Particles (PM _{2.5})	25µg/m ³	Annual mean	2020
	Target of 15% reduction in concentrations at urban background	Annual mean	In urban areas between 2010 and 2020

5.1.54 As established by the Environment Act 1995 Part IV, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives set down by Government for a

⁵¹ <http://www.legislation.gov.uk/wsi/2002/3182/regulation/2/made>

number of pollutants. The process of Review and Assessment of air quality undertaken by local authorities is set out under the LAQM regime. Where the results of the Review and Assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an Air Quality Management Area (AQMA) – a geographic area defined by high levels of pollution and exceedences of health-based standards. It is noteworthy that the site of the Scheme is not within any AQMA.

5.1.55 One of the aims of the LAQM regime is for local authorities to enhance integration of air quality into the planning process. Current LAQM Policy Guidance for Wales⁵² clearly recognises land-use planning as having a significant role in terms of reducing population exposure to increased concentrations of pollution. Generally, the decisions made on land-use allocation can play a major role in improving the health of the population.

5.1.56 Planning Policy Wales (PPW)⁵³ contains current land use planning policy for Wales. It provides the policy framework for the effective preparation of local planning authorities' development plans. This is supplemented by 21 topic-based Technical Advice Notes (TANs). Procedural guidance is given in Welsh Office/National Assembly for Wales/Welsh Government circulars. With respect to air quality, PPW Chapter 13 'Minimising and Managing Environmental Risks and Pollution' states:

"13.11.1. Development plans are important vehicles for the promotion of environmental protection and should enable consideration of the effects which proposed developments, and transport demand associated with them, may have on air or water quality and the effects which air or water quality may have on proposed developments. Local planning authorities should take account of such quality objectives when preparing development plans and should work closely with pollution control authorities in the preparation of these plans and when determining planning applications."

5.1.57 Policy B3 of the Gwynedd UDP⁵⁴ provides guidance on Development that Creates Pollution or Nuisance. This states that *"Proposals that will cause significant harm to the quality of public health, safety or amenities, or to the quality of the built or natural environment as a result of higher levels of air, water, noise, or soil pollution will be refused unless adequate controls can be attained by means of planning conditions and powers of regulatory bodies, and that arrangements can be made to monitor discharges. In addition, proposals located adjacent to an existing source of pollution or nuisance will be refused unless the Local Planning Authority is satisfied that there will be no risk to the health or safety of the local community or potential occupants of the new development that cannot be satisfactorily overcome."*

5.1.58 The Isle of Anglesey County Council and Gwynedd Council have prepared the draft Anglesey and Gwynedd Joint Local Development Plan⁵⁵. This Plan sets out the land use planning policy framework over a 15 year period (2011 – 2026) and is currently expected to be adopted in spring 2017. In relation to air quality, Policy PCYFF1 states that *"... planning permission will be refused where the proposed development would have an unacceptable adverse impact on ... the health, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance,*

⁵² Local Air Quality Management Interim Policy Guidance for Wales. March 2016. Published by the Welsh Government.

⁵³ Welsh Government (November 2016). Planning Policy Wales. Edition 9.

⁵⁴ <https://www.gwynedd.llyw.cymru/en/Council/Strategies-and-policies/Environment-and-planning/Planning-policy/Unitary-Development-Plan-and-Supplementary-Planning-Guidance.aspx>

⁵⁵ <http://www.anglesey.gov.uk/planning-and-waste/planning-policy/joint-local-development-plan-anglesey-and-gwynedd/>

vibration, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance."

Air Quality Guidance for Construction Sites

- 5.1.59 There are a number of regulatory and legislative constraints in place to control pollution from construction and demolition activities. Part III of the Environmental Protection Act 1990 identifies the emission of dust from construction sites as having the potential to be a statutory nuisance and requires its control under Section 80.
- 5.1.60 Several documents describing the best practices to mitigate the impacts of dust from construction and demolition activities are available. The IAQM has provided detailed guidance on assessment and mitigation for construction and demolition dust⁵⁴. The Greater London Authority in partnership with the London Councils has also produced a guidance document⁵⁶, which recommends mitigation measures dependent upon the scale of development and its location to control dust from various activities during construction and demolition phases. BRE (Building Research Establishment) has also produced a report⁵⁷, which outlines measures to control the emissions of dust.

Existing Air Quality

- 5.1.61 Gwynedd Council has undertaken LAQM Review and Assessment of air quality for pollutants required under regulations since 1999 within its boundary and currently there are no AQMAs declared. NO₂ diffusion tube monitoring data at 12 locations (see Table 5.1.9) for 2014 provided by the Council show no exceedences of the NO₂ annual mean objectives value of 40µg/m³. The closest NO₂ monitoring site is Bangor (B3), approximately 5km west of the Scheme.
- 5.1.62 During 2013, there was only one automatic monitoring location for PM₁₀ and 12 diffusion tube locations for NO₂. The Progress Report 2014 concluded that all monitoring locations were below the Annual Mean Objective of 40µg/m³ in 2013. The LAQM Progress Report 2013 indicates that the only ambient air quality monitoring carried out by Gwynedd Council was the monitoring of nitrogen dioxide at 12 diffusion tube locations (see Table 5.1.9). Results from diffusion tube monitoring carried out in 2012 show that all monitoring locations apart from one, Site C2 (GCC-002) were below the annual mean objective of 40µg/m³. However, predictions of NO₂ levels to the nearest receptors confirm that there are no relevant public exposures at this location, and this remains the case.
- 5.1.63 The Automatic Urban and Rural Network (AURN) is the UK's largest automatic monitoring network and is the main network used for compliance reporting against the Ambient Air Quality Directives - it includes automatic air quality monitoring stations measuring oxides of nitrogen (NO_x), sulphur dioxide (SO₂), ozone (O₃), carbon monoxide (CO) and particles (PM₁₀ and PM_{2.5}). These sites provide high resolution hourly information which is communicated rapidly to the public, using a wide range of electronic, media and web platforms.
- 5.1.64 The nearest AURN station to the Scheme is the urban background site at Wirral Tranmere. This site measures ozone, nitric oxide, nitrogen dioxide, nitrogen oxides as nitrogen dioxide and PM_{2.5}. In 2014, the annual mean concentrations recorded at this site were 20.5µg/m³ and 1.8µg/m³ respectively for NO₂ and PM_{2.5}, both well below the respective AQS objectives. However, due to the lack of proximity of the monitoring station to the Scheme (it is some

⁵⁶ Greater London Authority and London Councils (2014) The control of dust and emissions from construction and demolition – supplementary planning guidance

⁵⁷ V Kukadia, S Upton, D Hall (2003), Control of dust from construction and demolition activities, BRE Publications

67km to the north-east) monitoring data from this site is not considered to be representative of air quality in the immediate vicinity of the Scheme.

Table 5.1.9 – Diffusion Tube Locations and Distance from the Scheme

Site Name	Co-ordinates		Distance from the Scheme (km)
	X	Y	
GCC/002 Roundabout A487, Caernarfon (C2)	248273	362132	17
GCC/003 Lon Cambell, Caernarfon (C3)	248480	363456	17
GCC/005 Ffordd Bangor, Caernarfon (C5)	248892	364120	16
GCC/008 A4087, Bangor (B3)	257587	371543	5
GCC/011 A5122, Bangor (B5)	256292	371663	7
GCC/012 Faenol Roundabout, Bangor (B6)	254286	368835	9
GCC/013 Bethesda (BETH 1)	261529	367380	5
GCC/015 Llanwnda (LL1)	247770	358663	20
GCC/037 Poolside, Caernarfon (C6)	248022	362757	17
GCC/038 A55, Bangor (B4)	256871	369493	7
GCC/039 A55, Bangor (CO-LOC)	256871	369493	7
GCC/040 Pwllheli (PW1)	237517	335217	45

Background Concentrations

- 5.1.65 Through the application of their PCM model (see paragraph 5.1.49), Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution. The datasets include annual average concentration estimates for NO_x, NO₂, PM₁₀ and PM_{2.5}, using a base year of 2011. The model used is semi-empirical in nature; it uses the National Atmospheric Emissions Inventory emissions to model-predict the concentrations of pollutants at the centroid of each 1km grid square, but then calibrates these concentrations in relation to actual monitoring data.
- 5.1.66 Annual mean background concentrations have been obtained from the Defra published background maps⁵⁸, based on the six 1km grid squares which cover the Scheme and the surrounding area.
- 5.1.67 These background concentrations are the pollutant levels without the contribution of local source *i.e.* the A55(T). The road contributions estimated through the DMRB model are added to this background to obtain total pollutant concentrations. Tables 5.1.10 to 5.1.12 provide the estimated background concentrations used in this assessment for the baseline year (2016), opening year (2018) and future design year (2033). Background concentrations are not available beyond 2030; therefore 2030 background concentrations have been taken as being representative of background concentrations for the future design year of 2033. This represents a conservative approach in terms of background pollutant contributions, as in general the Defra background maps suggest a trend of declining pollutant levels in future years, due to a number of factors including the increased penetration of lower polluting vehicles within the fleet and tighter national limits on emissions attributed to the National Emissions Ceiling Directive (NECD) and other European policies (this is despite the inherent uncertainties associated with future year NO_x and NO₂ predictions – see paragraphs 5.1.34 to 5.1.39).

⁵⁸ Defra Background Maps (2016). <http://laqm.Defra.gov.uk/review-and-assessment/tools/background-maps.html>

Table 5.1.10 – 2016 Background Pollutant Concentrations

Grid Square (E,N)	2016 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)		
	NO ₂	NO _x	PM ₁₀
263500, 372500	5.7	7.3	11.2
264500, 372500	6.4	8.3	10.9
265500, 372500	5.9	7.6	10.9
263500, 371500	5.7	7.3	10.9
264500, 371500	4.5	5.8	10.3
265500, 371500	4.3	5.5	10.2
AQS objective	40.0	-	40.0

Table 5.1.11 – 2018 Background Pollutant Concentrations

Grid Square (E,N)	2018 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)		
	NO ₂	NO _x	PM ₁₀
263500, 372500	5.2	6.7	11.0
264500, 372500	5.8	7.5	10.8
265500, 372500	5.4	6.9	10.7
263500, 371500	5.2	6.6	10.8
264500, 371500	4.2	5.3	10.2
265500, 371500	4.0	5.1	10.1
AQS objective	40.0	-	40.0

Table 5.1.12 – 2033 Background Pollutant Concentrations

Grid Square (E,N)	2033 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) ^a		
	NO ₂	NO _x	PM ₁₀
263500, 372500	4.3	5.4	10.8
264500, 372500	4.6	5.8	10.5
265500, 372500	4.2	5.4	10.5
263500, 371500	4.1	5.2	10.5
264500, 371500	3.5	4.4	9.9
265500, 371500	3.4	4.3	9.8
AQS objective	40.0	-	40.0

^a Background concentrations for 2030 have been taken as being representative of 2033 background concentrations

Magnitude of Impacts and Significance of Effects (before mitigation)

Construction Phase

- 5.1.68 Construction activities are associated with the generation of dust and PM₁₀ emissions. The occurrence of dust will mainly depend on the nature and scale of the work and type of activities undertaken. Although construction activities are a significant contributor to total PM₁₀ emissions in the UK, their contribution to larger particles is even more considerable. These large particles tend to fall out of the atmosphere quickly; therefore, the impacts from dust are most likely to occur within 200m of the dust-generating activity.
- 5.1.69 The proposed construction works may result in the generation of dust and PM₁₀, which could potentially result in loss of amenity and/or adverse impacts on health at nearby sensitive locations.

5.1.70 This assessment of dust/PM₁₀ presents the effects which are likely to be relevant prior to the use of the appropriate mitigation measures on site. As per the IAQM guidance³⁴, the risk associated with the site to potentially generate dust/PM₁₀ is identified. Potential unmitigated effects at receptor locations are determined and site-specific recommendations are then made to ensure residual dust/PM₁₀ effects associated with the construction phase are not significant.

Demolition

5.1.71 Potential sources of impacts associated with demolition activities include fugitive dust/PM₁₀ emissions resulting from the removal of the existing road pavement by demolition plant, and any on-site crushing and screening that may take place. The total volume of material to be removed (*i.e.* the existing A55(T) road surface and sub-surface) may exceed 50,000m³. The dust emission magnitude for demolition is therefore considered to be **large**.

Earthworks

5.1.72 Potential sources of impacts associated with earthworks/ground preparation activities include fugitive dust/PM₁₀ emissions resulting from disturbance of dusty materials during site preparation and levelling, vehicle movements and wind action. The total material moved as part of the earthworks/ground preparation activities may exceed 100,000 tonnes and involve the formation of earth bunds. The total site area is greater than 10,000m². The dust emission magnitude for earthworks is therefore considered to be **large**.

Construction

5.1.73 Potential sources of impacts associated with construction activities include fugitive dust/PM₁₀ emissions resulting from disturbance of dusty materials by construction plant, the construction materials used, vehicle movements and wind action. Construction activities include the construction of the new A55(T), with a total volume between 25,000 and 100,000m³, and the use of potentially dusty construction materials (*e.g.* aggregates) that has a moderate potential for dust release. The dust emission magnitude for construction is therefore considered to be **medium**.

Trackout

5.1.74 Dust emissions during trackout from the site may occur from the transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The number of predicted outward HDV (*i.e.* >3.5 tonne) movements in any one day is likely to be somewhere between 10 and 50 and the approximate unpaved on-site road length is likely to be between 50m and 100m. The dust emission magnitude for trackout is therefore considered to be **medium**.

Summary

5.1.75 The dust emission magnitude for the four activities are summarised in Table 5.1.13.

Table 5.1.13 – Construction Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Large
Earthworks	Large
Construction	Medium
Trackout	Medium

Sensitivity of the Area

5.1.76 There are a number of residential properties (1-10) within 20m of the Scheme, which are located along the A55(T) between Tai'r Meibion and Abergwyngregyn (*e.g.* 2 Bryn-Meddyg, Abergwyngregyn and The Old School). The sensitivity of the area with respect to dust soiling

effects on people and property in relation to demolition, earthworks and construction activities is therefore **medium**.

5.1.77 There are a number of residential properties (1-10) within 50m from the public highway within 500m from the site entrance(s) on the A55(T) between Tai'r Meibion and Abergwyngregyn. The sensitivity of the area with respect to dust soiling effects on people and property in relation to trackout is therefore **low**.

5.1.78 The existing annual mean background PM₁₀ concentration is no greater than 13.1µg/m³ ⁵⁹, which is classified as 'well below' the annual objective. Given the above information regarding the number of receptors within proximity to the site boundary and within proximity to the site entrance(s) on the public highway, the sensitivity of the area with respect to human health impacts in relation to demolition, earthworks, construction and trackout is therefore **low**.

5.1.79 A summary of the sensitivity of the surrounding area is detailed in Table 5.1.14.

Table 5.1.14 – Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Low
Human Health	Low	Low	Low	Low

Risk of Dust Impacts

5.1.80 The risk of dust impacts is defined using Tables 6 to 9 in the IAQM guidance³⁴ for demolition, earthworks, construction and trackout respectively. The dust emission magnitude classes in Table 5.1.13 combined with the sensitivity of surrounding area classes in Table 5.1.14, result in the site risk categories shown in Table 5.1.15.

Table 5.1.15 – Summary of Dust/PM₁₀ Risk

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	Medium	Medium	Low
Human Health	Medium	Low	Low	Low

5.1.81 Following the construction dust assessment, in the absence of any mitigation the Scheme is found to be **high** risk from demolition and **medium** risk from earthworks and construction, and **low** from trackout activities in relation to dust soiling effects on people and property, as shown in Table 5.1.15. The risk in relation to human health impacts is **medium** from demolition and **low** from earthworks, construction and trackout activities, as also shown in Table 5.1.15.

Operational Phase

Assessment of Particulate Matter (PM₁₀)

5.1.82 Table 5.1.16 presents the annual mean PM₁₀ concentrations predicted at the assessed receptor locations for the 2016 BC, 2018 DM and 2018 DS scenarios, and the resultant magnitude of change and impact significance in accordance with DMRB guidance.

⁵⁹ Source: Defra background map estimate for 2015 for grid square 266500, 373500

Table 5.1.16 – Predicted 2018 Annual Mean PM₁₀ Concentrations Associated with Emissions from Road Traffic

Receptor ID (see Figure 5.1.2)	Annual Mean PM ₁₀ (µg/m ³)					% 2018 DS of AQS Objective	Magnitude of Change	Impact Significance
	AQS Objective	2016 BC	2018 DM	2018 DS	% Change 2018 DM vs 2018 DS			
1	40	12.5	12.3	12.9	1.5%	32.3%	Small	Negligible
2	40	11.4	11.2	11.3	0.3%	28.3%	Imperceptible	Negligible
3	40	12.0	11.8	12.2	1.0%	30.5%	Small	Negligible
4	40	11.7	11.6	11.9	0.8%	29.8%	Imperceptible	Negligible
5	40	11.6	11.5	11.8	0.8%	29.5%	Imperceptible	Negligible
6	40	11.3	11.1	11.3	0.5%	28.3%	Imperceptible	Negligible
7	40	12.5	12.3	12.9	1.5%	32.3%	Small	Negligible
8	40	11.0	10.9	10.9	<0.1%	27.3%	Imperceptible	Negligible
9	40	13.0	12.8	13.6	2.0%	34.0%	Small	Negligible

5.1.83 The maximum predicted annual mean PM₁₀ concentration with the Scheme in place (2018 DS) was at 'Receptor 9' (Bryn Meddyg; see Figure 5.1.2) with a predicted concentration of 13.6µg/m³; this represents 34.0% of the 40µg/m³ annual mean AQS objective. This receptor also represents the location where the greatest increase in annual mean PM₁₀ concentrations due to the Scheme was predicted, with a 0.8µg/m³ (2.0%) increase in 2018 DS relative to 2018 DM.

5.1.84 Table 5.1.17 presents the annual mean PM₁₀ concentrations predicted at the assessed receptor locations for the 2016 BC, 2033 DM and 2033 DS scenarios, and the resultant magnitude of change and impact significance in accordance with DMRB guidance.

Table 5.1.17 – Predicted 2033 Annual Mean PM₁₀ Concentrations Associated with Emissions from Road Traffic

Receptor ID (see Figure 5.1.2)	Annual Mean PM ₁₀ (µg/m ³)					% 2033 DS of AQS Objective	Magnitude of Change	Impact Significance
	AQS Objective	2016 BC	2033 DM	2033 DS	% Change 2033 DM vs 2033 DS			
1	40	12.5	12.1	12.8	1.8%	32.0%	Small	Negligible
2	40	11.4	11.0	11.0	<0.1%	27.5%	Imperceptible	Negligible
3	40	12.0	11.6	12.1	1.3%	30.3%	Small	Negligible
4	40	11.7	11.4	11.7	0.7%	29.3%	Imperceptible	Negligible
5	40	11.6	11.2	11.6	1.0%	29.0%	Small	Negligible
6	40	11.3	10.9	11.0	0.2%	27.5%	Imperceptible	Negligible
7	40	12.5	12.1	12.8	1.8%	32.0%	Small	Negligible
8	40	11.0	10.6	10.7	0.2%	26.8%	Imperceptible	Negligible
9	40	13.0	12.7	13.6	2.3%	34.0%	Small	Negligible

5.1.85 The maximum predicted annual mean PM₁₀ concentration with the Scheme in place (2033 DS) was at 'Receptor 9' (Bryn Meddyg) with a predicted concentration of 13.6µg/m³; this

represents 34.0% of the 40µg/m³ annual mean AQS objective. This receptor also represents the location where the greatest increase in annual mean PM₁₀ concentrations due to the Scheme was predicted, with a 0.9µg/m³ (2.3%) increase in 2033 DS relative to 2033 DM.

5.1.86 In accordance with DMRB guidance, the magnitude of change due to the Scheme upon annual mean PM₁₀ concentrations at all assessed existing receptor locations is considered to be no greater than small, for both the 2018 and 2033 assessment scenarios. Effects associated with annual mean PM₁₀ exposure from road traffic emissions at all assessed existing receptor locations are therefore considered to be **negligible**.

5.1.87 The annual mean PM₁₀ concentration predicted at all the assessed existing receptor locations in the baseline year (2016), the opening year (2018) and the future design year (2033) were no greater than 13.6µg/m³, as shown in Tables 5.1.16 and 5.1.17. At such low concentrations, the empirical relationship provided in LAQM.TG(16)³³ to predict short-term PM₁₀ impacts from the annual mean PM₁₀ concentration is no longer applicable; this is due to the equation (see paragraphs 5.1.31 to 5.1.33) providing erroneous results when applied to annual mean PM₁₀ concentrations below 14.8µg/m³. Therefore, the number of exceedences of the 24-hour PM₁₀ 50µg/m³ AQS objective at any of the existing receptor locations is considered to be <1 for all of the assessed receptors. This is well below the 35 permitted exceedences, and therefore short-term PM₁₀ exposure from road traffic emissions at all assessed existing receptor locations is considered to be **negligible**.

Assessment of Nitrogen Dioxide (NO₂)

5.1.88 Table 5.1.18 presents the annual mean NO₂ concentrations predicted at the assessed receptor locations for the 2016 BC, 2018 DM and 2018 DS scenarios, and the resultant magnitude of change and impact significance in accordance with DMRB guidance.

Table 5.1.18 – Predicted 2018 Annual Mean NO₂ Concentrations Associated with Emissions from Road Traffic

Receptor ID (see Figure 5.1.2)	Annual Mean NO ₂ (µg/m ³)					% 2018 DS of AQS Objective	Magnitude of Change	Impact Significance
	AQS Objective	2016 BC	2018 DM	2018 DS	% Change 2018 DM vs 2018 DS			
1	40	14.3	14.2	15.1	2.3%	37.8%	Small	Negligible
2	40	6.8	6.7	6.8	0.2%	17.0%	Imperceptible	Negligible
3	40	12.1	12.0	12.7	1.8%	31.8%	Small	Negligible
4	40	10.8	10.6	11.2	1.5%	28.0%	Small	Negligible
5	40	10.1	10.0	10.5	1.3%	26.3%	Small	Negligible
6	40	8.1	8.0	8.2	0.5%	20.5%	Imperceptible	Negligible
7	40	14.8	14.7	15.6	2.3%	39.0%	Small	Negligible
8	40	6.7	6.6	6.7	0.3%	16.8%	Imperceptible	Negligible
9	40	18.0	17.8	19.0	3.0%	47.5%	Small	Negligible

5.1.89 The maximum predicted annual mean NO₂ concentration with the Scheme in place (2018 DS) was at 'Receptor 9' (Bryn Meddyg) with a predicted concentration of 19.0µg/m³; this represents 47.5% of the 40µg/m³ annual mean AQS objective. This receptor also represents the location where the greatest increase in annual mean NO₂ concentrations due to the Scheme was predicted, with a 1.2µg/m³ (3.0%) increase in 2018 DS relative to 2018 DM.

5.1.90 Table 5.1.19 presents the annual mean NO₂ concentrations predicted at the assessed receptor locations for the 2016 BC, 2033 DM and 2033 DS scenarios, and the resultant magnitude of change and impact significance in accordance with DMRB guidance.

Table 5.1.19 – Predicted 2033 Annual Mean NO₂ Concentrations Associated with Emissions from Road Traffic

Receptor ID (see Figure 5.1.2)	Annual Mean NO ₂ (µg/m ³)					% 2033 DS of AQS Objective	Magnitude of Change	Impact Significance
	AQS Objective	2016 BC	2033 DM	2033 DS	% Change 2033 DM vs 2033 DS			
1	40	14.3	13.3	14.2	2.3%	35.5%	Small	Negligible
2	40	6.8	6.2	6.3	0.2%	15.8%	Imperceptible	Negligible
3	40	12.1	11.2	11.9	1.8%	29.8%	Small	Negligible
4	40	10.8	9.9	10.5	1.5%	26.3%	Small	Negligible
5	40	10.1	9.3	9.8	1.3%	24.5%	Small	Negligible
6	40	8.1	7.4	7.6	0.5%	19.0%	Imperceptible	Negligible
7	40	14.8	13.7	14.7	2.5%	36.8%	Small	Negligible
8	40	6.7	6.1	6.2	0.3%	15.5%	Imperceptible	Negligible
9	40	18.0	16.6	17.9	3.2%	44.8%	Small	Negligible

5.1.91 The maximum predicted annual mean NO₂ concentration with the Scheme in place (2033 DS) was at 'Receptor 9' (Bryn Meddyg; see Figure 5.1.2) with a predicted concentration of 17.9µg/m³; this represents 44.8% of the 40µg/m³ annual mean AQS objective. This receptor also represents the location where the greatest increase in annual mean NO₂ concentrations due to the Scheme was predicted, with a 1.3µg/m³ (3.2%) increase in 2033 DS relative to 2033 DM.

5.1.92 In accordance with DMRB guidance, the magnitude of change due to the Scheme upon annual mean NO₂ concentrations at all assessed existing receptor locations is considered to be no greater than small, for both the 2018 and 2033 assessment scenarios. Effects associated with annual mean NO₂ exposure from road traffic emissions at all assessed existing receptor locations are therefore considered to be **negligible**.

5.1.93 The empirical relationship provided in LAQM.TG(16)³³ states that exceedences of the 1-hour mean AQS objective for NO₂ are only likely to occur where annual mean concentrations are 60µg/m³ or above. Annual mean NO₂ concentrations at all assessed receptor locations are well below this limit for all of the assessed scenarios, and therefore exceedences of the 1-hour mean AQS objective for NO₂ are not considered likely. Short-term NO₂ exposure from road traffic emissions at all assessed existing receptor locations are therefore considered to be **negligible**.

5.1.94 Considering the predicted PM₁₀ and NO₂ impacts associated with the Scheme, as discussed above, and the factors presented in paragraph 5.1.45, the overall impact of the operational phase of the Scheme on local air quality is assessed as **not significant**.

Assessment of Carbon Dioxide (CO₂)

5.1.95 Table 5.1.20 presents the predicted carbon emissions for the base and future year scenarios. For the calculation of carbon emissions a road length of 2.2km has been assumed. All inputs to the regional DMRB model are the same as those used in the local DMRB model for the purposes of estimating air pollutant concentrations. The percentage changes of all the

scenarios relative to the 2016 baseline, and between the DM and DS scenarios, are provided in Table 5.1.21.

Table 5.1.20 – Predicted Carbon Emissions

	2016 BC	2018 DM	2018 DS	2033 DM	2033 DS
Total Carbon Emissions (tonnes/year)	1,725	1,735	1,917	1,896	2,102

Table 5.1.21 – Percentage Change in Carbon Emissions

% Change relative to 2016 BC				% Change 2018 DM vs 2018 DS	% Change 2033 DM vs 2033 DS
2018 DM	2018 DS	2033 DM	2033 DS		
0.6%	11.2%	9.9%	21.9%	10.5%	10.9%

5.1.96 Based on the traffic input data used in this assessment, the calculation results show that carbon emissions will increase in all the scenarios relative to the baseline year, 2016. The increase could be attributed to either the increase in traffic flows and/or the traffic speed in future years resulting in higher emissions. Compared to the 2016 BC, 2018 DM shows an imperceptible increase in carbon emissions (0.4%). 2018 DS, 2033 DM and 2033 DS show increases of approximately 11.2%, 9.9% and 21.9% respectively compared to the 2016 BC. Both the 2018 DS and 2033 DS scenarios show an increase of approximately 11% relative to their equivalent DM scenarios. The increases in carbon emissions in the DS scenarios relative to the DM scenarios are attributable to the increase in vehicle speeds that is a consequence of the proposed road improvements.

Proposed Mitigation Measures

Construction Period

5.1.97 Construction impacts associated with the Scheme would result in the generation of dust and PM₁₀. However, employment of construction best practice (to be implemented via a Construction Environmental Management Plan, CEMP - see Chapter 7) would be expected to ensure that no significant adverse dust or PM₁₀ impacts would occur during the construction process.

5.1.98 The IAQM guidance⁶⁰ outlines a number of site-specific mitigation measures based on the assessed site risks (see Table 5.1.15), which would be included within the CEMP. The measures are grouped into those which are highly recommended (*i.e.* considered to be essential mitigation measures for the purposes of this ES) and those which are desirable.

5.1.99 As the site is classed as **High Risk** with regards to the potential for dust soiling during on-site activities, the following mitigation measures are highly recommended:

- With respect to communications:
 - Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
 - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary.

⁶⁰ Institute of Air Quality Management (IAQM) (2014) Guidance on the assessment of dust from demolition and construction.

- Display the head or regional office contact information.
- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
- With respect to site management:
 - Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
 - Make the complaints log available to the local authority when asked.
 - Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.
 - Hold regular liaison meetings with other any high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport deliveries which might be using the same strategic road network routes.
- With respect to monitoring:
 - Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
 - Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
 - Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- With respect to preparing and maintaining the site:
 - Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
 - Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
 - Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
 - Avoid site runoff of water or mud.
 - Keep site fencing, barriers and scaffolding clean using wet methods.
 - Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
 - Cover, seed or fence stockpiles to prevent wind whipping.
- With respect to operating vehicles/machinery and sustainable travel:
 - Ensure all vehicles switch off engines when stationary - no idling vehicles.
 - Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan that supports and encourages sustainable travel, *i.e.* car-sharing.
- With respect to operations:
 - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
 - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
 - Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
 - Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- With respect to waste management:
 - Avoid bonfires and burning of waste materials.

5.1.100 As the site is classed as **High Risk** for Demolition the following mitigation measures are highly recommended:

- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

5.1.101 As the site is classed as **Medium Risk** for Earthworks the following mitigation measures are desirable:

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

5.1.102 As the site is classed as **Medium Risk** for Construction the following mitigation measure is highly recommended:

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

5.1.103 Additionally, as the site is classed as **Medium Risk** for Construction the following mitigation measures are desirable:

- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

5.1.104 As the site is classed as **Low Risk** for Trackout the following mitigation measures are desirable:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

5.1.105 Through adopting these measures and being mindful of changing weather patterns, especially prolonged dry periods, the dust nuisance associated with the Scheme would be limited.

Mitigation during the Operational Phase

5.1.106 Given that the aim of the Scheme is for increased safety standards rather than increased capacity on the section of the A55(T), and that all air quality impacts during the operational phase have been identified to be **not significant**, long-term scheme-specific mitigation measures are not considered necessary.

Magnitude of Impacts and Significance of Effects (after mitigation)

Construction Impacts

5.1.107 Provided that the mitigation measures outlined above are initiated to reduce the levels of airborne dust and particulates generated by site activities, all residual air quality impacts during the construction period are considered to be **not significant**.

Operational Impacts

5.1.108 The Scheme would not result in any significant changes to local air quality during its operation, either beneficial or adverse, and no mitigation measures are required. This is largely because the aim of the scheme is increased safety rather than increased capacity, and traffic growth is not predicted to increase in future years above that expected from normal growth. All residual air quality impacts during the operational phase of the Scheme are considered to be **not significant**.

Summary

Construction Effects

5.1.109 It is inevitable that a degree of airborne dust and PM₁₀ would be generated during the construction period. However this would be temporary, lasting the duration of the construction period only and, providing the recommended mitigation measures as defined are implemented, potential adverse impacts during the construction period would be minimised.

Operational Effects

5.1.110 Based on the data, methodology and assumptions applied and results obtained, the conclusions of the operational assessment are summarised as:

- All the objectives for NO₂ and PM₁₀ are likely to be achieved at all nearby receptors for the assessment years 2018 and 2033, following completion of the Scheme; and,
- As a result of changes to traffic due to operation of the Scheme, there would be negligible increases in predicted NO₂ and PM₁₀ concentrations. Associated adverse impacts are no greater than negligible.
- The assessment shows an increase of carbon emissions for the 2018 and 2033 scenarios relative to the baseline year of 2016, in part due to the predicted traffic growth in the intervening years. Both the 2018 Do Something and 2033 DS scenarios show an increase of approximately 11% relative to their equivalent Do Minimum scenarios; these predicted increases are attributable to the increase in vehicle speeds that is a consequence of the proposed road improvements.

5.1.111 In conclusion, the assessment has demonstrated that all air quality impacts associated with the Scheme can be considered to be **not significant**, and therefore local air quality impacts are not considered to be a constraint to the Scheme. The Scheme is therefore not expected to hinder the objectives, policies and plans relating to Air Quality identified in the Regulatory/Policy Framework section of this chapter.

5.2 CULTURAL HERITAGE

Introduction

- 5.2.1 This chapter summarises the effects of the Scheme on Cultural Heritage and Archaeology. The scope of the assessment has encompassed standing monuments, buried archaeology and areas of heritage value including historic landscapes, parks and gardens and Conservation Areas.
- 5.2.2 Development can result in adverse effects to known and undiscovered archaeological remains and can negatively affect the setting of sensitive features including Scheduled Monuments (SMs), Listed Buildings and Conservation Areas.
- 5.2.3 The aim of this chapter is to outline the cultural heritage and archaeological features that are present within the study area, identify potential impacts that could occur to them as a result of the Scheme, explain mitigation measures proposed to avoid or reduce such effects and summarise any residual effects remaining.

Methodology

Standards and Guidance

- 5.2.4 The following standards and guidance have been used to complete the Cultural Heritage assessment - further explanation of the methods adopted is also provided in this section:
- Design Manual for Roads and Bridges HA208/07, Volume 11, Section 3, Part II: HA 208/07 (Highways Agency *et al*, 2007);
 - Conservation Principles for the sustainable management of the historic environment in Wales (Cadw, 2011);
 - Chartered Institute for Archaeologists Code of Conduct (2014);
 - Chartered Institute for Archaeologists Standard and Guidance for historic desk-based assessment (2014);
 - Circular 61/96 – Planning and the Historic Environment: Historic Buildings and Conservation Areas (Welsh Office, 1996);
 - Circular 60/96 - Planning and the Historic Environment: Archaeology (Welsh Office, 1996), and;
 - Consultation on proposals for secondary legislation to support the Historic Environment (Wales) Act 2016 and various best practice guidance documents Annex 6: Draft Setting of Historic Assets (Welsh Government, 2016).

Heritage Desk-based Assessment and Field Survey of 300m Study Area

- 5.2.5 The assessment was carried out in accordance with the methodology contained within the DMRB Volume 11, Section 3, Part 2 Cultural Heritage, HA208/07 as described below. This guidance divides cultural heritage into three sub-topics:
1. Archaeological Remains – the material remains of human activity from the earliest periods of human evolution to the present. These may be buried traces of human activities, sites visible above ground, or moveable artefacts. Archaeological Remains can encompass the remains of buildings, structures, earthworks and landscapes; human, animal or plant remains, or other organic material produced by or affected by human activities, and their settings (HA 208/07, Annex 5, para 5.1.1);
 2. Historic Buildings – ‘architectural or designed or other structures with a significant historical value’. These may include structures that have no aesthetic appeal or structures not usually thought of as ‘buildings’, such as milestones or bridges (HA 208/07, para 2.5), and;

3. Historic Landscape – the current landscape, whose character is the result of the action and interaction of natural and/or human factors (HA/208/07, Annex 7, para. 7.1.2). The evidence of past human activities is a significant part of the Historic Landscape and may derive both from archaeological remains and historic buildings within it.
- 5.2.6 A 300m study area (see Figure 5.2.1, Volume 1a) was defined along the length of the Scheme between Junction 13 (NGR SH62977173) and Junction 12 (NGR SH65067263). The assessment is summarised in this chapter (see Technical Appendix A, Volume 2 for the full heritage desk-based assessment). The following sources were consulted for the purposes of the heritage desk-based assessment (HDBA):
- The regional Historic Environment Register (HER); this included an examination of the core HER, and secondary information held within the record including reports, pre-Ordnance Survey and historic Ordnance Survey mapping (including the 1:2500 County Series maps).
 - The National Monuments Record of Wales (Aberystwyth) was checked for sites additional to the HER.
 - The inventories of the Royal Commission on Ancient and Historical Monuments for Wales and works held within the regional libraries and the University of Wales; Bangor library were examined.
 - Indices to relevant journals, including county history and archaeological society journals and national society journals such as *Archaeologia Cambrensis* were checked.
 - Information about Listed Buildings and Scheduled Monuments was obtained from Cadw: Welsh Historic Monuments;
 - The Central Register of Aerial Photography for Wales (Aerial Photographs Unit, Welsh Government, Crown Offices, Cathays Park, Cardiff), was checked for pre-afforestation RAF aerial photographs.
- 5.2.7 Field surveys involving site walkovers were previously carried out in good weather on 1st April and 22nd October 2008 and were updated for the current assessment on 22nd June 2015. The aim of this work was to:
- verify the results of the HDBA;
 - identify any further archaeological sites which may exist as above ground features, and;
 - photograph and record the present condition of all sites noted.
- Archive material consulted during the desktop study provided some dating evidence for known sites, and maps of successive dates made it possible to understand how the landscape had developed. Ordnance Survey map coverage of the area was good. The tithe maps (1839 and 1848) provided some additional information although the fields are not noted in detail, rather as blocks of land ownership. The location of sites described in the text are shown on Figure 5.2.1, Volume 1a.
- 5.2.8 The HDBA made recommendations for trial trenching prior to any other work on site, for two sites of unknown, but potentially high, archaeological value that lie within the scheme footprint and may be directly affected by it; the medieval Township at Wig (Asset Number 27) and the Canovium (Caerhun) - Segontium (Caernarfon) Roman Road (Asset Number 30). After discussion with GAPS, it was decided that instead of Asset Number 30, another, potentially more easily locatable, stretch of the same Roman Road should be targeted; the Canovium - Segontium Roman Road to the south of Tai'r Meibion (Asset Number 12).
- 5.2.9 Archaeological trial trenching was undertaken at the two sites in June 2016. Four trial trenches (three at Wig Farm and one at Tai'r Meibion Farm) were excavated with an 8 tonne

mechanical excavator under archaeological supervision down to the natural drift geological levels. The trenches at Wig Farm were located to identify the location, nature and degree of survival of features related to medieval settlement. The trench at Tai'r Meibion was placed to identify the exact location and degree of survival of the Canovium - Segontium Roman Road. See Technical Appendix A, Volume 2 for the full Trial Trenching Report.

Assigning value to features

5.2.10 Each of the cultural heritage assets identified during the desk-based assessment of the 300m study area was assigned a ranked value according to the criteria provided in the DMRB, Volume 11, Section 3, Part 2, Chapter 5, Sections 5.25 - 5.44 (HA 208/07), which range on a six-point scale of Very High, High, Medium, Low, Negligible and Unknown for the three cultural heritage sub-topics of archaeological remains, historic buildings and historic landscapes (see Tables 5.2.1-3). The assessment of value was based on professional judgement. The value of an archaeological asset refers to both the physical remains and information inherent in the site. If a site is excavated in advance of destruction the physical remains will be destroyed but the information will have been retained. This is termed "Preservation of Archaeological Remains by Record" in Planning and the Historic Environment: Archaeology (Welsh Office Circular 60/96). It should be noted that even though this is seen as a valid mitigation measure, preservation *in situ* is the preferred option.

Table 5.2.1: Criteria to assess the value of archaeological remains

Value	Criteria
Very High	<ul style="list-style-type: none"> World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives.
High	<ul style="list-style-type: none"> Scheduled Monuments (including proposed sites). Undesignated assets of schedulable quality and importance. Assets that can contribute significantly to acknowledged national research objectives.
Medium	<ul style="list-style-type: none"> Designated or undesignated assets that contribute to regional research objectives.
Low	<ul style="list-style-type: none"> Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest.
Unknown	The sensitivity of the site has not been ascertained.

Table 5.2.2: Criteria to assess the value of historic buildings

Value	Criteria
Very High	<ul style="list-style-type: none"> Structures inscribed as of universal importance as World Heritage Sites. Other buildings of recognised international importance.
High	<ul style="list-style-type: none"> Scheduled Monuments with standing remains. Grade I and Grade II* Listed Buildings. Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade. Conservation Areas containing very important buildings. Undesignated structures of clear national importance.
Medium	<ul style="list-style-type: none"> Grade II Listed Buildings. Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations.

	<ul style="list-style-type: none"> • Conservation Areas containing buildings that contribute significantly to its historic character. • Historic Townscape or built-up areas with important historic integrity in their buildings, or built settings (e.g. including street furniture and other structures).
Low	<ul style="list-style-type: none"> • 'Locally Listed' buildings. • Historic (unlisted) buildings of modest quality in their fabric or historical association. • Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (e.g. including street furniture and other structures).
Negligible	Buildings of no architectural or historical note; buildings of an intrusive character.
Unknown	Buildings with some hidden (i.e. inaccessible) potential for historic significance.

Table 5.2.3: Criteria to assess the value of historic landscapes

Value	Criteria
Very High	<ul style="list-style-type: none"> • World Heritage Sites inscribed for their historic landscape qualities. • Historic landscapes of international value, whether designated or not. • Extremely well preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s).
High	<ul style="list-style-type: none"> • Designated historic landscapes of outstanding interest. • Undesignated landscapes of outstanding interest. • Undesignated landscapes of high quality and importance, and of demonstrable national value. • Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	<ul style="list-style-type: none"> • Designated special historic landscapes. • Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value. • Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s).
Low	<ul style="list-style-type: none"> • Robust undesignated historic landscapes. • Historic landscapes with importance to local interest groups. • Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations.
Negligible	Landscapes with little or no significant historical interest.

Assigning magnitude of impact

- 5.2.11 The magnitude of impact of the Scheme on a cultural heritage asset is the degree of change that would be experienced by the asset and its setting if the Scheme were to be completed compared to a 'do nothing' scenario. The magnitude of impact was assigned on a five-point scale of Major, Moderate, Minor, Negligible, and No Change using the criteria provided in HA208/07 (see Tables 5.2.4-6).

Table 5.2.4: Factors in the Assessment of Magnitude of Impacts: Archaeological Remains

Value	Criteria
Major	Change to most or all key archaeological materials, such that the resource is totally altered. Comprehensive changes to setting.
Moderate	Changes to many key archaeological materials, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset
Minor	Changes to key archaeological materials, such that the asset is slightly altered.

	Slight changes to setting
Negligible	Very minor changes to archaeological materials, or setting
No Change	No change

Table 5.2.5: Factors in the Assessment of Magnitude of Impacts: Historic Buildings

Value	Criteria
Major	Change to key historic building elements, such that the resource is totally altered. Comprehensive changes to the setting.
Moderate	Change to many key historic building elements, such that the resource is significantly modified. Changes to the setting of an historic building, such that it is significantly modified.
Minor	Change to key historic building elements, such that the asset is slightly different. Change to setting of an historic building, such that it is noticeably changed.
Negligible	Slight changes to historic buildings elements or setting that hardly affect it
No Change	No change to fabric or setting.

Table 5.2.6: Factors in the Assessment of Magnitude of Impacts: Historic Landscapes

Value	Criteria
Major	Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit.
Moderate	Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character.
Minor	Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access: resulting in limited changes to historic landscape character.
Negligible	Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character.
No Change	No change to elements, parcels or components; no visual or audible changes; no changes arising from in amenity or community factors.

Assigning significance of effect

- 5.2.12 The significance of the effect of the Scheme on a cultural heritage asset is assessed in terms of the magnitude of the impact arising from the Scheme in relation to the value or sensitivity of the receptor. This is determined using the matrix shown in Table 5.2.7, as derived from HA208/07.

**Table 5.2.7: Matrix used to assign significance of effect for Cultural Heritage features
 (source: HA208/07)**

Archaeological Importance	Very High	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Moderate or large	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Moderate or slight
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight
		No Change	Negligible	Minor	Moderate	Major
	Magnitude of Impact					

Historic Landscape assessment

- 5.2.13 The Scheme falls within the Dyffryn Ogwen and North Arllechwedd Landscapes of Outstanding Historic Interest, as set out in the ICOMOS/Cadw/Countryside Council for Wales Register of Landscapes of Outstanding Historic Interest in Wales (Cadw/ICOMOS, 1998; Dyffryn Ogwen HLW (Gw) 10, No. 28 and North Arllechwedd HLW (Gw) 12, No. 30) (see Figure 5.2.2, Volume 1a). Detailed guidance on the use of the Register is provided in the *Guide to Good Practice on Using the Register of Landscapes of Historic Interest in Wales in the Planning and Development Process*, revised (2nd) edition, Cadw, 2007 (“*Guide to Good Practice*”).
- 5.2.14 The Scheme involves a transport improvement scheme, which therefore requires an Assessment of the Significance of the Impact of Development on Historic Landscape Areas on the Register of Landscapes of Historic Interest in Wales (commonly referred to as an ASIDOHL2). An ASIDOHL2 report has been completed and is available as a separate document (see Technical Appendix A, Volume 2). Two different assessment criteria and methodologies (ASIDOHL2 and DMRB for the HDBA) have therefore been used to evaluate the impact of the development on the historic landscape and the results are summarised in this chapter (see Technical Appendix A, Volume 2 for the full ASIDOHL2 and DMRB reports). Landscape impacts of the Scheme are also reported in Chapter 5.3 (Landscape).
- 5.2.15 The two studies have produced slightly differing yet comparable results. For example, the impact of the scheme on the Very High Value HLCA 31 Lowland Coastal Area around Wig is assessed as Medium in the ASIDOHL2 and the Overall Significance of Impact as Moderate. The impact of the scheme on the High Value HDBA Asset Number 24 (Enclosed Fields S and E of Tai'r Meibion), a part of HLCA 31 directly physically impacted by the scheme, is Moderate and the Significance of Effect Moderate Adverse prior to mitigation. The DRMB methodology also assesses the Significance of Effect taking into account mitigation,

ASIDOHL2 does not. The concluding Significance of Effect of the scheme on Asset 24 with mitigation is thus reduced to Moderate/Slight Adverse in the HDBA. In both studies, the recommended mitigation for minimising the impact on affected landscapes is the same: the replacement or reinstatement of any affected boundary features, trees and hedgerows.

Assessment of Impact on setting of Registered Historic Parks and Gardens, Scheduled Monuments and Listed Buildings within 2km of the Scheme

- 5.2.16 In addition to the DMRB assessment of the heritage assets discussed previously, Cadw requested that the impact of the Scheme on the settings of Registered Historic Parks and Gardens, Scheduled Monuments and Listed Buildings outside of the 300m study area, but within 2km of the Scheme, was appraised.
- 5.2.17 This assessment was conducted in accordance with the draft guidance set out in *Consultation on proposals for secondary legislation to support the Historic Environment (Wales) Act 2016 and various best practice guidance documents: Annex 6: Draft Setting of Historic Assets in Wales* (Welsh Government, 2016).
- 5.2.18 The scope and scale of the proposals as an improvement to an existing trunk road determined the aspects of impact on setting of historic assets that were considered. It is not expected that the scheme would result in an increase in traffic and hence noise levels, when compared to the existing road. Nor would the scheme dominate or detract from our ability to understand an historic asset when compared to the impact on this aspect of setting resulting from the existing road.
- 5.2.19 The assessment of the impact on setting of all Registered Historic Parks and Gardens, Scheduled Monuments and Listed Buildings lying within 2km of the Scheme was conducted as a three phase process:
- Phase 1: All Registered Parks and Gardens, Scheduled Monuments and Listed Buildings within 2km of the Scheme, but outside the 300m study area, were identified. The sites identified to be included were agreed with Cadw.
 - Phase 2: A digital terrain model (DTM) of the scheme location and surrounding area at a resolution of 2m was constructed in a Geographic Information System (GIS). The DTM enabled the calculation of simulated viewsheds⁶¹ within the GIS. Viewsheds over the scheme footprint for an observer height of 1.8m were calculated from the locations of all identified Historic Parks and Gardens, Scheduled Monuments and Listed Buildings that lie beyond the 300m and within the 2km study areas in order to identify assets whose settings were likely to be affected by the visual impact of the scheme.
 - Phase 3: The visual impact on the settings of the Registered Historic Parks and Gardens, Scheduled Monuments and Listed Buildings identified during viewshed analyses as having views over the scheme, was further assessed by a combination of field visits, reference to aerial photography and where coverage allowed, analysis of Google Street View. Field visits were carried out on 2nd August 2016. A sample of sites with negative results was tested by field visit to assess the reliability of the viewsheds.
- 5.2.20 In accordance with the draft guidance⁶², the impact of the development on the setting of the historic asset was then assessed as positive, neutral or negative. For examples of the considerations taken into account when assessing impact see Table 5.2.8. In addition to considerations set out in the draft guidance, the examples in Table 5.2.8 also draw upon

⁶¹ A viewshed is the extent of a geographical area visible from a given point in the landscape.

⁶² Consultation on proposals for secondary legislation to support the Historic Environment (Wales) Act 2016 and various best practice guidance documents: Annex 6: Draft Setting of Historic Assets in Wales (Welsh Government, 2016).

setting impact assessment considerations provided in relevant English Heritage⁶³ and Historic Environment Scotland⁶⁴ guidance documents. Positive or negative impacts are also described as severe, moderate, slight and very slight as recommended in the draft guidance (see Table 5.2.9). The draft guidance does not specify criteria for the assessment of the severity of the impact and the assessment criteria used are therefore based on the criteria for assessing the magnitude of impact on the setting of archaeological remains and historic buildings as set out in DMRB (HA208/07), see Tables 5.2.4 – 5.2.5. As stated in the draft guidance, depending on the level of impact, especially if it is severe or moderate, mitigation measures to reduce the negative impact of the proposals will also be considered.

Table 5.2.8: Examples of negative and positive impacts on the setting of historic assets within 2km of the Scheme

Impact	Example
Negative	<ul style="list-style-type: none"> • The Scheme causes an interruption of key views to or from the historic asset. • The Scheme causes a negative visual impact relative to the scale of the historic asset and its setting. • The Scheme would dominate the historic asset or detract from our ability to understand and appreciate it, including for example its functional or physical relationship with the surrounding landscape and associated structures. • The Scheme compares unfavourably with the extent, character and scale of the existing built environment within the surroundings of the historic asset. • The Scheme would have a negative cumulative effect — sometimes relatively small changes, or a series of small changes, can have a major impact on our ability to understand, appreciate and experience a historic asset. • The Scheme cannot be absorbed into the existing landscape without the erosion of the landscape’s key characteristics. • The Scheme has a negative impact on non-visual factors of the setting of the historic asset, such as sense of remoteness, evocation of the historical past, sense of place, cultural identity or spiritual responses. • The Scheme has a deleterious impact on non-visual elements of the setting of an historic asset, such as the addition of noises and smells.
Positive	<ul style="list-style-type: none"> • The Scheme would lead to the removal of a structure or tree belts which block identified significant views. • The Scheme introduces new views (including glimpses or better framed views) that add to the public experience of the historic asset. • The Scheme removes or re-models an intrusive building or feature. • The Scheme would lead to the replacement of a detrimental feature by a new and more harmonious one. • The Scheme introduces a wholly new feature that adds to the public appreciation of the historic asset. • The Scheme would restore or reveal a lost historic feature. • The Scheme would improve public access to, or interpretation of, the historic asset including its setting.
Neutral	<ul style="list-style-type: none"> • The Scheme would result in no change to the setting of an historic asset.

⁶³ The Setting of Heritage Assets (English Heritage, 2012)

⁶⁴ Managing Change in the Historic Environment: Setting (Historic Environment Scotland, 2016)

Table 5.2.9: Criteria used to assess the magnitude of impact of the Scheme on the setting of historic assets within 2km

Magnitude of Impact	Criteria
Severe	Comprehensive changes to the setting of an historic asset
Moderate	Considerable changes to the setting of an historic asset that affect the character of the historic asset
Slight	Slight changes to the setting of an historic asset
Very slight	Very minor changes to setting of an historic asset

Limitations and assumptions

5.2.21 While a variety of sources, that include but are not limited to the Historic Environment Record (HER) and the NMR (National Monuments Record), have been consulted as part of the desk-based survey and a walk-over survey was conducted to inform this assessment there is still the potential for the discovery of unknown archaeological remains as a result of the works associated with the Scheme. In particular, due to their ephemeral and random nature, prehistoric features and sites could survive beneath the topsoil, especially in locations adjacent to sources of water, such as burnt mound spreads.

Baseline Information

Policy Context

5.2.22 The following plans, policies and legislation are considered relevant to the Cultural Heritage assessment:

- Ancient Monuments and Archaeological Areas Act 1979
- Planning (Listed Buildings and Conservation Areas) Act 1990
- The Hedgerow Regulations (Section 97, The Environment Act, 1997)
- The Town and Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016
- Circular 60/96 Planning and the Historic Environment: Archaeology (Welsh Office, 1996)
- Circular 61/96 Planning and the Historic Environment: Historic Buildings and Conservation Areas (Welsh Office, 1996)
- Gwynedd Unitary Development Plan (adopted version) - Policy CH25
- Gwynedd and Anglesey Joint Local Development Plan (draft version) - Policy AT1: Conservation Areas, World Heritage Sites and Registered Historic Landscapes, Parks and Gardens, Policy AT4: Protection of Non-Designated Archaeological Sites.
- One Wales: Connecting the nation –The Wales Transport Strategy, Outcome 16: Our Heritage (Welsh Assembly Government, 2008)

Archaeological and Historical context

5.2.23 This section provides an overview of the historical background to the study area and is relevant to all three cultural heritage sub-topics. Please refer to Technical Appendix A, Volume 2 for further details.

Prehistoric and Roman (up to 400 AD)

5.2.24 Evidence of prehistoric activity within the coastal strip is provided mainly by stray finds from the fields. A Bronze Age axe was found at Wig Farm (PRN 6811), while a Bronze Age stone axe hammer from Pentre Aber Farm, Abergwyngregyn (PRN 4071) and a Bronze Age burial urn at Pen-y-Bryn, immediately to the east of Abergwyngregyn (PRN 4079), have also been found. Systematic study of the Aber valley, immediately to the south-east of the study area

has produced many prehistoric and later remains⁶⁵, whilst east of Abergwyngregyn a 'burnt mound' has been located⁶⁶ (GAT 1994a). There is significant evidence for prehistoric activity in the uplands with several cairns of Bronze Age type on the hill-tops and ridges as well as remains of settlements and fields.

- 5.2.25 During the Roman period a major road between *Segontium* (Caernarfon) and *Canovium* (Caerhun) in the Conwy valley ran very close to the study area (PRN 17,568). The course of this road is known to the east of Abergwyngregyn at Madryn Farm, where a Roman milestone has been discovered (PRN 638). The exact line of the road within the study area cannot be clearly identified, although based on the location of known milestones it probably ran to the south of the study area⁶⁷. A Roman coin has been recovered from Abergwyngregyn parish (PRN 4073), while a possible Roman fortlet has been identified at Tal-y-Bont, 2km west of the study area (PRNs 2454 and 2465).

Medieval (400 AD – 1485 AD)

- 5.2.26 In the early medieval period the centralised control of Roman administration broke down into territorial divisions known as *cantrefi* (hundreds), which were subdivided into *commotes*. Abergwyngregyn was the commotal centre of Arllechwedd Uchaf and one of the seats of the Princes of Gwynedd, and thus important as a regional centre of power. The court, or *llys*, may have been located at or near the site of the motte (PRN 370), or closer to the present Pen-y bryn, on the east side of Abergwyngregyn⁶⁸. The earliest settlement at Abergwyngregyn is probably indicated by the site of St. Bodfan's church on a rise in ground to the west of the village. The original church was demolished and rebuilt but it lies within a sub-circular enclosure or *llan*. Such features usually indicate an early medieval foundation, and the earliest ecclesiastical settlement would have developed around the church.
- 5.2.27 It was control of the crossing point at the junction of the coastal road and another taking the upland route through the valleys that was the key to Abergwyngregyn's importance and the reason why a small castle on a mound or motte was built there, possibly during a campaign by the Norman Earl of Chester during an unsuccessful attempt to subjugate Gwynedd between 1081-1090. Later, when Gruffudd ap Cynan reasserted the independence of Gwynedd and established administrative control he made Aber the *llys* or court of the commote of Arllechwedd Uchaf. The hall that was built there became one of the favourite residences of the princes of Gwynedd. The valley was a sheltered place and its position facing the priory at Penmon may also have made it attractive. The earliest antiquarian description was by Leland in the 1530's who stated 'The moode in the parish of Aber otherwise Llan Boduan, wher Tussog Lluelin uab Gerwerd Trundoon had a castle or palace on a hill by the church, whereof yet parte stondith'. Excavations in 1993 revealed the foundations of a hall close to the castle mound of Ty'n y Mwd, associated with pottery of the 13th-15th century, a ring-brooch of 13th-14th century style and a coin dating to 1335-43^{69, 70, 71, 72, 73}.

⁶⁵ GAT 2001. Historic Land Register Management Survey. Stage 1 Report (G1553) (Unpublished GAT Report No. 419).

⁶⁶ Kelly, R. S. 1994a. A55 North Wales Expressway Aber Improvements (GAT 1034), Archaeological Assessment. (Unpublished GAT Report No. 26).

⁶⁷ Hopewell, D. 2005. Roman Roads in North-West Wales (Unpublished GAT Report No. 572).

⁶⁸ Johnstone, N. 2000. *Llys and Maerdref: the royal courts of the princes of Gwynedd*. *Studia Celtica* 34: 167-210.

⁶⁹ Johnstone, N. 1994. *Ty'n y Mwd, Aber, excavation*, GAT Report No. 86.

⁷⁰ Johnstone, N. 1995. *Llys and Maerdref: An investigation into the location of the Royal courts of thirteenth-century Gwynedd*. GAT Report No. 167.

⁷¹ Johnstone, N. 1997. An investigation into the location of the royal courts of thirteenth-century Gwynedd. In N. Edwards (ed.) *Landscape and Settlement in Medieval Wales*: 55-69. Oxford.

⁷² *Ibid.* 73.

5.2.28 The hall of the llys lay close to the motte and within a curvilinear enclosure believed to be the bailey or castle yard. The village grew up around the west side of this bailey enclosure. In the late 13th century 24 families were recorded as living there⁷⁴. After the death of Llywelyn the Manor of Aber passed through various hands and although still maintained for some time the hall eventually fell into decay. However, the village continued and in 1339 was granted the right to hold a weekly market and a fair three times a year⁷⁵. It seems to have flourished because of its position on the crossroads at the junction of the valley and coastal road and the route from the coastal road across the Lafan Sands for the ferry across to Anglesey, which was the chief route across the Straits until the opening of Telford's bridge in 1826. This route was also a droving route, which took the valley road over the hills and may have therefore been associated with the Aber fairs.

5.2.29 Abergwyngregyn is also of significance owing to it having been at the focus of the traditional routes from Anglesey across the Lafan Sands, the mainland to the west and the Conwy valley across the hills to the east. There was also a medieval settlement at Wig (PRN 681) which is referred to in medieval extents and grants. It was a bond township of two *gafaelion*. The medieval township may have contained more than one settlement, but it is likely that at least one of these lay on or near the present Wig, which lies 100m north of the Scheme. An area of earthworks survives at Wig Farm which could be medieval in date and if this is the case could form part of a documented medieval settlement of regional importance.

Post-medieval and later (1485 AD to the present day)

5.2.30 During the post-medieval period there appears to have been dispersed settlement along the fertile coastal strip east of Abergwyngregyn. The survival of estate maps and plans for this area is extremely limited⁷⁶. A 1693 survey of the sea coast of England [including Wales] shows roads crossing the Lafan Sands, with no detail of the fields in the coastal strip⁷⁷. A plan of the *New Road of Penmaenmawr* dated to 1769⁷⁸ (UCNWB Penrhyn 198) showing the proposed new turnpike route between Conwy and Bangor, shows a pattern of irregular small fields on the coastal strip, although it does not show any detail or the location of any structures with the exception of the old bridge at Abergwyngregyn.

5.2.31 A survey of the glebe land at Aber parish dated to 1776 shows four irregular shaped fields, three of which appear to have been under cultivation and one pasture on the coastal strip immediately north of Abergwyngregyn on the west side of the river⁷⁹, and also indicated that the surrounding land was the property of the Baron Hill estate. The earliest reasonably detailed depiction of the wider area is provided by the John Evans map of 1797, which shows buildings scattered across the coastal strip by Abergwyngregyn. The more accurate 1 inch OS depiction, completed by 1823, shows a scatter of buildings on either side of the main road and linked to it by a series of smaller roads or tracks. In 1839 the Bangor to Conwy road was improved in Abergwyngregyn with a new road and bridge built north of the village itself, effectively bypassing it⁸⁰. The Llanllechid tithe map of 1839 and the Abergwyngregyn

⁷³ Longley, D. 1997. The royal courts of the Welsh princes in Gwynedd, AD 400-1283. In N. Edwards (ed.) *Landscape and Settlement in Medieval Wales*: 41-54. Oxford.

⁷⁴ Lewis, E.A. 1912. *The Medieval Boroughs of Snowdonia*, London.

⁷⁵ *Ibid.* 79

⁷⁶ Johnstone, N. 1995 *Llys and Maerdref: An investigation into the location of the Royal courts of thirteenth-century Gwynedd*. GAT Report No. 167.

⁷⁷ Collins, G. 1693 *Survey of the Sea Coast of England*

⁷⁸ Plan of the New Road of Penmaenmawr, 1769. University of Bangor Archives, Penrhyn 198

⁷⁹ Gwynedd Council Archives XPE/56/106

⁸⁰ UB BH 6895 Plan and Section of an Alteration of Road near Aber Village 1839, University of Bangor Archives, Baron Hill 6895.

tithe map of 1848⁸¹ only shows the boundaries between different land blocks, rather than the individual fields themselves. A railway plan of c.1840 shows that the area was divided into numerous small fields of irregular size and shape, which could date back to early times.

5.2.32 The principal 19th century landowners in the study area were the Bulkeley and Pennant families, the former having gained control of the manor in 1689, who at some time between 1848 and 1896 reorganised the coastal strip into a landscape of rectilinear fields. This resulted in the loss of many of the small roads and buildings shown on earlier maps. This field pattern has survived with only limited alteration until the present day. The Bulkeley family remained the main proprietors of the manor until 1863 when they sold off their Caernarfonshire lands and Abergwyngregyn holdings to the Penrhyn estate in whose holding it remained until into the 20th century⁸².

5.2.33 Improvements were carried out at Wig Farm and Wig Bach cottages in the early years of the 20th century⁸³ (UCNWB Baron Hill MSS 6608, Penrhyn MSS 14), and Wig Bach cottage was demolished in 2011.

Summary: archaeological and historical context

5.2.34 The assessment area and that surrounding it is rich in archaeological remains from the prehistoric through to the post-medieval period. The majority of the sites are located around the village of Abergwyngregyn. The whole area under assessment is likely to be the site of early settlement, with a particular emphasis on cooking activity close to the water courses; this usually takes the form of mounds of fire-cracked rocks. The presence of the Roman road between Caernarfon and Caerhun is of great significance and means that there is significant potential for finding Roman remains. There is significant evidence for medieval settlement at Abergwyngregyn and Y Wig within the study area.

Baseline Description and Evaluation of Assets within the 300m Study Area

5.2.35 Including the results of the trial trenching, a total of 53 cultural heritage assets consisting of 24 historic buildings, 25 archaeological remains, three Historic Landscape Character Areas, and a Historic Landscape Field System have been identified within the 300m study area (see Figure 5.2.1, Volume 1a). These are listed in Table 5.2.10 and briefly comprise:

- *Six heritage assets of High value;*
- *Eighteen heritage assets of Medium value;*
- *Twenty heritage assets of Low value;*
- *Six heritage asset of Negligible value;*
- *Three heritage assets of Unknown value.*

Table 5.2.10: Value of Cultural Heritage Assets identified within the 300m study area

Asset No. and Name	HER/Other reference	Designation	Value
1. No's 1 & 2 Tan-y-Lon	NMR: 409169 CADW: 2293	Listed Building Grade II	Medium
2. Turnpike House	CADW: 22937	Listed Building Grade II	Medium
3. No's 7 & 8 Tan-y-Lon	NMR: 306313 CADW: 22934	Listed Building Grade II	Medium
4. No's 9 & 10 Tan-y-Lon	NMR: 409170	None	Low

⁸¹ *Ibid.* 84

⁸² Evans, P. 2003 Abergwyngregyn-Llanfairfechan Pipeline. Archaeological Desk-based Assessment (Unpublished CAP Report No. 272)

⁸³ Wig Farm, University of Bangor Archives, Penrhyn MSS 14

5. Shelter Shed/ Pigsties at Ty'n-yr-Hendre	HER: 30287 CADW: 22972	Listed Building Grade II*	High
6. Farm buildings at Ty'n-yr-Hendre	HER: 30287 NMR: 403409 CADW: 22971	Listed Building Grade II*	High
7. Road and quarry pits, possible, Ty'n-y-Hendre	HER: 37195	None	Low
8. Ty'n-y-Hendre Farm, Abergwyngregyn	HER: 30287 CADW: 22970	Listed Building Grade II	Medium
9. Lynchet, Ty'n-y-Hendre	HER: 37196	None	Low
10. Cairn, Site of, Ty'n-yr- Hendre	HER: 2344	None	Negligible
11. Metal Detecting Finds (Coins), E of Tal-y-Bont	HER: 5789	None	Negligible
12. Tai'r Meibion, Roman Road segments (part of RR67c Caerhun- Caernarfon route)	NMR: 405340	None	Medium
13. No 1 Tan-yr-Allt cottages	HER: 30285 NMR: 409168 CADW: 22935	Listed Building Grade II	Medium
14. No 2 Tan-yr-Allt cottages	HER: 30285 CADW: 22976	Listed Building Grade II	Medium
15. No 3 Tan-yr-Allt cottages	HER: 30285 CADW: 22936	Listed Building Grade II	Medium
16. No 4 Tan-yr-Allt cottages	HER: 30285 CADW: 22977	Listed Building Grade II	Medium
17. Culverts, N of Tan-yr-Allt cottages	HER: 30280	None	Negligible
18. Hedgerow, Abergwyngregyn	HER: 30288	None	Low
19. Revetment Walls, N of Tai'r Meibion	HER: 30276	None	Low
20. Gilfach Baptist Chapel, Llanllechid	NMR: 6744	None	Low
21. Tai'r Meibion	HER: 30282 CADW: 22968	Listed Building Grade II	Medium
22. Farm buildings at Tai'r Meibion	CADW: 22969	Listed Building Grade II	Medium
23. Tai'r Meibion garden, Abergwyngregyn	NMR: 86479	None	Low
24. Enclosed fields, S and E of Tai'r Meibion	HER: 30289	None	High
25. Field boundaries, E of Tai'r Meibion	HER: 30278	None	Low
26. Slate gate piers, S of Wig	HER: 30279	None	Low
27. y-Wig medieval township	HER: 6811	None	Unknown
28. Findspot – Bronze Celt, Wig Farm	HER: 2322	None	Negligible
29. Wig Farm, Abergwyngregyn	HER: 30283 CADW: 22909	Listed Building Grade II	Medium
30. Part of Roman Road, Segontium to Canovium	HER: 17568	None	Unknown
31. Field boundaries, E of Wig	HER: 30281	None	Low
32. Tumulus, Bryn Meddyg, Aber	HER: 2321	None	Unknown
33. Wig garden, Abergwyngregyn	NMR: 86513	None	Low
34. Lowland coastal area around Wig – Landscape	HER: 15857	None	High
35. Site of Wig Bach, Abergwyngregyn	HER: 30284	None	Negligible
36. Cottages, Bryn Meddyg, Abergwyngregyn	HER: 30286	None	Low
37. Quarry, Bryn Meddyg	HER: 20831	None	Low
38. Coed Bryn Meddyg relict field system	NMR: 408179	None	Medium
39. The Old School, Aber	NMR: 411152	None	Low
40. Mill pond, SW of St Bodfan's Church	HER: 34621	None	Low
41. Abergwyngregyn Parish Church	HER: 6900 NMR: 43704	None	Low

42. Tan-y-Fynwent; College Farmhouse; Llys Onnen; The Bull's Head	HER: 19151 NMR: 419587	None	Low
43. Findspot – Axe Hammer, College Farm, Aber	HER: 4071	None	Negligible
44. The Old Rectory, Abergwyngregyn	HER: 11458 NMR: 16824 CADW: 3654	Listed Building Grade II	Medium
45. Abergwyngregyn – Landscape	HER: 15859	None	High
46. Aber Falls Hotel, Abergwyngregyn	HER: 34848	None	Low
47. Crymlyn Cottage	CADW: 22938	Listed Building Grade II	Medium
48. Cottage adjoining Crymlyn Cottage	CADW: 22939	Listed Building Grade II	Medium
49. Road E of Tan-yr-Allt cottages to Crymlyn	HER: 30277	None	Medium
50. Abergwyngregyn Church (site of)	HER: 1628; 6900	None	Medium
51. Enclosed Hill Slopes Below Moel Wnion	HER: 15832	None	High
52. Slate-built culvert		None	Low
53. Stone and earth field boundary bank south of Tai'r Meibion		None	Low
Unknown Sites			Unknown

Statutory Sites

5.2.36 There are no World Heritage Sites or Conservation Areas within the study area. However, there is one registered Historic Park or Garden within 2km; Penrhyn Park, which is 2km to the west of the scheme (see Figure 5.2.4, Volume 1a). A total of 12 Scheduled Monuments were identified within 2km of the scheme footprint (see Table 5.2.14 and Figure 5.2.4, Volume 1a). These include eight prehistoric settlement and funerary sites, three medieval settlement sites and a Post-medieval/Modern bridge. Two are located in the village of Abergwyngregyn, but the majority are located on the hill slopes to the south of the north-west end of the scheme. Two further sites are located on rising ground to the south-west end of the scheme.

Historic Landscapes

5.2.37 The study area is within the Dyffryn Ogwen and the North Arllechwedd Landscapes of Outstanding Historic Interest as identified on the Register of Landscapes of Outstanding Historic Interest in Wales (Cadw: Welsh Historic Monuments, 2001) (see Figure 5.2.2, Volume 1a). The study area also includes the discreet Historic Landscape Character Areas (HLCA) of the *Lowland Coastal Area Around Wig* (HLCA 31), the *Enclosed Hill Slopes Below Moel Wnion* (HLCA 39) and is 100m south-west and north-west of *Abergwyngregyn* (HLCA 34) (see Figure 5.2.3, Volume 1a).

Listed Buildings

5.2.38 In addition to the 16 Listed Buildings within 300m of the scheme (see Table 5.2.10), a total of 49 Listed Buildings were identified outside of the 300m study area, but within 2km of the scheme footprint (see Table 5.2.15 and Figure 5.2.5, Volume 1a). One of these is Grade I Listed (Penrhyn Castle). Six are Grade II* Listed: Pen-y-bryn, Gatehouse/Barn at Pen-y-bryn, Church of St Tegai, Bridge at the mouth of the Afon Ogwen (listed twice) and Wyatt Memorial at the Church of St Tegai. The other 42 Listed Buildings are Grade II Listed. The Listed Buildings tend to be situated on the low lying coastal plain with clusters within the settlements at Llandygai and Tal-y-bont to the west and Abergwyngregyn to the north-east. Another cluster of sites is located on rising ground around Marianwinllan, to the south-west of the scheme.

Non-statutory sites

- 5.2.39 A total of 37 non-statutory historical features have been identified within the 300m study area; 26 are listed on the HER and nine are listed on the NMR, two were identified during the trial trenching so are not yet registered.

Potential impacts likely to be caused by the Scheme

Construction Period

- 5.2.40 Potential negative impacts from the Scheme are likely to occur during the main construction period. There is potential for negative impacts arising from construction activity and plant movement within the area of the Scheme, as well as the construction of temporary compounds to house offices, plant, welfare facilities, fuel and parking areas. These activities may result in:

- Permanent, negative impacts due to both mitigated works and /or accidental damage to, or alteration of, archaeological assets, historic buildings and historic landscapes or their component parts, and;
- Temporary, negative impacts on the settings of archaeological assets and historic buildings due to the visual impact of the construction works and increased noise and pollution levels (see also Chapters 4.1: Air Quality and 4.7: Noise).

Operational Effects

- 5.2.41 The likely potential operational impacts of the Scheme consist of:
- Negative impacts on the settings of archaeological assets and historic buildings due to the visual impact of the Scheme.

Magnitude of Impacts and Significance of Effects (before mitigation)

Archaeological Remains within 300m

- 5.2.42 Archaeological remains were discovered at 25 sites within, or close to, the Scheme (see Figure 5.2.1, Volume 1a). The majority of the sites lie outside the Scheme footprint and would not be affected. Eleven archaeological assets would, or may be, directly physically impacted. The impact on a further two archaeological assets is limited to effects on setting. Table 5.2.11 summarises the value of the archaeological remains identified along with the predicted magnitude of impact and significance of effect prior to mitigation.

- 5.2.43 Two sites (Assets 12 and 27) within the scheme footprint required archaeological trial trenching before definite mitigation could be recommended. These sites could be interpreted as the remains of the medieval township of y-Wig and the Segontium-Canovium Roman Road. Archaeological features were encountered within two of the trenches, Trench 02 at Wig Farm and Trench 04 at Tai'r Meibion Farm. In addition to two modern drains Trench 02 revealed evidence for a slate culvert (Asset 52) that appears to be part of a Post-medieval water management system associated with the water mill at Wig Farm. No evidence for medieval settlement (Asset 27) was identified. Trench 04 at Tai'r Meibion revealed evidence for two modern drains and a stone and earth field boundary bank (Asset 53) of unknown date. No evidence for the Roman Road (Asset 12) was encountered. The value of both assets therefore remains medium and unknown respectively, but evidence for both assets may still survive within the scheme footprint and be encountered during the course of the works.

- 5.2.44 A possible Tumulus or Iron Age/ Roman settlement enclosure near Bryn Meddyg (Asset 32) is also of unknown archaeological value, but is outside the footprint of the proposals and has therefore not been assessed further.

5.2.45 The remaining sites that would, or may, be directly physically affected consist of the Coed Bryn Meddyg relict field system (Asset Number 38) and the Road east of Tan yr Allt Cottages to Crymlyn ('Roman Road') (Asset Number 49), assessed as Medium value; the culverts (Asset Number 17), Revetment walls (Asset Number 19), Field boundaries (Asset Numbers 25 and 31) and a Quarry (Asset Number 37) are all identified as Low value. Two previously unknown 'Low' value archaeological assets were identified during the trial trenching; a slate-built culvert (Asset Number 52) and a stone and earth field boundary bank south of Tai'r Meibion (Asset Number 53). Asset Number 30 (Part of Roman Road, Segontium to Canovium) is assigned an unknown value but is considered to form another, less well-defined, part of the same archaeological feature as Asset 12 (of Medium value).

5.2.46 The settings of two archaeological assets would be affected. There would be a slight adverse significance of effect on the setting of the garden at Tai'r Meibion (Asset Number 23) and the garden at Wig Farm (Asset Number 33) due to the modern character of the new road and the new footpath between Tan-yr-Allt and Tan-y-Lon.

5.2.47 Only one boundary is defined as falling within the Hedgerow Regulations (1997), namely that bounding the minor road towards Crymlyn (Asset Number 18). This falls into the Hedgerow Regulations by meeting the criterion of an integral part of a field system pre-dating the Enclosure Acts (Hedgerow Regulations, Part II, Section 5a). This boundary may be medieval in origin, but has evidence of alteration over time, and comprises a mixture of hedgerow and drystone walling, some of it affected by 19th Century estate management.

Table 5.2.11: Value, Magnitude of Impact and Significance of Effect for affected Archaeological Remains within 300m before Mitigation

Asset No. and Name	Archaeological Value	Status	Magnitude of impact	Significance of effect
12. Tai'r Meibion, Roman Road segments (part of RR67c Caerhun-Caernarfon route)	Medium	None	Major	Large adverse
17. Culverts, N of Tan-yr-Allt cottages	Negligible	None	Moderate	Slight adverse
18. Hedgerow, Abergwyngregyn	Low	None	Major	Moderate adverse
19. Revetment Walls, N of Tai'r Meibion	Low	None	Minor	Slight adverse
23. Tai'r Meibion garden, Abergwyngregyn	Low	None	Negligible	Slight adverse
25. Field boundaries, E of Tai'r Meibion	Low	None	Up to Major	Moderate adverse
27. y-Wig medieval township	Unknown	None	Unknown	Unknown
30. Part of Roman Road, Segontium – Canovium	Unknown	None	Unknown	Unknown
31. Field boundaries, E of Wig	Low	None	Minor	Slight adverse
33. Wig garden, Abergwyngregyn	Low	None	Moderate	Slight adverse
37. Quarry, Bryn Meddyg	Low	None	Minor	Slight adverse
38. Coed Bryn Meddyg relict field system	Medium	None	Minor	Slight adverse
49. Road E of Tan yr Allt Cottages to Crymlyn (Roman Road)	Medium	None	Up to Major	Up to Large adverse
52. Slate-built culvert	Low	None	Negligible	Slight adverse
53. Stone and earth field boundary bank south of Tai'r Meibion	Low	None	Negligible	Slight adverse
Unknown Sites	Unknown	None	Up to Major	Unknown

Historic Buildings within 300m

5.2.48 Twenty-four historic buildings or structures were identified within 300m of the scheme. Of these 16 are listed buildings and two of these are Listed Grade II* (Asset Numbers 5 and 6). The majority of these buildings would not be affected. However, there would be a moderate adverse significance of effect on the setting of Wig Farm (Asset Number 29), and a slight adverse significance of effect on the setting of Tai'r Meibion and its farm buildings (Asset Numbers 21 and 22) and the cottages at Bryn Meddyg, Ty'n-y-Hendre, and Tan-yr-Allt (Asset Numbers 6, 13, 14, 15, 16 and 36) due to the modern character of the new roads and footway.

5.2.49 No historic buildings would be directly affected as a result of loss or destruction associated with the Scheme. However, the setting of some would potentially be affected. Table 5.2.12 summarises the value of the historic buildings considered likely to be significantly affected by the Scheme along with the predicted magnitude of impact and significance of effect prior to mitigation.

Table 5.2.12: Value, Magnitude of Impact and Significance of Effect for Historic Buildings within 300m before Mitigation

Asset No. and Name	Value	Status	Magnitude of impact	Significance of effect
6. Farm buildings at Ty'n-y-Hendre	High	Listed Building: Grade II*	Negligible	Slight adverse
13. No. 1 Tan-yr-Allt cottages	Medium	Listed Building: Grade II	Negligible	Slight adverse
14. No. 2 Tan-yr-Allt cottages	Medium	Listed Building: Grade II	Negligible	Slight adverse
15. No. 3 Tan-yr-Allt cottages	Medium	Listed Building: Grade II	Negligible	Slight adverse
16. No. 4 Tan-yr-Allt cottages	Medium	Listed Building: Grade II	Negligible	Slight adverse
21. Tai'r Meibion	Medium	Listed Building: Grade II	Negligible	Slight adverse
22. Farm buildings at Tai'r Meibion	Medium	Listed Building: Grade II	Negligible	Slight adverse
29. Wig Farm, Abergwyngregyn	Medium	Listed Building: Grade II	Negligible	Moderate adverse
36. Cottages, Bryn Meddyg, Abergwyngregyn	Low	None	Negligible	Slight adverse

Historic Landscapes

5.2.50 The area around the Scheme can be seen as two discrete historic character units containing former estate farms, industrial remains and a rail and road transport corridor, along a fertile strip of coastal land (Lowland coastal area around Wig: Asset Number 34), and an area of interface between the fertile coastal strip and the uplands (Enclosed fields, S and E of Tai'r Meibion: Asset Number 24). There would be a slight adverse effect within the coastal plain and moderate adverse effect on the landscape east of Tai'r Meibion.

5.2.51 Table 5.2.13 summarises the value of the historical landscapes considered likely to be affected by the Scheme, along with the predicted magnitude of impact and significance of effect prior to mitigation.

Table 5.2.13: Value, Magnitude of Impact and Significance of Effect for Historical Landscapes before Mitigation

Asset No. and Name	Value	Status	Magnitude of impact	Significance of effect
24. Enclosed fields, S and E of Tai'r Meibion	High	None	Moderate	Moderate adverse
34. Lowland coastal area around Wig	High	None	Negligible	Slight adverse

5.2.52 The ASIDOHL2 assessment (see Technical Appendix A, Volume 2) defines the level of impact as moderate on both the Dyffryn Ogwen and North Arllechwedd Landscape Areas of Outstanding Historic Interest (HLW (Gw) 10 and 12 respectively). This means that, without mitigation, there would be a developmental impact on key elements of both of the landscape areas with a result that there is some reduction in their overall value.

Registered Parks and Gardens and Scheduled Monuments within 2km

5.2.53 The results of the viewshed analysis showed that Penrhyn Park potentially has views over the entire scheme from various elevated locations within its boundaries and this was confirmed by site visit. It lies 1.7km from the north-west end of the scheme, but despite views over it, the presence of trees and vegetation (most of which would be unaffected by the scheme), the scope and scale of the Schemes to the existing trunk road, and the distance of the Park from the scheme means that it would have a Very Slight Negative impact on the setting of Penrhyn Park (see Table 5.2.14).

5.2.54 The results of viewshed analyses showed that 5 of the 12 scheduled monuments within the 2km study area have no views of the scheme from within their scheduled areas. The impact of the scheme on the setting of these monuments was therefore assessed to be Neutral. Elements of the scheme are potentially visible from the remaining 7 Scheduled Monuments (see Table 5.2.14). The scheme would have a Neutral impact on the setting of 3 Scheduled Monuments with potential views over the scheme: CN007 and CN218 in the village of Abergwyngregyn, and CN252 to the south-west of the scheme. The scheme would have a Very Slight Negative impact on the setting of four monuments on the higher ground to the south of the scheme CN038, CN137, CN243 and CN344. See Technical Appendix A (Volume 2) for further details.

Table 5.2.14: Impact on Setting of Registered Parks and Gardens and Scheduled Monuments within 2km

Reference Number	Name	NGR	Site Type	Views of Scheme	Impact on Setting
GD40	Penrhyn Park	SH6020071918	-	YES	Very Slight Negative
CN007	Aber Castle Mound (Pen-y-Mwd)	SH6567372647	Medieval motte	YES	Neutral
CN038	Maes y Gaer Camp (Hillfort)	SH6635872509	Prehistoric hillfort	YES	Very Slight Negative
CN056	Rhiw Coch Camp	SH6168769305	Prehistoric enclosed hut circle	NO	Neutral
CN061	Bont-Newydd	SH6626272007	Post-Medieval /Modern bridge	NO	Neutral
CN137	Medieval Homestead 400m SE of Maes y Gaer	SH6667972276	Medieval rectangular hut settlement	YES	Very Slight Negative
CN218	Enclosure & Associated Structures at Pen-y-Bryn	SH6581272776	Medieval Enclosure	YES	Neutral
CN243	Settlement Above Ffridd Ddu	SH6511471322	Prehistoric hut circle	YES	Very Slight

			settlement		Negative
CN245	Hut Circle Settlement on Caer Mynydd	SH6571771394	Prehistoric hut circle settlement	NO	Neutral
CN252	Hut Circle Settlement NW of Tan-y-Marian	SH6139770149	Prehistoric hut circle settlement	YES	Neutral
CN344	Cras, cairn to N of	SH6537871230	Prehistoric round cairn	YES	Very Slight Negative
CN345	Cras, ring cairn to N of	SH6543271255	Prehistoric ring cairn	NO	Neutral
CN346	Cras cairn	SH6538870894	Prehistoric round cairn	NO	Neutral

Listed Buildings within 2km

5.2.55 The results of the viewshed analysis indicate that 24 of the 49 Listed Buildings within 300m to 2km of the Scheme have no views over it. Therefore, the impact on their setting is assessed as Neutral (see Table 5.2.15) and no further assessment was carried out. Elements of the scheme are potentially visible from the remaining 25 Listed Buildings, which are listed in Table 5.2.15, together with the findings of the further assessments carried out to determine the scale of the visual impact of the scheme on their setting. The Scheme would have a Neutral impact on the setting of 19 Listed Buildings with potential views over it and would have a Very Slight Negative impact on the setting of 6 Listed Buildings with views over it. See Technical Appendix A (Volume 2) for further details.

Table 5.2.15: Impact on Setting of Listed Buildings within 300m to 2km

Cadw Listed Building Number	Listing Grade	Name	NGR	Views of Scheme	Impact on Setting
3651	II*	Pen-y-bryn	SH6582472739	YES	Neutral
3652	II	Pen-y-bryn Cottage	SH6583772752	YES	Neutral
3655	II	Bont Newydd	SH6626272008	NO	Neutral
3656	II*	Gatehouse/Barn at Pen-y-bryn	SH6584172795	YES	Neutral
3657	II*	Church of St Tegai	SH6007670987	YES	Neutral
3659	I	Penrhyn Castle	SH6026671918	YES	Very Slight Negative
3671	II	Plas Hwfa	SH6157470657	YES	Very Slight Negative
3672	II	Tal-y-bont-uchaf and attached farmbuildings	SH6130070672	YES	Very Slight Negative
22904	II	Ddol Cottages	SH6562772601	YES	Neutral
22905	II	Tyn-y-buarth	SH6564572581	YES	Neutral
22906	II	Bryn Hyfryd	SH6566772576	YES	Neutral
22907	II	Tan-y-dderwen	SH6561372670	NO	Neutral
22908	II	Tan-y-bryn	SH6561272648	NO	Neutral
22910	II	Gatehouse range including stabling, cowhouses and walls enclosing yard to south at Madryn Farm	SH6645873546	NO	Neutral
22911	II	Tan-y-dderwen	SH6561172664	NO	Neutral
22912	II	Bron Derw	SH6561672643	NO	Neutral
22913	II	Ddol Cottages	SH6563472595	YES	Neutral
22914	II	Bro Dawel	SH6567672570	YES	Neutral
22915	II	Fron	SH6565472580	YES	Neutral

Cadw Listed Building Number	Listing Grade	Name	NGR	Views of Scheme	Impact on Setting
22916	II	Stable range in yard at Madryn Farm	SH6644073520	NO	Neutral
22917	II	Cart shelter, barn, granary and smithy at Madryn Farm	SH6646873498	NO	Neutral
22925	II	Tal-y-bont Lodge	SH6033770879	NO	Neutral
22926	II	Tan-y-marian	SH6158770052	NO	Neutral
22928	II	Plas-uchaf	SH6208969897	NO	Neutral
22929	II	Pont Tal-y-bont (partly in Llandygai community)	SH6022570890	NO	Neutral
22931	II*	Bridge at the mouth of the Afon Ogwen (partly in Llandygai community)	SH6107072139	YES	Neutral
22940	II	U-shaped Range of Farmbuildings at Tal-y-bont-uchaf	SH6132870666	YES	Very Slight Negative
22946	II	Tyddyn-isaf & Tyddyn-isaf bach	SH6140769626	NO	Neutral
22947	II	Capel Bethlehem	SH6046470508	NO	Neutral
22948	II	Cart Shelter and Pigsties at Plas-uchaf	SH6209569913	NO	Neutral
22949	II	L-shaped Cowhouse Range at Plas-uchaf	SH6210769903	NO	Neutral
22950	II	Small Cowhouse Range at Plas-uchaf	SH6212369909	NO	Neutral
22951	II	Eglwys St Cross	SH6086770804	YES	Neutral
22952	II	Pen-y-bryn	SH6141469791	NO	Neutral
22955	II	Estate Kennels	SH6121272109	YES	Neutral
22956	II	Railway Viaduct (partly in Llandygai community)	SH6027270696	NO	Neutral
22957	II	Penrhyn Park boundary wall (partly in Llandygai community)	SH6103471779	YES	Neutral
22965	II	Glan-y-mor-isaf	SH6195972324	YES	Very Slight Negative
22966	II	Farm buildings at Glan-y-mor-isaf	SH6198472344	YES	Very Slight Negative
22967	II	Pigsties at Glan-y-mor-isaf	SH6194872349	YES	Neutral
23366	II*	Wyatt Memorial at the Church of St Tegai	SH6008470977	YES	Neutral
23381	II	Railway Viaduct (partly in Llanllechid community)	SH6016670674	NO	Neutral
23393	II	Horse Drinking Trough and Fountain	SH6016170887	NO	Neutral
23402	II	Pont Tal-y-bont (partly in Llanllechid community)	SH6018870887	NO	Neutral
23430	II	Former Sawmill Manager's House	SH6013570748	NO	Neutral

Cadw Listed Building Number	Listing Grade	Name	NGR	Views of Scheme	Impact on Setting
23431	II	No.1 Tre-felin Cottages	SH6010270734	NO	Neutral
23456	II*	Bridge at the mouth of the Afon Ogwen (partly in Llanllechid community)	SH6105672141	YES	Neutral
23463	II	The Old School House	SH6005271018	YES	Neutral
81043	II	Ty'n Ffridd	SH6577072470	YES	Neutral

Proposed Mitigation Measures

5.2.56 The alignment of the Scheme avoids as far as possible sites of archaeological interest. Where a site is affected, mitigation measures would be required in accordance with the guidelines in DMRB, Volume 11, Section 3, Part 2, HA 208/07, Chapter 4. The scope of mitigation would be agreed in advance of the works with the archaeological curator for the scheme (Gwynedd Archaeological Planning Service) and formalised in a Written Scheme of Investigation.

5.2.57 The following are the basic categories of proposed archaeological mitigation measures for direct impacts on archaeological features. The detailed recording, basic recording and watching brief options fulfil the “preservation by record” option described in Welsh Office Circular 60/96.

- None: No impact, so no requirement for mitigation measures.
- Avoidance: Features which may be affected directly by the scheme, or by the construction of the scheme, should be avoided.
- Basic recording: Recording by photograph and description requires a photographic record and written description prior to the commencement of works on site. A measured survey may be required in certain cases.
- Watching brief: Observation of particular identified features or areas during works in their vicinity. This may be supplemented by detailed or basic recording of exposed layers, structures or sections.
- Detailed recording: Detailed recording requires a photographic record, surveying and the production of a measured drawing prior to the commencement of the works on site. Archaeological excavation works may also be required, depending upon the particular feature and the extent and effect of the impact. This may entail full excavation and recording where a known site will be destroyed or partially destroyed by the scheme. Some built sites would require dismantling by hand, to provide a detailed record of the method of construction and in the case of a listed structure, the salvage of materials for re-use and re-building.

5.2.58 For wider areas of high archaeological potential there are the following main options:

- Geophysical survey
- Trial trenching
- Strip map and sample
- Reinstatement and/ or relocation

5.2.59 The following mitigation measures are proposed for the individual assets listed in Tables 5.2.11 to 5.2.13 that would be affected by the scheme:

Watching Brief (with subsequent appropriate recording, if required):

- 12. Roman road south-east of Tan-yr-Allt (Caerhun-Caernarfon route)

- 27. y-Wig medieval township
- 30. part of Roman Road (Segontium – Canovium)
- 38. Coed Bryn Meddyg relict field system
- 49. Road E of Tan yr Allt Cottages to Crymlyn (Roman Road)

A watching brief would also be present during all excavation and soil stripping in order to ensure that unknown sites are identified and recorded.

Basic recording:

- 17. Culverts, north of Tan-yr-Allt cottages
- 19. Revetment Walls, north of Tai'r Meibion
- 25. Field boundaries, east of Tai'r Meibion
- 31. Field boundaries east of Wig
- 33. Wig garden
- 37. Quarry, Bryn Meddyg
- 52. Slate-built culvert
- 53. Stone and earth field boundary bank south of Tai'r Meibion

Detailed recording:

- 18. Hedgerow along Roman Road (along with reinstatement)

Sympathetic landscaping and reinstatement:

- 6. Farm buildings at Ty'n-y-Hendre
- 13. No. 1 Tan-yr-Allt cottages
- 14. No. 2 Tan-yr-Allt cottages
- 15. No. 3 Tan-yr-Allt cottages
- 16. No. 4 Tan-yr-Allt cottages
- 21. Tai'r Meibion
- 22. Farm buildings at Tai'r Meibion
- 23. Tai'r Meibion garden
- 24. Enclosed fields, south and east of Tai'r Meibion (and maintenance of historic features)
- 29. Wig Farm
- 33. Wig garden
- 34. Lowland coastal area around Wig
- 36. Cottages, Bryn Meddyg

5.2.60 In respect of the potential for unknown archaeology, some areas are steeply embanked and have significant areas of made ground, with a very low potential for the discovery of archaeological remains. Others areas are relatively level and have a higher potential. An intermittent watching brief is therefore proposed during initial topsoil stripping of these areas. Any newly-discovered archaeological remains would be recorded to an appropriate level in advance of destruction.

5.2.61 With regard to Asset 18 (hedgerow along Roman Road), as the Scheme is a highways project to be consented under other legislation, the removal of the hedgerow is permitted under the Hedgerows Regulations 1997, Reg 6 (1) (h). The works will however be undertaken within the spirit of the Hedgerows Regulations 1997 and archaeological mitigation would include detailed recording and translocating/re-instating the original boundary feature on its new alignment wherever possible. For more detail regarding the translocation of this and other affected hedgerows see Chapters 5.3 (Landscape) and 5.4 (Nature Conservation).

5.2.62 With regard to impacts on the setting of archaeological sites and historic buildings the Scheme runs alongside and within the existing A55(T) and is embanked in places so this lessens its impact on the landscape in this area. However, the impact on the setting of historic features would be reduced by sensitive planting using species already in existence in the surrounding landscape and reinstatement of boundary features (see Chapter 5.3: Landscape). Minimal lighting and signage would also be used wherever possible (see Chapter 2, Section 2.3).

5.2.63 The assessment of the impact of the Scheme on historic landscapes was conducted as an ASIDOHL2 study and as part of the HDBA (see Table 5.2.3 and Table 5.2.6). Mitigation for historic landscapes would consist of sympathetic design and planting, and reinstatement of boundary features, which would slightly lessen the adverse significance of effect identified, particularly by maintaining the local vernacular field boundary construction styles for any affected slate fences, cloddiau or hedges.

Magnitude of Impacts and Significance of Effects (after mitigation)

5.2.64 Due to the nature of the impact on many of the archaeological features (*i.e.* direct impact resulting in destruction of the feature during the construction phase) many of the mitigation measures would not reduce the overall magnitude of impact and significance of effect. Nevertheless the mitigation measures would provide an opportunity to record such features before they are lost to the scheme. Landscape mitigation for adverse impacts on the setting of historic features and appearance of historic landscapes would be expected to establish in the medium to long term and reduce the significance of residual effects accordingly.

5.2.65 Table 5.2.16 summarises the residual effects remaining for archaeological remains after the proposed mitigation measures have been applied.

Table 5.2.16: Value, Magnitude of Impact and Significance of Effect for affected Archaeological Remains within 300m after Mitigation

Asset No. and Name	Magnitude of Impact before mitigation	Significance of effect before mitigation	Proposed mitigation	Magnitude of Impact after mitigation	Significance of effect after mitigation
12. Tai'r Meibion, Roman Road segments (part of RR67c Caerhun-Caernarfon route)	Major	Large adverse	Watching Brief	Major	Large adverse
17. Culverts, N of Tan-yr-Allt cottages	Moderate	Slight adverse	Basic recording	Negligible	Slight adverse
18. Hedgerow, Abergwyngregyn	Major	Moderate adverse	Detailed recording and reinstatement	Moderate	Moderate adverse
19. Revetment Walls, N of Tai'r Meibion	Minor	Slight adverse	Basic recording	Negligible	Slight adverse
23. Tai'r Meibion garden, Abergwyngregyn	Negligible	Slight adverse	Sympathetic landscaping and reinstatement	Negligible	Slight adverse
25. Field boundaries, E of Tai'r Meibion	Up to Major	Moderate adverse	Basic recording	Up to Major	Slight adverse

27. y-Wig medieval township	Unknown	Unknown	Watching Brief	Unknown	Unknown
30. Part of Roman Road, Segontium – Canovium	Unknown	Unknown	Watching Brief	Unknown	Unknown
31. Field boundaries, E of Wig	Minor	Slight adverse	Basic recording	Negligible	Slight adverse
33. Wig garden, Abergwyngregyn	Moderate	Slight adverse	Basic recording, sympathetic landscaping and reinstatement	Minor	Slight adverse
37. Quarry, Bryn Meddyg	Minor	Slight adverse	Basic recording	Negligible	Neutral
38. Coed Bryn Meddyg relict field system	Minor	Slight adverse	Watching Brief	Minor	Slight adverse
49. Road E of Tan yr Allt Cottages to Crymlyn ('Roman Road')	Up to Major	Up to Large adverse	Watching Brief	Up to Major	Up to Large adverse
52. Slate-built culvert	Negligible	Slight adverse	Basic recording	Negligible	Slight adverse
53. Stone and earth field boundary bank south of Tai'r Meibion	Negligible	Slight adverse	Basic recording	Negligible	Slight adverse
Unknown Sites	Up to Major	Unknown	Watching brief	Up to Major	Unknown

5.2.66 Table 5.2.17 summarises the residual effects remaining for historic buildings after the proposed mitigation measures have been applied.

Table 5.2.17: Value, Magnitude of Impact and Significance of Effect for affected Historic Buildings within 300m after Mitigation

Asset No. and Name	Magnitude of Impact before mitigation	Significance of effect before mitigation	Proposed mitigation	Magnitude of Impact after mitigation	Significance of effect after mitigation
6. Farm buildings at Ty'n-y-Hendre	Negligible	Slight adverse	Sympathetic landscaping	Negligible	Slight adverse
13. No. 1 Tan-yr-Allt cottages	Negligible	Slight adverse	Sympathetic landscaping	Negligible	Slight adverse
14. No. 2 Tan-yr-Allt cottages	Negligible	Slight adverse	Sympathetic landscaping	Negligible	Slight adverse
15. No. 3 Tan-yr-Allt cottages	Negligible	Slight adverse	Sympathetic landscaping	Negligible	Slight adverse
16. No. 4 Tan-yr-Allt cottages	Negligible	Slight adverse	Sympathetic landscaping	Negligible	Slight adverse
21. Tai'r Meibion	Negligible	Slight adverse	Sympathetic landscaping and reinstatement	Negligible	Slight adverse
22. Farm buildings	Negligible	Slight adverse	Sympathetic	Negligible	Slight adverse

at Tai'r Meibion			landscaping and reinstatement		
29. Wig Farm, Abergwyngregyn	Moderate	Moderate adverse	Sympathetic landscaping and reinstatement	Minor	Slight adverse
36. Cottages, Bryn Meddyg, Abergwyngregyn	Negligible	Slight adverse	Sympathetic landscaping	Negligible	Neutral

5.2.67 Table 5.2.18 summarises the residual effects remaining for historic landscapes after the proposed mitigation measures have been applied.

Table 5.2.18: Value, Magnitude of Impact and Significance of Effect for affected Historic Landscapes after Mitigation

Asset No. and Name	Magnitude of Impact before mitigation	Significance of effect before mitigation	Proposed mitigation	Magnitude of Impact after mitigation	Significance of effect after mitigation
24. Enclosed fields, S and E of Tai'r Meibion	Moderate	Moderate adverse	Sympathetic Landscaping and Maintenance of Historic Features	Minor	Moderate to slight adverse
34. Lowland coastal area around Wig	Negligible	Slight adverse	Sympathetic Landscaping	Negligible	Slight adverse

5.2.68 With regard to the Dyffryn Ogwen and North Arllechwedd Landscape Areas of Outstanding Historic Interest, replacing or reinstating any boundary features and affected trees or hedgerows using species already in existence in the surrounding landscape would result in an overall reduction of the residual visual impact on the landscape once the replacement landscaping establishes in the medium to long term. The minimal use of lighting and signage would also reduce the impact on the surrounding historic landscape as much as possible.

Impact on the setting of Registered Historic Parks and Gardens, Scheduled Monuments and Listed Buildings within 2km

5.2.69 Eleven assets within the 2km study area were identified whose setting would be negatively impacted by the Scheme, consisting of: 1 Registered Historic Park or Garden (GD40), 4 Scheduled Monuments (CN038, CN137, CN243 and CN344) and 6 Listed Buildings (LB3659, LB3671, LB3672, LB22940, LB22965 and LB22966). In all cases, the impact on their setting is considered to be Very Slight Negative resulting from the potentially increased visibility of the scheme from these assets in comparison with their current views over the existing A55(T). This would be caused by the loss of trees and hedgerows affected by the Scheme. A programme of replacement and or re-instatement of any affected trees and hedgerows is proposed (see Chapter 5.3) and it is considered that implementation of these mitigation measures would result in an overall Neutral impact on the setting for all affected assets, once the replacement landscaping establishes in the medium to long term.

Summary

5.2.70 This chapter summarises the results of the DMRB desk-based and field surveys undertaken for a 300m study area along the length of the Scheme. The assessment, based on guidance provided in the DMRB Volume 11, Section 3, Part II (HA208/07), identified 53 heritage assets within the study area.

5.2.71 The chapter has provided a summary of the value assigned to cultural heritage assets, proposed mitigation measures and the significance of impacts with and without mitigation

for the three cultural heritage sub-topics of archaeological remains, historic buildings and historic landscapes. The majority of the heritage assets are of Medium or Low value, although there are six assets of High value. There is a possibility that further assets would be discovered during groundworks, although the potential for the discovery of High or Very High value archaeological remains is considered to be low.

5.2.72 Two sites (Assets 12 and 27) required archaeological trial trenching. Archaeological features were encountered within two of the trenches, but no evidence for medieval settlement (Asset 27) or the Roman Road (Asset 12) was encountered. However, evidence for both assets may still survive within the scheme footprint and be encountered during the course of the works.

5.2.73 The overall significance of effect of the Scheme after mitigation on the fifteen affected archaeological assets within 300m of the scheme is generally slight adverse, though the significance of effect on three assets will be moderate or large adverse:

- the scheme could have a large adverse significance of effect on one asset, Asset 12, the Tai'r Meibion, Roman Road;
- the scheme will have up to a large adverse significance of effect on one asset, Asset 49, the Road East of Tan yr Allt Cottages to Crymlyn;
- the scheme will have a moderate adverse significance of effect on one asset, Asset 49, the Hedgerow, Abergwyngregyn;
- the scheme will have a slight adverse significance of effect on nine archaeological assets, Asset numbers 17, 19, 23, 25, 31, 33, 38, 52 and 53;
- the scheme will have a neutral significance of effect on one archaeological asset, Asset 37, the Quarry at Bryn Meddyg, and;
- the scheme will have an unknown significance of effect on Asset 30, Part of the Roman Road between Segontium and Canovium.

5.2.74 The overall significance of effect of the Scheme after mitigation on the nine affected historic buildings within 300m of the scheme is generally slight adverse, though the significance of effect on one building is neutral:

- the scheme will have a slight adverse significance of effect on eight Historic Buildings, Asset numbers 6, 13, 14, 15, 16, 21, 22 and 29; and
- the scheme will have a neutral significance of effect on one Historic Building Asset, Asset number 36: Cottages, Bryn Meddyg, Abergwyngregyn.

5.2.75 The overall significance of effect of the Scheme after mitigation on the two affected Historic Landscapes within 300m of the scheme is slight adverse or slight adverse to moderate adverse:

- the scheme will have a slight to moderate adverse significance of effect on Asset 24, Enclosed fields, South and East of Tai'r Meibion, and;
- the scheme will have a slight adverse significance of effect on Asset 34, the Lowland coastal area around Wig.

5.2.76 This chapter also summarises the results of a study to assess the impact on the setting of Registered Historic Parks and Gardens, Scheduled Monuments and Listed Buildings that are located outside of the 300m study area but within 2km. One Historic Park and Garden, 12 Scheduled Monuments and 49 Listed Buildings were identified. The scheme would have a Neutral impact on the setting of 51 of these and a Very Slight Negative impact on the setting of 11. Mitigation consists of the replacement or reinstatement of any existing trees or hedgerows which are affected by the works (see Chapter 5.3: Landscape).

- 5.2.77 The ASIDOHL2 study concluded that, without mitigation, the overall significance of impact of the proposed development on Dyffryn Ogwen and North Arllechwedd Landscape Areas of Outstanding Historic Interest was moderate. However, replacing or reinstating any boundary features and affected trees or hedgerows would result in an overall reduction of the residual visual impact on the historic landscape in the medium to long term.
- 5.2.78 The proposals mainly involve online improvements to the existing highway network so alternative alignments as part of an iterative design approach are limited. However, no assets are of sufficient value to require any changes to the general arrangement of the scheme. The principal mitigation measures are the recording of archaeological remains at an appropriate level in advance of destruction; the use of appropriate materials within the scheme; sympathetic planting using locally common species; reinstatement of field boundaries, and avoidance of outlying sites by access and ancillary works.
- 5.2.79 Considering the mitigation measures outlined previously the Scheme is expected to accord with the objectives and policies relating to cultural heritage identified in the Regulatory/Policy Framework section of this chapter.

5.3 LANDSCAPE

Introduction

5.3.1 The Landscape assessment summarised in this chapter considers the impact of the Scheme on landscape character and visual amenity. The assessment of effects on landscape character and visual amenity are two separate, but interlinked, procedures. The baseline landscape, its analysis and the assessment of character contribute to the definition of the baseline for the assessment of visual amenity.

5.3.2 Landscape effects primarily derive from modifications to the physical landscape which may give rise to changes in character and how this is perceived and experienced by users. Visual effects relate to changes arising from the modification of the composition of views as a result of changes to the landscape, to people's responses to the changes and the overall effects in respect of visual amenity.

Landscape Character

5.3.3 There are a number of ways in which development of the type proposed can influence landscape character:

- The scale and form of development can prove inappropriate and intrusive in the context of existing landform, characteristics and landscape elements which contribute to overall character;
- Development proposals can affect important landscape elements, possibly involving the loss or fragmentation of important and distinctive landscape features such as hedgerows, woodland, trees, field pattern and built form;
- The proposals can introduce activity, features and forms that are out of keeping with established land use, cultural or historical landscapes; and
- The proposals can contribute to the regeneration of despoiled landscapes and the establishment of areas of new landscape.

Visual Amenity

5.3.4 Development can change people's direct experience and perception of the landscape depending on existing context, the scale, form, colour and texture of the proposals, the nature of activity associated with the development and the distance and angle of view.

5.3.5 In relation to visual effects, the quality of view and the experience of the viewer can be downgraded or improved. Proposals may not just alter the composition of a view but can, by virtue of proximity; obstruct the overall outlook to a degree.

5.3.6 Visual effects on residents, visitors and users of open space can encompass the following:

- The loss of the whole or part of an existing view where earthworks or structures forming part of the proposals obstruct views;
- The introduction of intrusive elements such as earthworks, structures, lighting and traffic flows into existing views; and
- Removal of existing intrusive elements in existing views or removal of associated structures and road related features.

Key Issues

5.3.7 The Scheme would result in the widening of an existing highway with the addition of a number of off-line side road improvements aimed at increasing safety for road users. The changes would occur within the context of an established highway corridor, which already influences the perception of the landscape and represents a notable feature of many of the

local views from nearby visual receptors. Full details of the Scheme can be found in Chapter 2.3 – Scheme Description. The key issues to emerge in relation to landscape and visual effects are therefore associated with the modifications to the existing corridor, namely:

- The loss of existing landscape features such as roadside hedgerows, mature trees and other landscape features that contribute to the local landscape character and sense of place;
- The broadening of the established corridor as a result of off-line and side road improvements;
- The introduction of a new drainage channel and small bund (<1m height) running parallel with the existing road to the south between The Old School and Tai'r Meibion;
- Minor modifications (<1m) to the vertical alignment to accommodate local undulations in the existing road surface to comply with current standards;
- Removal of existing roadside hedgerows and hedge banks alongside roads to provide access to property where direct access from the A55(T) has been removed; and
- The visual effects that would occur to local sensitive receptors due to changes to the existing road corridor and local access roads as a result of the removal of roadside vegetation resulting in exposed views of the road itself and associated traffic.

Methodology

Method of Assessment

5.3.8 The Landscape assessment has been undertaken in accordance with Interim Advice Note 135/10 (W): April 2014, Welsh Government. The following additional guidelines and guidance documentation relevant to the assessment of Landscape Effects have also been referenced:

- Guidelines for landscape and visual impact assessment: Third edition – 2013, published by The Landscape Institute and Institute of Environmental Management and Assessment;
- Landscape Character Assessment: Guidance for England and Scotland, published by Scottish Natural Heritage and the Countryside Agency (2002), and;
- Welsh Transport Planning and Appraisal Guidance – WelTAG, June 2008, the Welsh Government.

5.3.9 Professional judgement has been used in determining sensitivity and likely effects arising as a result of the Scheme. This is based on previous experience in the study of landscape character and visual sensitivity and a sound understanding of the nature of the project and changes likely to arise as a result of its implementation. The level of uncertainty is low as the design of the Scheme is at an advanced stage.

5.3.10 The guidelines rely on an appreciation of the existing physical baseline conditions and visual context, using professional judgement and a thorough understanding of the development proposals, determination of sensitivity, sensitivity to change, the magnitude of impact and the potential to mitigate significant effects. This assessment reports the findings relating to landscape character and visual effects separately.

5.3.11 The Scheme is situated on the northern fringes of the Snowdonia National Park, a landscape of distinctive quality. Much of the surrounding landscape demonstrates features of good quality that contribute to the setting of the broader designation, as a result of which a detailed assessment of landscape character has been undertaken. A detailed assessment of the likely visual effects has also been undertaken due to the proximity of a number of sensitive receptors to the changes arising from the Scheme.

5.3.12 The assessment involves an iterative process in which the analysis and evaluation of potential effects inform the development of the scheme design and landscape mitigation measures. There are five key stages to the assessment process:

- Recording and analysis of the existing landscape and visual context of the receiving environment;
- An appreciation of the nature, forms and features of the proposals;
- An assessment of the magnitude of impact likely to result from the development and the susceptibility of the existing landscape and identified visual receptors to change, pre-mitigation;
- Identification of design and mitigation measures appropriate to the Scheme and landscape of the receiving local area; and
- Evaluation of the significance of the effects identified based on the above assessment.

Impact Assessment

5.3.13 The following key tasks have been undertaken as part of the landscape and visual assessment (see Chapter 5.2: Cultural Heritage for historic landscape impact assessment):

- Analysis of existing landscape and visual assessment data derived from previous environmental studies of the area;
- Desk-based analysis of OS mapping relating to landform, vegetation, settlement patterns and the drainage regime in the wider area;
- Desk-based analysis of aerial photography for the area;
- Preliminary desk-based plotting of potential character zones derived from the above analyses;
- Site appraisal and appropriate modification of preliminary zones. Site recording involved annotation of 1:1250 and 1:25000 scale OS plans defining the zones and the key elements determining character;
- Site photography to illustrate character zones, notable views / viewpoints and key landscape elements;
- Drafting and description of character zones including analysis of their susceptibility to change;
- Consultation with statutory agencies;
- Evaluation of change in character and potential resultant effect on existing quality, and;
- Review of available statutory planning and policy documentation relevant to the study area.

Change Over Time

5.3.14 Impacts change over time as planting included as part of the development mitigation proposals establishes and matures, and as the existing landscape surrounding the development evolves. The assessment acknowledges this change and reports on the impacts during the construction phase; upon opening of the scheme during the winter (effectively pre-mitigation, prior to the maturation of any proposed planting) when it is considered that potential effects would be at their most significant; and those 15 years following opening of the scheme, both in summer and winter periods when mitigation would have substantially matured.

Landscape Character

5.3.15 Landscape character assessment is broadly based on identification of the sensitivity of the landscape to change within the proposed study area, and the magnitude of impact within the landscape that would result from the construction and operation of the proposed development. It also involves a combination of identification of character and analysis of the quality and value of a defined area.

- 5.3.16 The wider landscape of the study area is broken down into distinctive Landscape Character Areas underpinned from LANDMAP's identified regional character areas and site analysis. Assessment is undertaken in relation to each specific character area and the significance of effect for each is identified.
- 5.3.17 The process involves analysis of landscape character and quality within and between areas, and an analysis of value, leading to the recognition of the sensitivity of the area to any changes likely to result from the construction of the proposals.
- 5.3.18 The classification of landscape character involves the appraisal of the baseline landscape in relation to three criteria (character, quality and value) to inform the evaluation of character. Please refer to Technical Appendix B, Volume 2 for further details about these and the criteria applied for identifying sensitivity to change, magnitude of effect and significance of effect for the Landscape Character assessment

Visual Effects

- 5.3.19 The assessment of visual effects is based on identification of the sensitivity of receptors (locations from which people would be able to view the development) within the proposed study area and the magnitude of impact that would result from the construction and operation of the proposed development, based upon information gathered through site surveys and analysis of the design proposals.
- 5.3.20 It describes the current visual context from important viewpoints and evaluates the implications of the proposals for residents, visitors and users of the areas neighbouring the proposed development. It also describes the landscape proposals and other mitigation measures that would form an integral part of the scheme and the extent to which they would mitigate potentially significant visual effects.

Zone of Theoretical Visibility

- 5.3.21 The purpose of identifying the Zone of Theoretical Visibility (ZTV) is to define the effective boundaries within which the proposed development could potentially affect receptor views of the landscape within the wider area surrounding the development. In this instance, the containment resulting from the surrounding landscape, landform, vegetation and settlement pattern of the study area has enabled the visual envelope to be readily identified through site-based appraisal.
- 5.3.22 The ZTV is also commonly known as the visual envelope, a term adopted throughout this assessment. The visual envelope indicates the maximum area of land likely to be able to gain views of the proposed development. It provides a means of identifying potential receptors so that an assessment of visual effects can be undertaken. It is not representative of visual impact in itself, nor does it indicate that the proposals would be visible from all locations within the envelope.
- 5.3.23 A Visual Envelope Plan would normally be produced for this type of study but due to the scale of the proposed changes within the context of extensive views, particularly to the north and south it was considered appropriate to limit the extent of the ZTV to within 1km; this representing a distance beyond which the likely scale of the proposed changes would not risk potentially significant effects (please refer to Figure 5.3.6, Volume 1a).

Identification of Key Receptors

- 5.3.24 Potential visual receptors have been initially recorded by reviewing the settlement, land use, topography, vegetation, access and transportation pattern of the study area contained

within the boundaries of the visual envelope. Key receptors plotted via the desk-based review and validated through site survey include:

- Settlements, farmhouses and individual properties;
- Local roads with views of the corridor;
- Public access areas including footpaths and other rights of way; and
- The northern fringes of the Snowdonia National Park.

5.3.25 The desk study included analysis of Ordnance Survey plans of various scales up to 1:10,000 and correlation with detailed plans and sections of the scheme. The field studies included:

- visiting each property/farmstead and recording existing and potential views;
- walking the local footpaths and the slopes to the south of the scheme location;
- driving the route along the A55(T) over a period of several years, summer and winter, and;
- driving around the local road network to assess more distant views.

5.3.26 The site work included analysis of the visual 'shadows' cast by significant tree belts as well as mature woodland, and by variations in topography and landform gradient. This latter factor is particularly important given that even subtle variations can have a large bearing on whether or not the effects of the Scheme would be visible from certain viewpoints.

5.3.27 In addition to the assessment of effects on individual receptors, several key viewpoints have also been assessed (please refer to Figure 5.3.1, Volume 1a for the locations). These have been selected in consultation with Snowdonia National Park Authority as representative views that are typical of views available within the wider landscape.

Field Assessment of Affected Receptors

5.3.28 For the assessment of visual effects, each receptor or receptor grouping identified was visited and surveyed. Weather conditions during the initial assessment period in November 2008 were damp although visibility remained good, the subsequent survey undertaken in July 2015 was bright and sunny with good visibility. Factors considered during the visual assessment included:

- Receptor type and number (*e.g.* dwelling / footpath);
- Receptor height;
- Existing view;
- Distance of view;
- Percentage and elements of scheme visible;
- Viewpoint position (view up / view down / level view);
- Angle of view (acute / perpendicular / average);
- Type of view (foreground / mid ground / background) and position of the scheme in the view, and;
- Analysis of potential impact during construction, upon opening of the scheme and fifteen years into operation, summer and winter.

Analysis of Visual Effects

5.3.29 Analysis of visual effects and evaluation involves consideration of the visual sensitivity to change and magnitude of impact based upon information gathered through site surveys and analysis of the aesthetics of the proposals.

5.3.30 Analysis of visual effects relates to the potential effects during construction, subsequent opening of the facilities and fifteen years into operation (the end of the assessment period), for both summer and winter periods. The analysis assumes that the visual context applicable

at the year of opening is that which would be experienced during winter months when the degree of visual exposure is potentially greatest.

- 5.3.31 The analysis fifteen years into operation demonstrates the effectiveness of any landscape and mitigation proposals for the scheme. The analysis relates to each key receptor and concludes with an evaluation of the significance of effect related to each receptor.

Visual Sensitivity to Change

- 5.3.32 Visual sensitivity to change considers the nature of the receptor. Least sensitive receptors are considered, for example, to be people engaged in work whose primary focus would not necessarily be on the surrounding landscape views. Conversely, more emphasis is placed upon receptors whose change in view or visual amenity is either the prime focus, greater in scale or potentially covers a wider area.

- 5.3.33 The degree and importance of the view gained by a receptor also contributes to an understanding of how sensitive a given receptor is towards change. Therefore, value of the view and scenic quality are also taken into account in the assessment. Please refer to Technical Appendix B, Volume 2 for further details about the criteria applied for identifying sensitivity to change, magnitude of effect and significance of effect for the Visual Effects assessment.

Baseline Information

Policy Context

- 5.3.34 The following guidelines, legislation and planning policy documents provide the framework for the protection and conservation of landscape within the study area. Specific planning policy designations relating to the Scheme and surrounding study area are dealt with separately in Chapter 2, Section 2.7. Existing planning policy and legislation directly relevant to the assessment of landscape and visual effects are briefly outlined below.

National level

- 5.3.35 Numerous statutes exist to ensure both direct and indirect protection of our most valued and important landscapes, their intrinsic visual qualities and the individual elements and components that constitute their appeal. Those with direct relevance to the assessment include the following:

- The National Parks and Access to the Countryside Act, 1949;
- Planning Policy Wales, November 2016;
- Technical Advice Note 12, Design, March 2016;
- Countryside and Rights of Way Act, 2000;
- Wildlife and Countryside Act, 1981;
- Town and Country Planning Act, 1990;
- Hedgerows Regulations, 1997;
- Environment Act, 1995, and;
- Countryside Act, 1968.

- 5.3.36 Statutes and national planning policy make no direct provision for the protection or conservation of specific views. They are, however, an implicit part of the values and qualities recognised in broader landscape designations that seek to protect areas of recognised scenic quality.

Key Policies and Plans

Wales Transport Strategy

- 5.3.37 The Wales Transport Strategy, published by the Welsh Assembly Government in April 2008, identifies the importance of Wales' heritage including the unique landscapes and townscapes. The report identifies a number of Outcomes aimed at achieving a sustainable transport strategy for Wales; Outcome 16 requires an improved effect of transport projects on heritage and indicators of this would be the neutral effect of new transport schemes on landscape and townscape. Please refer to Chapter 5.2 – Cultural Heritage for an assessment of the policies relating directly to heritage resources.

Planning Policy Wales - Edition 9 (November 2016)

- 5.3.38 Planning Policy Wales (PPW) (Edition 9, November 2016) sets out planning policies of the National Assembly for Wales in relation to land use. Of particular relevance to this assessment is Chapter 5 - Conserving and Improving Natural Heritage and the Coast which outlines the Welsh Government's commitments to the natural heritage of Wales. The Welsh Government's objectives for the conservation and improvement of the natural heritage and that are relevant to landscape and visual amenity are to:
- promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;
 - ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;
 - ensure that statutorily designated sites are properly protected and managed.
- 5.3.39 The document is supplemented by a series of Technical Advice Notes; those that are relevant to this proposal are:
- Technical Advice Note 5 (2009) – Nature Conservation and Planning, provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation, which includes landform;
 - Technical Advice Note 12 (2016) – Design, the purpose being to equip all those involved in the design of development with advice on 'Promoting sustainability through good design', and;
 - Technical Advice Note 18 (2007) – Transport, aims to establish an approach to sustainable travel, including the use of existing landscape features to mitigate the potentially harmful effects of transport infrastructure projects.

Local Policy Context

- 5.3.40 The *Gwynedd Unitary Development Plan (UDP) 2001-2016* is the current planning document for the area. It establishes a policy framework for the development needs to provide a basis for consistent and appropriate decisions. It is supported by Supplementary Planning Guidance (SPG) aimed at supporting the policies contained within the UDP. Of specific relevance to the assessment of potential landscape effects is the SPG: Landscape Character and this is a material consideration in the determination of planning applications that are likely to affect the landscape.
- 5.3.41 Local planning authorities have powers to designate local areas of outstanding scenic quality and character via the development plan process. Specific Gwynedd UDP policies relating to the protection, conservation and enhancement of landscape relevant to the study area are:

Policy B12 - Protecting Historic Landscapes, Parks and Gardens

5.3.42 Proposals that are within or on sites visible from a park and garden identified and described in Part 1 of the Register of Historic Landscapes, Parks and Gardens of Special Interest in Wales will be refused if they cause significant harm to their character, appearance or setting.

5.3.43 The scheme extents have been identified as being within a Historic Landscape, as defined in the Gwynedd Unitary Development Plan.

Policy B13 – Protecting the Open Coastline

5.3.44 Outside the Heritage Coast, proposals on open coastal areas included in the Plan area will only be approved if they comply with all the following criteria:

- they require a location on or in close proximity to the coast or open estuaries;
- there will be no adverse impact on:
 - a. water quality
 - b. public access considerations
 - c. the built environment or the landscape
 - d. nature conservation interest of the area due to their location, noise, scale, form, appearance, materials, noise or emissions or due to an unacceptable increase in traffic;
- priority will be given to locations that are visually well related to existing buildings or structures;
- there are no suitable locations within developed areas of coastline

Policy B14 - Protecting the Landscape Character of Snowdonia National Park

5.3.45 Development and land use changes will not be permitted where these would adversely affect the qualities and special character of the Snowdonia National Park by:

- causing significant visual intrusion, and/or
- being insensitively and unsympathetically sited within the landscape

5.3.46 The scheme extents lie on an area of the coastal plain between the Menai Straits and the hills forming the Snowdonia National Park, therefore policies B13 and B14 are of relevance to the assessment.

5.3.47 Gwynedd Council in conjunction with the Isle of Anglesey County Council are currently preparing a *Joint Local Development Plan (JLDP)*, setting out the planning policy framework for the next 15 years (2011 – 2026). Whilst the Gwynedd UDP remains the current planning document, policies emerging as part of the joint development plan are a material consideration as part of the planning decision process. Policies contained within the JLDP of relevance to the assessment have been outlined below:

Policy AMG 1: Special Landscape Areas

5.3.48 When considering proposals within Special Landscape Areas (SLA) as identified by the proposals map and listed below, there will be a need to appropriately consider the scale and nature of the development thus ensuring that there is no detrimental impact on the landscape. The development should aim to add to the historic, visual, geographical, ecological and cultural features of the SLA.

5.3.49 Proposals should address and coincide with the prepared 'Statement of Significance'.

5.3.50 Where there are reasonable grounds to suggest that proposals may result in a significant adverse impact on the SLA (either located within or directly outside) the Council will require

a Landscape and Visual Impact Assessment in order to further consider the impact of the development on the designated area.

5.3.51 In exceptional circumstances, where development is necessary and could result in significant impact on the landscape, appropriate mitigation and compensation measures should be provided.

5.3.52 Within the southern part of the study area (please refer to Figure 5.3.1, Volume 1a) the landscape has been designated locally as a Special Landscape Area. Whilst the Scheme does not directly impact on the landscape within the designation, it does occur in close proximity to its boundary and therefore has the potential to adversely affect the perception of the landscape that contributes to the wider understanding of the landscape as a whole.

Policy AMG2: Protecting and Enhancing Features and Qualities that are Unique to the Local Landscape Character

5.3.53 Proposals that would have an adverse impact upon landscape character as defined by the Landscape Character Areas included within the current Landscape Strategy for the relevant authority, must demonstrate through a landscape assessment how landscape character has influenced the design, scale, nature and site selection of the development.

5.3.54 A proposal will be granted provided that it doesn't have an adverse impact upon features and qualities which are unique to the local landscape in terms of visual, historic, geological, ecological or cultural aspects. Measures should be taken to ensure that the development doesn't:

- Cause significant adverse impact to the character of the built or natural landscape;
- Fail to harmonise with, or enhance the landform and landscape;
- Lose or fails to incorporate traditional features, patterns, structures and layout of settlements and landscape of both the built and natural environment.

5.3.55 Particular emphasis will be given to the landscapes identified through the Landscape Character Areas as being of high and outstanding quality because of a certain landscape quality or a combination of qualities.

5.3.56 Additional consideration will also be given to developments which directly affect the landscape character and setting of the AONBs or the National Park.

Landscape Designations

5.3.57 Designations of direct relevance to the baseline receiving landscape, its contextual setting and overall character comprise the following (see also Figure 5.3.1, Volume 1a).

Snowdonia National Park

5.3.58 The landscape quality associated with the study area was judged not to merit inclusion within the Snowdonia National Park when it was designated in 1949, but it is close to the boundary, as indicated on Figure 5.3.1, Volume 1a. The boundary of Snowdonia National Park is approximately 620m from the Scheme to the A55(T) at its western end and approximately 110m at its eastern end (see Figure 5.3.1, Volume 1a), becoming closer still (25m) within the village of Abergwyngregyn. Widening of the Roman Road between Tai'r Meibion and Crymlyn would bring changes to the local road within 170m of the National Park boundary as it extends to follow the route of the Roman Road to the east, from Crymlyn to Abergwyngregyn.

Landscape Character Areas

- 5.3.59 LANDMAP, with contribution from Gwynedd Council, has identified local Landscape Character Areas (LCA) that are within the proposed site boundary or within close proximity, see Figure 5.3.1, Volume 1a. LANDMAP is the national information system for Wales, devised by the Countryside Council for Wales, now part of Natural Resources Wales, for taking landscape into account in decision-making, and studies are undertaken at a County or National Park scale throughout Wales.
- 5.3.60 The area is also included within the non-statutory Register of Landscapes of Historic Interest in Wales (see Chapter 5.2: Cultural Heritage for further details).

Public Rights of Way

- 5.3.61 There are a number of public rights of way, including footpaths, bridleways and strategic recreational routes, in the area with an appreciation of the existing A55(T), refer to paragraph 5.3.86 for details of the rights of way associated with the Scheme (please see Figures 5.3.6 and 5.8.1, Volume 1a and Chapter 5.8: Effects on All Travellers for further details).

Landscape Character

- 5.3.62 The Scheme runs through the centre of a landscape that continues for an extensive length of the North Wales coast. This is mainly a 1km wide coastal plain bounded to the north by the Menai Strait and to the south by the foothills of the Carneddau of north-west Snowdonia. The site lies between Traeth Lafan with its expansive mud flats and sands fully exposed at low tide and the partially wooded hills to the south, which peak at Moel Wnion approximately 2.5km away and at 580m above ordnance datum (AOD). The topography of the area is illustrated in the site photographs in Figures 5.3.2 – 5.3.5, Volume 1a.
- 5.3.63 The foothills form the lowland slopes of the Carneddau and extensive views can be obtained from their higher slopes, looking north-west across the Menai Strait to Beaumaris and the Isle of Anglesey 5km distant and north-east across Conwy Bay towards the Great Orme and Llandudno.
- 5.3.64 The scheme would not pass directly through an area of statutory landscape designation, although an area of Special Landscape Value has been defined in the emerging JDLP. The area is also included within the non-statutory Register of Landscapes of Historic Interest in Wales (see Chapter 5.2: Cultural Heritage for further details).

Landscape Character Areas

- 5.3.65 The LANDMAP information is provided at a scale appropriate to the study area and has been used to describe the local baseline landscape character. Each Landscape Character Area (LCA) is visually and/or physically distinct from its surroundings. This distinction and determination of zoning references physical attributes such as existing water features, built form, land cover, woodland cover, land use, settlement pattern and accessibility. The wealth of physical attributes applied to each area can result in interfaces between LCAs and the wider landscape character areas not being defined as absolute.
- 5.3.66 The main characteristics of each LCA are outlined below, incorporating an assessment of value, quality and sensitivity. Comment is made on the scale at which elements within each LCA matter, their scarcity and their ability to be replaced or substituted.

LCA 1 - Abergwyngregyn, Scarp slopes and Lower Plateau

- 5.3.67 A narrow belt of hill slopes rises sharply from the Wig Open Lowland Farmland on north westerly facing slopes from 30 – 200m AOD. The steeper slopes and more variable landform results in less intensive management, confined primarily to sheep grazing with greater occurrence of woodland and smaller plantations. The field pattern is ill-defined, irregular and frequently disrupted by streams, rocky outcrops and tracks, these becoming more frequent on the higher slopes. Field boundaries are mainly earth banks with hedgerows, although gappy and reinforced by fencelines; infrequent stone walls bound some of the local roads. The majority of landscape features, with the exception of some of the older hedgerow and field trees, could be substituted in the medium term, the trees being a feature replaced in the long term. The scarp slopes are shown in context on Existing Viewpoints 7, 8 and 9 on Figures 5.3.4 and 5.3.5, Volume 1a.
- 5.3.68 In common with the wider area the settlement pattern is one of sparse dwellings and farmsteads, the orientation of these is typically to the north and west as a result of the expansive views and strong visual links that exist with the lower slopes, coastal plain and Menai Straits. The southern edge of Anglesey is visible to the horizon.
- 5.3.69 The area is considered to be of good quality with the landscape being typical of the upland fringe landscapes frequently found in north Wales. The landscape is more heavily wooded in its appearance and its elevated position makes it visible from the plateau to the north making the area of **moderate sensitivity to change**.

LCA 2 - Wig, Open Lowland Farmland

- 5.3.70 A narrow strip of open farmland extends along the north Wales coast at this point. It is settled throughout with larger farms and dwellings and is typified by a medium-sized, rectilinear field pattern, bounded by hedgerows with frequent mature hedgerow trees. Copses of trees and small pockets of remnant woodland remain, giving the area an almost wooded appearance. The landscape management is given over to mainly grazing with infrequent arable land uses. The majority of landscape features, with the exception of some of the older hedgerow and field trees, could be substituted in the medium term, the trees being a feature replaced in the long term.
- 5.3.71 There are strong visual links to the hills that form adjacent character areas to the south and from the northern edge of the character area the higher slopes of these hills are revealed and a marked sense of openness and remoteness is felt. This sense of remoteness is one of the key features that contribute towards a sense of place, reinforced by the views of the Menai Strait and the hills to the south. The farmland character is shown in context on Existing Viewpoints 1, 2, 3, 4 and 6 on Figures 5.3.2 and 5.3.3, Volume 1a.
- 5.3.72 The area is crossed by the existing A55(T) and the Chester to Holyhead railway line, both of which are existing visual detractors within the landscape; in particular the A55(T) with its frequent traffic movements being visible within the wider character area. Despite the presence of the A55(T) this is a landscape that is fairly inaccessible, footpaths lack connectivity and farms and other property are accessed from private lanes directly from the main road. The A55(T) also marks the start of the transition to the adjacent hill slopes as the topography starts to rise to the south.
- 5.3.73 The area is considered to be of good quality with the landscape demonstrating a strong landscape framework interrupted only by the existing transport links. The landscape, although broadly flat and at a low elevation, forms the fringes to the Snowdonia National Park and represents the transition from hill form to coastal plain. The area is visible from

higher ground to the south and would therefore be considered to be of **moderate sensitivity to change**.

LCA 3 - Moel Wnion Upland Grazing

- 5.3.74 This character area is formed by the rugged lower slopes of Moel Wnion as it rises to the south of the study area, eventually leading to the summits of the Carneddau which lie approximately 6km to the south. These upland slopes lack a sense of containment and are used primarily for sheep grazing. There is a lack of significant vegetation with grass, bracken and rocky outcrops prevailing. The scrubby vegetation is substitutable in the short to medium term. Areas of heather moorland are more difficult to substitute and are likely to only be substituted in the medium to long term.
- 5.3.75 Landform gradually slackens as an open plateau is reached, this permits open and expansive views to the north, across the Wig Lowland Farmland to the Menai Straits and Anglesey stretching out beyond. These expansive views are impressive and contribute to a greater sense of elevation and remoteness.
- 5.3.76 The area is considered to be of **good quality** forming the northern fringes of the Snowdonia National Park and representing a mountainous landscape that is conspicuous to the surrounding landscape. The landscape is also considered to be **highly sensitive** to change due to its elevated position and exposed nature from a lack of coherent landscape framework.

LCA 4 - Traeth Lafan, Shallow Tidal Waters

- 5.3.77 The coastline varies from being approximately 600m – 1km to the north of the A55(T) and the gently sloping narrow beach/coastal fringe that gives direct access to intertidal coastal waters at high tide. The character changes as the tide recedes revealing the wide, open mud flats of Traeth Lafan with SAC, SPA & SSSI designations. The footpath that runs along the length provides access throughout the character area and affords longer distance views to the hills to the south and Anglesey to the north and west. With its improved coastal footpath, this somewhat isolated coastal fringe presents attractions to ramblers, birdwatchers and other naturalists. The coastal fringe is shown in context on Existing Viewpoints 1-3 and 10 on Figures 5.3.2 and 5.3.5, Volume 1a.
- 5.3.78 The area is considered to be of very good quality and, although demonstrating little in the way of landscape structure, through its expanses of tidal mudflats it does contribute to the formation of a distinctive character. The area's promotion as a chain of nature conservation areas and recreational resource would suggest that the landscape has value at a regional level. The area is considered to have a **moderate sensitivity** to change.

Abergwyngregyn

- 5.3.79 Although outside the study area, Abergwyngregyn is the only settlement of note in the immediate area. The centre of the village is a designated conservation area with a number of historical buildings and archaeological sites. However the A55(T) is not visible from any existing properties within the village. This is due to the elevation of the village, which is generally set below the A55(T) and the combined screening effects of the landform and vegetation associated with the roadside and adjacent property. As a result of this no further landscape appraisal of this area has been carried out.

Table 5.3.1: Summary of Baseline Conditions - Landscape Character

Landscape Character Areas	Quality	Sensitivity to change
LCA 1 - Abergwyngregyn, Scarp slopes and Lower Plateau	Good	Moderate
LCA 2 - Wig, Open Lowland Farmland	Good	Moderate
LCA 3 - Moel Wnion Upland Grazing	Good	High
LCA 4 - Traeth Lafan, Shallow Tidal Waters	Very Good	Moderate

Summary of Baseline Conditions - Landscape Character

- 5.3.80 The landscape is a varied one; it is locally distinctive and clearly defined by the coastline to the north and prominent hillsides rising to the south. Land management techniques contribute to the nature of the landscape, defined by the rising landform forcing a change from the lowland plateau and dairy production to the north and the steep slopes and sheep grazing to the south.
- 5.3.81 Woodland forms a strong distinctive feature within the landscape, but does little to contain views due mainly to the rising landform. Managed hedgerows with mature trees form a strong landscape framework within which the existing A55(T) and railway are contained, although visually prominent in places.
- 5.3.82 From anywhere within the study area the landscape remains dominated by the moorland hillsides as they rise to the south, forming a very broad sense of enclosure and reinforcing the sense of the open coastal plain to the north.
- 5.3.83 Overall, the study corridor is formed by a coastal plain which forms a distinct change in landform as the slopes rise to the south and give way from a defined landscape framework to a landscape that is more reflective of the steeply rising contours. This is further reflected in the change from intensive dairy production on the coastal plain to the rough grazing land on the more steeply sloping landform and moorland.

Visual Context

- 5.3.84 The broad visual context has been identified initially through desk-based review of information outlined in previous studies and site survey work (refer to Figure 5.3.6, Volume 1a). Please refer to the supporting panoramic photographs on Figures 5.3.2 – 5.3.5, Volume 1a, which depict the broad visual context of the study area.

Principal Topographical Viewpoints

- 5.3.85 The landscape is typified by a distinct change in topography. As a result there are a number of clearly identifiable topographical viewpoints from which the study area forms a distinctive component. In the context of the study area these are mainly distant views from elevated moorland to the south.

Principal Rights of Way and Public Highway Viewpoints

- 5.3.86 Principal rights of way and public highway viewpoints have been identified as lengths of pathway, track, bridleway and local highway which offer views of the study corridor to user groups. These are:
- The coastal path extending to the north;
 - Rights of way on higher ground to the south; and
 - Several locations along Roman Road
- 5.3.87 Further information on the location, extent and effects on footpaths can be found in Chapter 5.8: Effects on All Travellers and Figure 5.8.1 (Volume 1a).

Principal Visual Receptors

5.3.88 The generally sparse settlement pattern of the area results in a total of 20 property groupings with a visual appreciation of the proposed changes within the existing road corridor. The tables that follow this section and Figure 5.3.6 (Volume 1a) identify principal receptor locations neighbouring the proposed development site, from where views could potentially be attained. They also identify prominent viewpoint locations which, from varying distances, would contain the proposed development in the overall outlook. The broad visual context is described for each, with particular reference to locations where there are groupings of visual receptors.

Public Rights of Way

5.3.89 There is a small network of footpaths scattered throughout the study area (see Figure 5.8.1, Volume 1a). Typically, to the north of the A55(T) corridor the footpaths follow field boundaries and tend to provide direct links to the coastline. On higher ground to the south the footpaths tend to be more sinuous following contours and shallow valleys and providing links to the moorland and mountains to the south.

Summary of Baseline Conditions - Visual Context (see Figure 5.3.6, Volume 1a)

5.3.90 The study corridor is dominated by agricultural land uses and settlement patterns tend to be sparse and limited to isolated farmsteads and residential properties. The local landform rising to the south contains a number of these scattered receptors along with several footpaths with a visual appreciation of the study area. In contrast the coastal plain to the north features numerous hedgerows and trees that restrict views of the study corridor.

5.3.91 Overall, visual receptors are scattered throughout the study corridor reflecting the sparse settlement pattern typical of the area. Receptors vary in their sensitivity and are frequently dominated by existing views of the A55(T) corridor. A number of footpaths exist in the study corridor which have views of the existing road corridor.

Magnitude of Impacts and Significance of Effects (before mitigation)

Key Issues

5.3.92 Key issues taken account of in the assessment of effects on landscape character and the degree of visual change, potentially both adverse and beneficial, comprise the following:

- Vehicular activity and movement;
- Horizontal and vertical alignment;
- Size, scale and appearance of earthworks;
- Degree of loss of existing components of the landscape; and
- Scope for mitigation strategies.

5.3.93 The identification and evaluation of effects has been undertaken utilising the engineering description and layout configuration summarised in Chapter 2: The Scheme and Figures 2.2 to 2.5, Volume 1a.

5.3.94 The findings of the assessment are split into two sections – the effects on Landscape Character and Visual Effects. The assessment of the effects on the former relate to the predicted changes in fabric, character and overall quality as a result of proposal construction. The latter relate solely to predicted changes in outlook composition from locations afforded views of the existing landscape and the effects on identified receptors resulting from proposal construction.

- 5.3.95 The proposals would be finished to a high standard of design, using quality materials, and would be integrated into the surrounding environment through the adoption of a robust, sustainable mitigation planting strategy.
- 5.3.96 As the primary form of mitigation comprises the planting of new hedgerows and trees/shrubs (see also Chapters 5.2: Cultural Heritage and 5.4: Nature Conservation) the assessment undertaken for the winter in the year of opening also represents an assessment of effects, pre-mitigation. This is in accordance with the IAN 135/10(W) guidance, which requires the consideration of effects before mitigation measures have been implemented, the assessment of potential effects having effectively been undertaken pre-mitigation establishment.
- 5.3.97 For landscape, consideration is given to the change in the effects arising over time as mitigation strategies mature. Post-construction effects have therefore been assessed assuming that the proposed outline mitigation strategies are instigated during construction and fulfil their intended environmental function by Year 15 - The Design Year.
- 5.3.98 Mitigation strategies encompassing ecological-based design measures and measures to address flooding and water quality are shown in Figures 5.3.7 – 5.3.9, Volume 1a, refer to Chapters 5.4: Nature Conservation and 5.10: Road Drainage and the Water Environment.
- 5.3.99 The cumulative effects of route construction and mitigation have also been considered, in terms of how they would merge into the surrounding landscape, and any benefits or disbenefits they would present to the ongoing development and evolution of the locality.
- 5.3.100 In undertaking the assessment of visual effects, impacts have been identified and quantified against four key phases in the overall project development and operation process. These phases also take account of outline mitigation and the overall change in outlook from affected receptor locations over time as follows:
- During construction;
 - Winter year of opening;
 - Winter 15 years post opening; and
 - Summer 15 years post opening.

Assessment of Effects - Landscape Character (see Figure 5.3.1, Volume 1a)

- 5.3.101 The following provides a summary of the anticipated effects and resulting ratings on identified LCAs, describing the broad implications for character areas identified in Section 5.3.3: Baseline Conditions.

LCA 1 - Abergwyngregyn, Scarp slopes and Lower Plateau

- 5.3.102 This rising landscape character has a wide appreciation of the surrounding landscape to the north, and is considered to be of **good quality** and of **moderate sensitivity** to change; views from this area are expansive with the existing A55(T) corridor featuring as just one element within the wider view.
- 5.3.103 Proposed changes would occur on the fringes of the character area, but would include some local improvements to access along Roman Road. The widening of Roman Road would require the translocation of an existing hedge and removal of relatively short lengths of existing roadside hedgerow and a number of associated trees. However, in context with the slopes to the north and south and the remaining mature, deciduous trees this is not considered to be significant. Changes within this corridor as a result of the proposals would therefore not appear as readily perceptible changes and, as the proposed changes would occur to the fringes of the character area and within the context of the existing A55(T)

corridor impacts are considered to be in the order of **negligible** in the winter year of opening and would reduce to **no change** into the winter and summer in year 15.

5.3.104 The overall effect on this landscape character area is considered **slight adverse** but this is anticipated to reduce to **neutral** in the design year as mitigation measures establish.

LCA 2 - Wig, Open Lowland Farmland

5.3.105 Changes to the existing landscape character, considered to be of **good quality**, are anticipated to be low in number. The formation of a new County road and access to Wig Farm would see the existing hedge retained from Junction 12 east to the western extent of highway improvements west of Tai'r Meibion farm; this hedgerow is currently heavily managed and has limited capacity to screen broader views to the north. East of this point, mitigation measures would seek to reinstate the edge of the existing woodland to the north and a new roadside hedge feature to the east to integrate the new agricultural access track into the local landscape framework; this would include a number of roadside trees to the eastern end of the scheme, opposite Bryn Meddyg cottages.

5.3.106 In addition a new hedge would be planted to the north of the County road as far east as the road to Wig Crossing cottages. The inclusion of a new hedge would recommence at the access to Wig Farm and extend to the boundary of Pentre Aber Farm that marks the eastern limit of the scheme. Some minor impacts would occur during the construction period whilst disruption to the existing landscape framework occurs. The landscape character is considered to be of **moderate sensitivity** to change and post construction the overall impact on the local landscape character is therefore anticipated to be **negligible** in the winter year of opening and would reduce to **no change** into the winter and summer in year 15.

5.3.107 The overall effect on this landscape character area is considered **slight adverse** but this is anticipated to reduce to **neutral** in the design year as mitigation measures establish.

LCA 3 - Moel Wnion Upland Grazing

5.3.108 This elevated landscape character area, considered to be of **good quality** and **highly sensitive** to change, has some visual appreciation of the proposed changes within the existing A55(T) corridor to the north although no direct impacts on the landscape character area would occur. Perceived changes as a result of the proposals would be very low from these areas and as such there is anticipated to be no change to the existing landscape character in the winter year of opening and this would remain as such into the winter and summer in year 15.

5.3.109 The overall effect on this landscape character area is considered **neutral** and this would remain as such into the winter and summer in year 15.

LCA 4 - Traeth Lafan, Shallow Tidal Waters

5.3.110 The coastal fringe character area to the north of the existing A55(T) corridor is considered to be of **very good quality** and of **moderate sensitivity** to change. There would not be any direct impacts upon the landscape character area by the proposed changes. In addition changes within the existing corridor of the A55(T) would not be readily perceptible post construction and the resulting magnitude of impact would be no change. Therefore there is anticipated to be no change to the existing landscape character of this area in the winter year of opening and this would remain as such into the winter and summer in year 15.

5.3.111 The overall effect on this landscape character area is considered **neutral** and this would remain as such into the winter and summer in year 15.

Assessment of Visual Effects (see Figure 5.3.6, Volume 1a)

- 5.3.112 Visual appreciation of the Scheme associated with receptors and locations afforded distant views over 1km has not been assessed, as any material change in outlook would not be readily perceived from these distances.
- 5.3.113 The following table provides a summary of the anticipated effects and associated ratings on identified visual receptors and describes the broad implications for receptors based on the locations identified in 'Baseline Information' and Figure 5.3.6 (Volume 1a) at a local level.

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
1	Ty'n - yr - Hendre Farm	1	Low	200m	<p>Ty'n-yr-Hendre Farm is located at the junction of two minor roads leading to the Tal-y-Bont Interchange whose buildings span between 75m and 200m from the centreline of the A55(T). The southern part of the farm is organised around a quadrant whose northeast lying side (that closest to the A55(T)) is separated from the minor road by a road side hedgerow. This southernmost part of the farm does contain small windows which look towards the A55(T) but the use of this building is not residential. Located 10m higher and 125m further south is a property likely to be the main residence, whose windows also look towards the A55(T). A block of trees are situated between the minor road and the A55(T) together with a large block of woodland above the property to the southeast.</p>	<p>Visual impacts. The Scheme at this point only relates to the provision of a County road/NMU route/PMA which would run parallel, north of the existing A55(T) road, behind the existing hedgerow which would be retained. As a result, the block of woodland which lies to the south of the A55(T), between itself and the minor road would remain. There is the potential for a slight visual awareness of construction activities set beyond the edge of the existing woodland and hedgerows.</p> <p>Proposed Mitigation Measures. None required. It is the intention to establish a hedgerow on the northern side of the County Road/NMU route/PMA.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
2	Tan - yr - allt Cottages	4	Low/Medium	100m	<p>These cottages are located on the minor road which runs parallel to the southern side of the A55(T). The windows of these properties overlook the existing A55(T). Isolated trees and existing hedgerows provide some level of screening against the main road. A footpath runs to the left of these properties in a south-eastwards direction complementing a footpath which runs in a north-westwards direction on the northern side of the A55(T) road, almost opposite the cottages. A block of woodland lies immediately east of this footpath (County No.43).</p>	<p>Visual impacts. The Scheme at this point only relates to the provision of a new footway along the access road immediately in front of the properties and to the provision of an NMU route/PMA/County route which would run parallel, north of the existing A55(T), behind the existing hedgerow which would be largely retained. The land falls away behind the raised level of the northern side of the A55(T) opposite the cottages. This is particularly marked at and close to the woodland block. The raised level of the road here (in particular with the retention of the trees on the raised false cutting which are separate from the block of woodland itself) and the retention of the existing hedgerows would minimise any views, resulting in a slight adverse to negligible change in the views. The dominant feature of the view is the existing A55(T), which would remain in the foreground and more intrusive than the proposed NMU route/PMA/County route.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
3	Tan – yr – Allt and Barn conversion	2	Medium	354m	<p>The farm house of Tan-yr-Allt has front elevation views from both floors facing north overlooking the adjacent farm buildings and extending to the north overlooking the coastal farmland and the Menai Straits. Also present within the group is a recent conversion of former farm buildings to a residential dwelling, set on the rising land form above Tan-yr-Allt cottages. The end gable windows overlook the access track and the rear of the cottages, beyond which are direct views towards the A55 (T). Beyond the main road are extended views towards the Menai Straits and Anglesey in the distance.</p>	<p>Visual Impacts. Within the limited views from the property are direct views towards the A55 (T) within which some awareness of construction activity and clearance of vegetation is likely to be perceptible. The new concrete barrier would highlight the central reserve within the view highlighting the horizontal nature of the road corridor. Post construction the elements of the view would not have substantially changed. The new NMU route/PMA/County road would be barely perceptible beyond the existing corridor.</p> <p>Proposed mitigation measures. Replacement and new hedges would in the medium term effectively replace the existing features of the view.</p> <p>As a result and as such the magnitude of change would be negligible.</p>	Slight adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
4	Fedw/Hillcrest	2	High	697m	Two small cottages set high on the scarp slope with expansive views from the front elevation overlooking the north Wales coastal belt - distant views of Anglesey and Great Orme's Head. The A55(T) is a discernible feature within the view but is not a dominant one given the extended views. The front elevations have relatively small windows and external space is limited.	<p>Visual Impacts. Proposed work to construct the new NMU route/PMA/County road would be perceptible within the wider and expansive views although vegetation clearance is unlikely to represent a significant modification to the elements within the views. Post construction the road is unlikely to be readily perceptible and this would continue as the replacement hedges mature to restore the existing views.</p> <p>Proposed mitigation measures. Replacement and new hedges would in the medium term effectively replace the existing features of the view.</p> <p>The magnitude of change would be no change.</p>	Slight adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
5	Ty'n Lon/Ty'n Lon Bam	2	Medium	377m	A detached house and adjacent bungalow have direct views to the north overlooking Tan-yr-Allt cottages beyond which are views of Tai'r Meibion and the A55(T). There are more distant views to the north towards the Menai estuary beyond the gently falling landform of the coastal farmland.	<p>Visual Impacts. The front elevation of both properties and in particular the detached house would have some awareness of construction activity occurring within the A55(T) corridor. Some awareness of the construction activity to Roman Road may also be apparent from the side elevation. Post construction there would not be a significant modification to the components of the view that is likely to give rise to significant effects.</p> <p>Proposed mitigation measures. Replacement and new hedges would in the medium term effectively replace the existing features of the view.</p> <p>The magnitude of impact would be negligible.</p>	Slight adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
6	Capel Gilfach	1	Medium	220m	<p>A converted chapel – the property has skylights within its roof and the north facing elevation has been converted to have extensive windows facing out to benefit from the views of the Menai estuary and adjoining farmland. Traffic is visible moving on the A55(T) although the road surface is generally well screened by existing intervening hedges and hedgerow trees.</p>	<p>Visual Impact. Some awareness of the construction activity is likely in the mid-distance as works are undertaken to construct the NMU route/PMA/County Road. However this would be occurring beyond the existing A55(T) corridor and generally would not represent a significant modification to the existing components of the view. Post construction the components of the view would generally be unchanged.</p> <p>Proposed mitigation measures. Replacement and new hedges would in the medium term effectively replace the existing features of the view.</p> <p>The magnitude of impact would be low.</p>	Slight adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
7	Tai'r Meibion	1	Low	27m	<p>The property already suffers a high level of visual intrusion from the A55(T). The existing hawthorn hedge bordering the A55(T) is reinforced by an adjacent mature cherry laurel hedge, although the property suffers from not having any trees to the frontage. Large sycamores and beeches to the east and west of the farmhouse give a good degree of screening in summer, but leave it exposed in winter.</p>	<p>Visual impacts. In view of the already exposed nature of the property, the road widening, central barrier, improvements to the existing layby and the extension of the accommodation subway would constitute moderate visual intrusion. Post construction the components of the view would generally be unchanged.</p> <p>Proposed Mitigation Measures. Replacement and/or translocation of hedges, with new woodland would in the medium term effectively replace the existing features of the view</p> <p>The magnitude of change would be low.</p>	Moderate Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
8	Gilfach	1	Medium	400m	The property has a north-western aspect, resulting in views which are directed towards and over the A55(T). However, the existing hedgerows along the A55(T) screen much of the view and form one element in a wide sweeping view which stretches across Traeth Lafan to Anglesey.	<p>Visual impacts. Although the improvements to the A55(T) may result in a greater degree of vehicle roofs being discernible, this would be negligible in light of the translocation/replanting of the hedgerows. There would be some perception of the changes to Roman Road immediately to the front of the property during construction, although impacts are considered not to be significant. A combination of the aspect of the property, adjacent buildings and intervening vegetation would limit visibility of the proposed agricultural access track and any changes to the east of the property.</p> <p>Proposed Mitigation Measures. Replacement and/or translocation of hedges alongside the new A55(T) boundary would restore existing features of the view.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
9	Rallt-uchaf	1	High	310m	<p>Cottages set high on the scarp slope with expansive views from the front elevation overlooking the north Wales coastal belt - distant views of Anglesey and Great Orme's Head. The A55(T) is a discernible feature within the view but is not a dominant one given the extended views. The front elevations have relatively small windows and external space is limited.</p>	<p>Visual Impacts. Proposed work to construct the new NMU route/PMA/ County road would be perceptible within the wider and expansive views although vegetation clearance is unlikely to represent a significant modification to the elements within the views. Post construction the new road is unlikely to be readily perceptible and this would continue as the replacement hedges mature to restore the existing views.</p> <p>Proposed mitigation measures. Replacement and/or translocation of hedges would in the medium term effectively replace the existing features of the view.</p> <p>The magnitude of change would be no change.</p>	Slight adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
10	Crymlyn Farm	1	Medium	450m	<p>The enclosure of the farm buildings and the location of the intervening woodland are such that the only views of the A55(T) are through a fairly narrow window directly to the north. The distance to the A55(T) within this view is around 550m, and with the influence of middle distance hedgerows etc., the visual intrusion caused by traffic on the A55(T) is currently insignificant. A rough tractor path marks its way through the field immediately in front of the property linking with the Wig Farm subway and access track.</p>	<p>Visual impacts The main impacts of the proposals would be the addition of the proposed farm access track link from Roman Road to Wig Farm underpass. This track would cut through the fields immediately in front of and to the sides of the property and partly follow an existing track. Currently these fields are used as pastoral agricultural land. The track would cross in front of the block of woodland which currently screens much of the views onto the A55(T). The track passes approximately 200m from the property at its closest point, and given the close proximity this would result in a significant degree of visual intrusion. However, as it would follow the well-worn existing tractor path it would minimise the impact slightly. Views of the track east of the property would be screened by mature trees. Changes to Roman Road would be screened by a combination of landform and intervening vegetation.</p> <p>Proposed Mitigation Measures. Any intrusion of the widened A55(T) would be compensated by re-planting and/or translocation of the roadside hedgerow.</p> <p>The magnitude of change would be low.</p>	Moderate Adverse	Slight Adverse	Slight Adverse	Slight Adverse

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
11	Wig Crossing Cottages	4	Low	350m	The front windows of the cottages face south-westwards along the same line, but to the west, of the A55(T), ensuring that any potential views of the A55(T) and proposed County road would be oblique. The presence of mature trees and hedgerows in the intervening landscape as well as the landform, effectively screen views towards the A55(T).	<p>Visual Impacts. The intrusion from the improvements to the A55(T) would be minor adverse as a result of the presence of site vehicles during the construction period. Residents would be able to gain oblique partial views of the proposed NMU route/PMA/County road, but in the long-term, once the northern hedgerow has been established, the impact of this road on views would be reduced.</p> <p>Proposed Mitigation Measures. No specific mitigation measures are required.</p> <p>The magnitude of change would be no change.</p>	Slight Adverse	Neutral	Neutral	Neutral
12	Wig Farm	1	Low/ Medium	110m	A high hedgerow and woodland belt effectively screen southern and western views towards the A55(T). There is also a line of existing mature trees to the south-east of the house, with 2 large horse chestnut trees in the field to the front. Although providing a good foil in summer, traffic can be seen to the south-east under these large tree canopies. The absence of a hedgerow adjacent to the A55(T) means that this exposure is more marked in winter allowing partial views towards the A55(T).	<p>Visual impacts. The main impacts of the proposals would be views of the elevated NMU route/PMA adjacent to the A55(T). However, the distance from the NMU route/PMA, the presence of intervening trees and vegetation, and the lack of a hedgerow at present combine to reduce the magnitude of what would otherwise be a moderate adverse impact.</p> <p>Proposed Mitigation Measures. The planting of a hedge to the boundary would reduce the magnitude of the impact.</p> <p>The magnitude of change would be low to no change.</p>	Moderate Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
13	Y Glyn Farm	1	Medium	360m	<p>The farmhouse has a north-western aspect overlooking the road, but the A55(T) is only one feature in a wide, open panorama stretching across to Penrhyn Castle and over Traeth Lafan towards Anglesey. A number of mature trees in the foreground hedgerow help to break up the view, but the visual intrusion of the A55(T) is minor.</p>	<p>Visual impacts. The addition of the junction and access track onto the A55(T) for use by this farm and the properties at Bryn Meddyg would result in a potential visual impact for upper storey views from Y Glyn Farm. However, the convex nature of the landform in the intervening field projects views over and beyond the A55(T) from lower level views so the visual impact of the Scheme would be minor adverse.</p> <p>Proposed Mitigation Measures. A woodland and scrub mix would be planted at the new westbound access track. The planting of new hedgerows adjacent to the carriageways and new hedgerows/planting at the Bryn Meddyg access track would reduce visual impacts further.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
14	No. 2 Bryn Meddyg	1	Low	20m	<p>This is one half of the closest of any property to the westbound carriageway and, although separated by a garden wall and mature roadside hedge, suffers severe exposure to traffic passing directly in front. It is partially shielded to the east by the neighbouring property (No. 1) and a mixture of vegetation such as fir trees and rose bushes. To the west a line of mature trees on the boundary is a good foil to the effects of traffic in both directions, although this is less effective in winter.</p>	<p>Visual impacts: 1) Loss of trees: The partial loss of trees to the west as a result of construction of the access track would increase the degree of visual intrusion from the west. Intermittent existing vegetation would assist in minimising this impact and the views most affected would be frontal resulting in a minor magnitude of change. 2) Changes within the existing A55(T) corridor including the addition of a concrete central barrier would be noticeable. However, given the existing presence of the A55(T) the magnitude of this impact is judged to be minor and resulting effects as slight/moderate adverse. Proposed Mitigation Measures. A combination of a screen fence and the planting of scrub and trees would limit visibility to the west and reduce the visual intrusion of the road. Important views beyond the A55(T) would not be substantially affected. The magnitude of change would be low to medium.</p>	Moderate Adverse	Slight Adverse	Slight Adverse	Slight Adverse

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
15	No. 1 Bryn Meddyg.	1	Low	20m	<p>The house is shielded from the road to the west by No.2 Bryn Meddyg and to the east by dense, well-established woodland. The planting directly in front of the property next to the garden wall is not as well established as that of No. 2.</p>	<p>Visual impacts. The Scheme would not affect the trees to the east and therefore would not cause a loss of screening. Changes within the existing A55(T) corridor including increasing the paved width and a concrete central barrier would have similar effects to those for No. 2 Bryn Meddyg and again, the already exposed nature of the frontage renders the magnitude of this as minor and resulting effect as slight/moderate adverse.</p> <p>Proposed Mitigation Measures. A combination of a screen fence and the planting of scrub and trees would limit visibility within acute views from the front of the property and marginally reduce the visual intrusion of the road. Important views beyond the A55(T) would not be affected.</p> <p>The magnitude of change would be low to medium.</p>	Moderate Adverse	Slight Adverse	Slight Adverse	Slight Adverse

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
16	Cwrtiau	1	High	564m	<p>A single isolated dwelling positioned on the edge of the Menai Strait. The property has side elevation windows that have oblique views to the west that look across the Chester to Holyhead railway line. Beyond which are views of traffic moving along the A55(T). The landform quickly rises beyond this with pockets of woodland within the irregular field pattern giving way to the rounded landform of the summit of Moel Wnion.</p>	<p>Visual Impacts. Construction of the NMU route would be perceptible in the medium distance. It would however not be a significant change in the components of the view. Post construction the elements of the view would be largely unchanged with the NMU route perceptible until mitigation measures mature and the concrete central barrier defining the linear nature of the road in the landscape is reduced.</p> <p>Proposed Mitigation Measures. The proposed hedge in combination with tree planting would filter/screen views of traffic on the A55(T).</p> <p>The magnitude of impact would be negligible.</p>	Slight Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
17	Morfa Aber Car Park	1	Medium	592m	The small car park facilitates access to the nature reserve and footpath that extends along the coastline. Whilst views of the A55(T) exist, the contrast between hill form of Moel Wnion and the expanse of the Menai Strait to the north is the dominant feature. The A55(T) and railway line are relatively minor elements within these views.	<p>Visual Impacts. The modifications to the components associated with the A55(T) would be relatively minor and whilst more readily perceptible during the construction phase the changes post construction would be barely perceptible. The presence of the NMU route and concrete barrier would slightly increase the awareness of the linear nature of the road within the landscape.</p> <p>Proposed Mitigation Measures. The proposed hedge in combination with tree planting would filter/screen views of traffic on the A55(T).</p> <p>The magnitude of impact would be negligible.</p>	Slight Adverse	Slight Adverse	Neutral	Neutral
18	The Old School	1	Low	33m	This is separated from the A55(T) by a fast-establishing planting belt on an embankment which completely screens the section of road to be improved.	<p>Visual Impacts. There is the potential for slight awareness of construction activities. However, post construction the inclusion of the concrete central barrier, and new NMU route beyond the road would not result in significant visual impacts.</p> <p>Proposed Mitigation Measures. No mitigation measures are required.</p> <p>The magnitude of change would be no change.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
19	Rhiwlas, Henffordd	2	Medium	350m	Henffordd Cottage is the most northern of this cluster of four properties, two of which have views across the landscape, directed in a north-westerly aspect towards the A55(T) improvement section. Existing vegetation in the intervening landscape screens the A55(T). In particular, the interconnecting minor road, which also serves as a footpath, is heavily tree-lined on both sides and within cutting. This effectively screens views towards the section of the A55(T) to be improved for at least one of the properties.	<p>Visual Impacts. Of the three properties, Henffordd Cottage is likely to be exposed to the greatest impact due to its elevated position west of the heavily vegetated interconnecting access track to the property itself. However this impact would be negligible due to the existing vegetation in the landscape and the A55(T) forming just one element in the view.</p> <p>Proposed Mitigation Measures. None proposed.</p> <p>The magnitude of change will be low.</p>	Slight Adverse	Neutral	Neutral	Neutral
20	1-3 Station Road and Ty-Bricks	4	High	350m	A single isolated dwelling and cluster of three houses located on Station Road leading north west to the nature reserve car park. The dwellings have an awareness of the open countryside to the south and west and within these views are glimpses of traffic on the A55(T). The landform quickly rises beyond this with pockets of woodland within the irregular field pattern giving way to the rounded landform of the summit of Moel Wnion.	<p>Visual Impacts. Construction of the NMU route would not be a significant change in the components of the view. The proposed central barrier would slightly increase the linear nature of the A55 in existing views. Post construction the traffic and the central barrier would remain visible and the NMU route may be perceptible until mitigation measures mature.</p> <p>Proposed Mitigation Measures. The proposed hedge in combination with intermittent tree planting would filter/screen views of traffic on the A55(T).</p> <p>The magnitude of impact would be negligible</p>	Slight Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
A	North-west from the A55(T) opposite Tan -yr-allt cottages (County Footpath: Llanllechid No.43)	1	Medium	250-0m	This section of footpath runs south-east from the railway to the A55(T). Well-established woodland flanks the footpath to the north-east effectively screening views in this direction. An existing hedgerow lines the already improved section of the A55(T) where this footpath meets the dual carriageway.	<p>Visual impacts. The addition of the County road would mean that the small section of footpath adjacent to the A55(T) would be removed and replaced by the County road, with the intention that the footpath would then be diverted along the road and NMU route/PMA. During construction and after, in the short-term, this would result in a moderate adverse impact on views to the south. Changes within the central reserve would be perceptible but would not be significant. However, once the new hedgerow on the northern side of the County road and replacement woodland planting within the verge is established, the impacts to the views would be reduced.</p> <p>Proposed mitigation measures Establishing a new hedgerow on the northern side of the County road and replacement woodland planting.</p> <p>The magnitude of change would be low</p>	Moderate Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
B	South from Tan-yr-Allt Cottages to Tan-yr-Allt and Crymlyn (County Footpath: Llanllechid No. 50)	1	Medium	96-565m	Rising to the south the footpath follows the access drive to several properties before linking with a local track that joins the local road on the upper slopes to the south of the study area. As elevation rises there is an increased extent of view affording views across the coastal strip towards Anglesey in the distance.	<p>Visual Impacts – The northern end of the footpath would have some awareness of construction activity within the existing A55(T) corridor, this would diminish as distance increases only to be replaced by a greater field of view within which activities would remain perceptible. On the upper slopes and post construction the extent of the proposed changes would be very limited with few noticeable differences in the scale of the perceptible changes.</p> <p>Proposed Mitigation Measures Proposals to retain as much of the existing vegetation in situ and/or replace sections of hedgerow would reduce the perception of change within the view.</p> <p>The magnitude of impact would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
C	Ty'n Lon – Roman Road via Gilfach (County Footpath: Llanllechid No. 42)	1	Medium	322-384m	Broadly following the contours the footpath links Ty'n Lon with the Roman Road. It has far reaching and extensive views overlooking the coastal strip and Menai Straits, within which the A55(T) is a noticeable and distinct feature.	<p>Visual Impact – The proposed changes and construction activity would be a perceptible feature although within the broader extent of view the potential significance of effect is somewhat limited.</p> <p>Proposed Mitigation Measures Proposals to retain as much of the existing vegetation in situ and/or replace sections of hedgerow would reduce the perception of change within the view.</p> <p>The magnitude of impact would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
D	North to Tai'r Meibion (County Footpath: Llanllechid No. 42)	1	Low	350-0m	This footpath is shown as extending north down from Roman road towards Tai'r Meibion farm. Views extend across the local pastoral landscape to include the Menai Straits. In a northerly direction users of the footpath would be increasingly aware of the A55(T) extending to the east as they near the farm buildings. Vehicles are visible beyond the intervening hedgerow. The buildings associated with the farm would limit views to the west until north of the A55(T) to link with the footpath continuing to the west adjacent to the main alignment.	<p>Visual impacts. Overall awareness of the A55(T) does not significantly increase, but changes to the underpass and construction of the new County road would be noticeable. However, post construction the footpath would link to the new County road via the underpass and impacts are considered to be slight. In addition, changes to facilitate the widening of Roman Road and provision of the agricultural access track would be locally significant to views to the south and east during construction.</p> <p>Proposed Mitigation Measures. The planting of hedgerows would result in only very slight changes to the views and only at a very local level immediately adjacent to the road.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
E	Chester to Holyhead Railway	1	Low	325-450m	Running on alternating embankments and cuttings, the majority of which are vegetated by pioneer species, travellers are afforded some intermittent views of traffic moving along the A55(T) corridor.	<p>Visual impact. Fleeting views of construction activities and remaining traffic movements post construction, likely to be little awareness of the NMU route/PMA/County road due to scale of changes. Post construction impacts are not considered to be significant.</p> <p>Proposed mitigation measures. Mitigation measures are not considered necessary.</p> <p>The magnitude of change would be low/no change.</p>	Slight Adverse	Neutral	Neutral	Neutral
F	Class 3 Road South from Wig Crossing to A55(T)	1	Low	400 - 0m	Enclosed local road bounded by hedgerows and rising land form to the west is afforded only glimpsed views of moving traffic along the existing A55(T).	<p>Visual Impacts. Construction of new local access road would result in some impacts at a local level remaining enclosed by the existing hedgerows. Post construction local impacts would remain due to new local road and slight widening of the existing A55(T) although not considered to be significant within the context of the existing road corridor.</p> <p>Proposed mitigation measures. Replacement of existing hedgerows to the north of the County road would provide some relief to local road users and partially screen low level traffic.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
G	North from Crymlyn Farm (County Footpath: Aber No. 1)	1	Low /Medium	500-0m	The higher section of this footpath has partial and restricted views north towards the A55(T), but the lower 200m have open vistas north and west over both carriageways. Views exist beyond the A55(T) towards Wig Farm with filtered views of the Menai Straits beyond.	<p>Visual impacts. The proposals would in part utilise the new access track to Wig Farm Changes within the existing highway boundary such as the new concrete barrier and widened paved surface would not feature significantly in the overall views. There would be greater access afforded to the footpath network to the north.</p> <p>Proposed Mitigation Measures. Re-planting and/or translocation of hedgerows to form the new highway boundary would maintain the overall landscape framework and screen views of the road.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
H	Roman Bethesda Crymlyn Road: to	1	Medium	700 - 550m	<p>The majority of this road is enclosed within hedgerows with little appreciation for the wider landscape. A local focused view is afforded in the vicinity of Ralltuchaf on a short steep hill, however due to elevated views and distance the A55(T) does not form a significant element within the view. There remains some appreciation of Roman Road although set down within the landscape and partially obscured by the existing roadside hedgerow and several mature trees.</p>	<p>Visual Impacts. Majority of views are enclosed by the existing roadside hedgerows. A short section with broad views across the landscape to the north and focused on the Menai Straits and coastline to the north-west horizon would afford limited opportunity for views of changes within the A55(T) and localized changes to Roman Road and the inclusion of the agricultural access track, although all set within a very broad visual context. Impacts are not anticipated to be significant. Potential for slight awareness of additional traffic movements during construction phase, but distance would render these impacts barely perceptible.</p> <p>Proposed mitigation measures. Where feasible the existing hedgerow along Roman Road would be translocated to facilitate the widening, with the hedgerow replanted elsewhere to restore local connectivity. In addition further planting to field boundaries would replace trees removed by local widening operations.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
I	<p>Unclassified Road linking Crymlyn to Rachub</p> <p>(Includes part of the North Wales Path)</p>	1	Medium	645m	<p>This local road rises steeply to the south and west from Crymlyn, as it does so increasingly expansive views are revealed, partially obscured by existing roadside hedges and hedge banks the views open up where stone walls are reached and views along and across the coastal strip are afforded. This road forms part of the northern boundary to the Snowdonia National Park. The existing A55(T) represents a relatively distinctive linear feature running parallel with the Chester to Holyhead railway line.</p>	<p>Visual Impacts – The construction activity within the existing A55(T) corridor would be perceptible for a short period although these views would be in the context of much broader views of the coastal strip and therefore are not anticipated to be significantly affected. Post construction the changes would be barely perceptible within the wider context.</p> <p>Proposed Mitigation Measures. The retention of existing vegetation and reinstatement of hedges where required would not substantially influence the perception of the existing road corridor within the broader views.</p> <p>The magnitude of impact would be negligible.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
J	Roman Road: Abergwyngregyn to Crymlyn	1	Low	125 - 600m	Narrow road bounded by hedgerow with occasional gaps largely encloses the majority of views to the north of the A55(T) and beyond. This road forms part of the northern boundary to the Snowdonia National Park.	<p>Visual Impacts. The majority of views are enclosed by existing hedgerow bounding the local road therefore views of changes within the existing A55(T) corridor would be largely imperceptible with no significant impacts. Potential for some slight awareness of additional traffic movements during construction phase including construction of new farm access track.</p> <p>Proposed Mitigation Measures. Mitigation measures are not considered necessary.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
K	<p>South from Bryn Gwylan</p> <p>(County Footpath: Aber No. 2)</p>	1	Medium	375-0m	<p>This footpath runs south from the railway to the A55(T). A narrow opportunity for a view exists south between the track and woodland adjacent to the site of Wig Bach. The view then opens up eastwards over gently rising ground towards the A55(T). It is proposed to stop access to the A55(T) and instead link this footpath with the proposed NMU route and so provide access to a greater area.</p>	<p>Visual impacts. The retention of the existing hedgerows would minimise substantially any impacts caused by the A55(T) improvements. Changes within the central reserve would be perceptible but would not be significant. In the short term, the proposed NMU route would result in a slight adverse impact which would in the long term, once the northern hedgerow was established, be significantly reduced.</p> <p>Proposed Mitigation Measures. Re-planting of hedgerows to form the new highway boundaries in combination with additional tree planting would limit broader awareness in the medium to long term.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Slight Adverse	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
L	<p>Footpath between Henffordd and Y Glyn Farm</p> <p>(County Footpath: Aber No. 3)</p>	1	Medium	550-375m	<p>This footpath runs along the contour line from Plas Nant to the cluster of cottages, which includes Henffordd, passing south of Y Glyn Farm. It also connects with the unclassified Roman road, along a heavily vegetated interconnecting minor road emanating from Henffordd cottage. Open views are obtained looking over the A55(T) and out towards Anglesey. The Roman road, with its associated trees and hedges, forms an intermediate foreground feature of interest.</p>	<p>Visual impacts. The distance from the A55(T) and the competing elements in the field of view would ensure that the Scheme would have little significance on the current level of visual intrusion. Photograph 1 on Figure 5.3.2, Volume 1a, although taken from slightly higher on the slope, illustrates that even with the existing hedge on the landward side, traffic is still visible at present.</p> <p>Proposed Mitigation Measures. None specifically proposed.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
M	Coastal footpath (County Footpaths: Aber No's. 2 and 13, including the North Wales Path)	1	High	670-870m	The views from this footpath are full of contrasts – to the north are open views across the Menai Straits and distant views to Anglesey. To the south the landform of the coastal strip rapidly rises to the lower slopes of Moel Wnion with the rounded hill forming a distinctive and visually prominent feature. The existing A55(T) represents a relatively discreet feature along which there are perceptible traffic movements that distract within the wider view.	Visual Impacts: During construction modifications to the highway would not be readily perceived, however associated construction traffic movements would represent a perceptible change to the view. Post construction the visual intrusion of the road would not be substantially modified although the loss in part of the roadside vegetation and distant awareness of the new central barrier would be likely to slightly increase the perception of the highway itself. Proposed Mitigation Measures. Re-planting of hedgerows to form the new highway boundary, in combination with additional tree planting would limit broader awareness in the medium to long term.	Slight Adverse	Neutral	Neutral	Neutral

Receptor Ref Code (See Figure 5.3.6, Volume 1a)	Receptor Details	Receptor Quantity	Sensitivity	Proximity to Proposals (metres)	Existing Visual Outlook	Views Relative to Development and Magnitude of Change	Visual Impact Rating			
							Views During Construction	Winter Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
N	Elevated footpaths associated with Moel Wnion including the North Wales Path and local links (County Footpaths: Aber No's 3 and 7, Llanllechid No. 7)	1	Medium	<500m	A number of footpaths associated with the elevated northern slopes of Moel Wnion (between 200 and 280m AOD) are afforded varying views depending on orientation across the plateau to the north, extending across the expanse of the Menai Straits, the mudflats forming the SSSI and the south eastern edges of Anglesey that form the significant horizon line. Views of the A55(T), interrupted by intervening vegetation and filtered by roadside hedgerows, are afforded at a distance. Although the alignment is perceptible in the view running broadly parallel with the equally visible railway line, detail of the road corridor is generally not considered to be significant. The awareness of the road gradually diminishes as the elevation of the viewing location increases, the broadening views of the estuary commanding the onlooker's attention.	<p>Visual Impacts: During the construction phase views of activity within the highway boundary are considered to be visible when considered within the wider views. Post construction the slightly wider footprint of the road corridor and inclusion of the NMU route/PMA/County road to the north would be perceptible. The inclusion of a concrete central barrier would potentially contribute to defining the centre of the road and draw attention to the overall corridor, although the overall change to the view would be considered to be low.</p> <p>Proposed mitigation measures. The re-planting and/or translocation of the existing hedgerows and inclusion of scattered roadside trees would not only maintain the overall landscape framework but would also break views of moving traffic and interrupt any remaining views of the central barrier, diminishing its impact.</p> <p>The magnitude of change would be low.</p>	Slight Adverse	Neutral	Neutral	Neutral

Representative Viewpoints

5.3.114 A selection of panoramic photographs is provided on Figures 5.3.2 – 5.3.5, Volume 1a representing typical views of the corridor. Several of these have been identified as representative viewpoints in consultation with key stakeholders, including the Planning Officer at the Snowdonia National Park Authority. A summary of the likely changes arising within these viewpoints, with mitigation in place and assuming approximately 15 years growth has been provided below.

Viewpoint 1 (see Figure 5.3.2, Volume 1a)

5.3.115 This viewpoint is taken from Roman Road to the west of Abergwyngregyn, and is looking north-west towards the A55(T). This road marks the northern boundary to the Snowdonia National Park. The view is a relatively static one and the existing road corridor represents one of the few visual detractors, the existing traffic adding movement to the view highlighting the presence of the road.

5.3.116 Changes in the view arising from the Scheme would include the removal of the hedges bounding the existing road and operations within the context of the existing corridor to increase the paved width and create the NMU route to the north of the carriageway. Whilst the removal of the hedges is likely to slightly increase the awareness of the carriageway, these would be re-established along similar alignments and in the medium to long term the elements of the view would be largely unchanged and no significant effects are anticipated.

Viewpoint 2 (see Figure 5.3.2, Volume 1a)

5.3.117 This viewpoint is taken to the south of the Scheme on a local unclassified road that links Crymlyn with Rachub to the south-west. This road marks the northern boundary to the Snowdonia National Park. This elevated location affords expansive views across the north Wales coastal strip, extending to Anglesey and Penrhyn Castle. The A55(T) extends across the entirety of the view, the moving traffic representing one of the few visual detractors.

5.3.118 Proposals to remove and replant hedges either side of the carriageway and the new County road to the north would result in a slight increase in awareness of the corridor, although once re-established the elements within the view are not anticipated to substantially change and no significant effects are anticipated on this view in the long term.

Viewpoint 3 (see Figure 5.3.2, Volume 1a)

5.3.119 Taken from a public footpath (Number 3) that traverses the scarp slope to the south of Glyn Farm, the view overlooks Roman Road; this forms the northern limit of the Snowdonia National Park at this point. The view is interrupted by several existing mature oak trees, beyond which the landform descends steadily to the A55(T). The road itself is a relatively discreet element within the view, partially obscured by roadside hedges; however traffic movements within the landscape highlight the presence of the road and represent the only significant visual detractor within the view.

5.3.120 Proposed changes would require the removal of the roadside hedges and their re-planting within a slightly wider road corridor. Whilst the removal of the hedges in the short term is likely to marginally increase the awareness of traffic it is not anticipated that this would represent a significant view. The proposed construction of the NMU route to the north of the improved highway would be beyond the road and set down within the landscape.

5.3.121 Replanting of the roadside hedges would restore the existing elements within the view and as a result no significant effects are anticipated to arise.

Viewpoint 8 (see Figure 5.3.4, Volume 1a)

5.3.122 This view, taken from adjacent to Wig Crossing cottages looks south-west towards the A55(T) and the rising scarp slope forming the lower slopes to Moel Wnion. The existing road is largely screened by a gentle rise in the intervening landform and numerous mature hedgerow trees that occur around Wig Farm to the south-east. In summer views of moving traffic are largely screened by this

combination of landform and vegetation, however in winter and in the absence of foliage these views are anticipated to be more noticeable.

- 5.3.123 Proposed changes would require the removal of the existing roadside hedge and its reinstatement to the north along with the construction of the County road in the intervening space. Whilst there is unlikely to be a significant change in the view during the summer months it is possible that during the winter there would be a marginal increase in the awareness of the modified corridor, particularly to the south. Whilst this view is likely to be marginally changed it is not anticipated that this would represent a significant effect.

Viewpoint 9 (see Figure 5.3.5, Volume 1a)

- 5.3.124 This view is taken from the footpath (Number 2, part of the Wales Coast Path) that runs along the coast and faces south to include the summit of Moel Wnion, its lower slopes and the coastal strip that forms the fringes of the Snowdonia National Park. The view demonstrates how the heavily cultivated coastal land quickly becomes more wooded along the scarp slope before the open moorland is reached closer to the summit. The A55(T) represents a relatively discreet element within these views, with traffic moving through the landscape visible but at some distance (approximately 650m). Isolated farms dotted across the slope combine with some extensive areas of woodland and plantations to break up the slope above the road corridor and create interest to the observer.

- 5.3.125 Proposed changes would require the removal of the existing roadside hedge and its reinstatement to the north along with the construction of the NMU route in the intervening space. Whilst there is anticipated to be a slightly increased awareness of the corridor and in particular the elements of moving traffic this is not likely to represent a significant effect. Upon re-establishment of the roadside hedges the combination of the NMU route and road corridor is not anticipated to markedly modify the elements of the view and significant effects are not anticipated.

Magnitude of Impacts and Significance of Effects

Landscape Character (see Figure 5.3.1, Volume 1a)

- 5.3.126 Of the four local landscape character areas identified as part of the assessment two would be directly affected as a result of the Scheme; LCA 1 Abergwyngregyn Scarp slope and LCA 2 Wig Open Farmland. The majority of changes occurring along the boundary of these two areas are marked by the presence of the existing A55(T). Impacts on LCA 2 Wig Open Farmland are limited to the formation of the new County road, PMA and NMU route, and whilst this would require the removal and replanting of adjacent hedges, the core of the LCA would be unchanged and therefore no significant effects are anticipated. LCA 1 would be impacted upon by operations to increase the paved width in addition to modifications to improve access along Roman Road and the formation of a new access track linking Roman Road with the Wig Farm underpass. Whilst some of the changes would be noticeable at a very local level the changes are not anticipated to significantly modify the way in which the wooded scarp slopes are perceived within the wider landscape and no significant effects are anticipated.
- 5.3.127 The other identified LCAs are not anticipated to receive any direct impacts as a result of the proposed changes, although some visual appreciation would occur as the elevation to the south gradually rises. These changes have to be considered within the broadening views as the character areas expand and rise to the south and changes within the existing A55(T) corridor are generally considered to have an insignificant impact. Impacts are therefore considered to be neutral.

Visual Effects

- 5.3.128 The following tables summarise the impact on identified visual receptors with an appreciation of the Scheme (see Figure 5.3.6, Volume 1a), including the effects of the proposed mitigation strategy as outlined in the next section of this chapter.

Table 5.3.2: Summary of Impacts on Visual Receptors

	Construction	Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
Neutral	0 Receptors	22 Receptors	30 Receptors	30 Receptors
Slight Adverse	28 Receptors	11 Receptors	3 Receptors	3 Receptors
Moderate Adverse	5 Receptors	0 Receptors	0 Receptors	0 Receptors

Table 5.3.3: Summary of Impacts on Footpaths, local roads and railway

	Construction	Year of Opening	Winter 15 Years after Opening	Summer 15 Years after Opening
Neutral	0 Receptors	11 Receptors	14 Receptors	14 Receptors
Slight Adverse	13 Receptors	3 Receptors	0 Receptors	0 Receptors
Moderate Adverse	1 Receptors	0 Receptors	0 Receptors	0 Receptors
Large Adverse	0 Receptors	0 Receptors	0 Receptors	0 Receptors

- 5.3.129 The assessment of visual impact on affected receptors across the study area has demonstrated that the magnitude of impact is generally low, whilst receptors themselves are of variable sensitivity to change.
- 5.3.130 The nature of the scheme and proposal to include a new County Road/PMA/NMU route to properties, widening of Roman Road and provision of a new footway, along with changes to the central reserve, represent small scale changes to the existing views on the whole. The exceptions to this are isolated properties immediately to the north of the existing A55(T), that are likely to be afforded views of the new PMA and NMU route in relatively close proximity and updates to the central reserve to include a solid restraint system. These changes are considered in the context of the existing effects of the A55(T), but with the potential for an increased awareness of the road corridor.
- 5.3.131 Other properties on rising ground to the south of the A55(T) have a varied outlook, depending on orientation, vegetation and elevation. The rise in elevation generally affords properties wider views and several have expansive views across the local landscape to the north and the coastline beyond. Within these views the A55(T) constitutes a small component and changes within this corridor are generally considered to be of a low magnitude. Mitigation measures to retain existing vegetation where possible would reduce the overall impact on views to neutral for the majority of these receptors.
- 5.3.132 Public rights of way with views of the study area and proposed changes are of medium sensitivity to change on the whole. Views of the existing A55(T) detract from views from footpaths immediately adjacent to the A55(T) whilst elevated locations have the potential to view the A55(T) and changes as a component within the wider views comprising the Menai Straits and Anglesey forming a significant horizon line (see Chapter 5.8: Effects on All Travellers for further assessment of impacts on public rights of way).
- 5.3.133 Construction activities would be visible from several of the footpaths as they interface with one another resulting in impacts that range between slight and large adverse. However, post construction and with the proposed mitigation measures in place these are likely to be reduced significantly to neutral (see Chapter 5.8: Effects on All Travellers for further assessment of impacts on public rights of way).
- 5.3.134 The majority of local roads are enclosed by existing hedgerows with limited opportunity for broader views of the local landscape including the A55(T). The exception to this would be Roman Road with localised widening resulting in moderate adverse impacts during the construction phase, reducing to neutral/slight adverse during the operational phase. A minor road to the Wig Crossing Cottages north of the A55(T), referenced as F on Figure 5.3.6, Volume 1a, would have the potential

for users' increased awareness of the construction activities to form the proposed NMU route/County road but impacts are not considered significant. See Chapter 5.8: Effects on All Travellers for further assessment of impacts on views from the road.

Proposed Mitigation Measures

5.3.135 Mitigation measures form an integral part of the overall proposals. They comprise a combination of earthworks, fencing, planting, grassland measures and other specific habitat creation measures (see Chapter 5.4: Nature Conservation and Figures 5.3.7-9, Volume 1a), based on the following two broad objectives:

- Successful integration of the new route into the existing local landscape structure. This may include enhancement of the local landscape or specific features where appropriate, and;
- Mitigation of localised landscape character and visual impacts identified during the undertaking of the environmental assessment by the creation of a strong, ecologically-based landscape framework, developed to integrate with the local retained landscape features.

5.3.136 The following section describes the principles that underscore the specific proposals for the Scheme and the components that would be adopted to establish an appropriate landscape structure as part of the scheme. This is followed by a description of the intended environmental functions, their objectives and the key features proposed throughout the length of the scheme.

Mitigation Approach

5.3.137 The key issues surrounding the proposed design and engineering which have shaped the approach to mitigation for Landscape Effects are as follows:

- Direct loss of existing hedgerows, woodland and scrub planting as a result of changes within the existing road corridor (see also Chapter 5.4: Nature Conservation), and;
- Loss of existing viable agricultural land as a result of the new County Road/PMA/NMU route (see Chapter 5.9: Community and Private Assets for further details).

Design Principles

Outline Mitigation Measures

5.3.138 The following forms of outline mitigation measures have been utilised as part of the overall mitigation strategy:

- Planting;
- Restoration/retention of hedgerow patterns through new planting and, in selected locations, translocation of existing hedgerows, and;
- Creation of ecological diversity and interest.

Landscape Design Principles

5.3.139 The landscape proposals have been developed with reference to DMRB Volume 10 - Environmental Design (The Good Roads Guide)⁸⁴. The following principles have guided the overall landscape design approach adopted in the assessment:

- To ensure that the proposed changes to the road alignment achieves best fit with local landform and respects existing landscape character;
- To conserve existing planting as far as is possible and enhance the existing planting structure, where appropriate;
- To optimise protection for residents and users of recreational features through the use of earthworks and planting, and;
- To minimise loss or damage to sites of ecological interest and enhance local diversity, where appropriate.

⁸⁴ Design Manual for Roads and Bridges: Volume 10 – Environmental Design (The Good Roads Guide) (1993-2006), published by HMSO.

Earthworks Principles

5.3.140 The design of the road corridor profile has been undertaken to safeguard locally important vegetation with screening capacity.

Planting Principles

5.3.141 The following principles have guided the overall planting design approach adopted in the assessment:

- Retention of existing trees, hedgerows and vegetation as far as is practical, augmented by the introduction of new hedgerows to restore linkages between severed hedgerows;
- Where appropriate, and where the condition of hedge is suitable, the relocation of existing hedgerows to preserve both local vegetation characteristics and ecological resources;
- Avoidance of planting across open tracts of land other than where planting is required for essential screening purposes;
- Use of visually interesting soft landscape elements to establish local identity and benefit the user's experience of the scheme, and;
- Utilisation of ecological principles in developing the planting proposals to address screening/integration and biodiversity issues (see Chapter 5.4: Nature Conservation).

Environmental Functions

5.3.142 Environmental functions are ascribed to specific hard and soft elements to reflect their intended function within the overall mitigation strategy. They also serve to inform a proposal's design and may influence any future maintenance techniques over the longer term.

5.3.143 The detailed proposals accord with the following environmental functions and references described in DMRB Volume 10: Section 0, Part 2 (HA87/01) (see Environmental Masterplans: Figures 7.1-7.7, Volume 1a):

- Visual Screening (EFA);
- Landscape Integration (EFB);
- Nature Conservation and Biodiversity (EFD), and;
- Visual Amenity (EFE).

5.3.144 It is important to note that specific elements within the mitigation strategy can have both a primary and secondary function, *e.g.* planting which is proposed primarily to serve as a visual screen (EFA) can also have secondary landscape integration (EFB) functions. The fulfilment of an environmental function is also not restricted to one type of feature or element - it may involve a combination of several types, *e.g.* planting with earthworks. As stated above, all of the mitigation elements developed for the scheme have also taken cognizance of ecological principles and functions during design development.

Landscape Elements (see Environmental Masterplans: Figures 7.1-7.7, Volume 1a)

5.3.145 Landscape elements are divided into broad classification types which are then sub-divided into detailed design elements based upon their stated function. The following sections describe the proposed landscape types which have been adopted as part of the mitigation strategy to fulfil environmental functions.

Planting Types (see Environmental Masterplans: Figures 7.1-7.7, Volume 1a)

5.3.146 A number of planting and seeding forms have been adopted to reflect the identified landscape character found throughout the length of the road corridor. These are based on landscape elements as described in DMRB Volume 10, Section 0, Part 3 (HA88/01), as indicated below.

Grassland (LE1)

5.3.147 Two types of grassland mix are proposed:

- Species Rich Grassland (LE1.3) - This would take the form of specifically selected 'wildflower mixes' appropriate to the location and applied across the verge on nutrient poor subsoils. The composition of the mixes would include species that would make a positive contribution to The Action Plan for Pollinators in Wales, published by the Welsh Assembly Government in 2013 (see also Chapter 5.4 – Ecology and Nature Conservation). The composition of the wildflower mix to deliver LE 1.3 would be identified at the detailed design stage; and,
- Open Grassland (LE1.6) - This would typically be a standard mix used for the areas to be returned to agriculture.

Native Planting (LE2)

5.3.148 Four types of native planting are proposed:

- Woodland (LE2.1) - Planting comprising a mix of transplants, whips and feathered trees using climax tree species and under-storey where appropriate to establish multi-layered woodland with a mix of native species dominated by oak. This mix is proposed to form a landscape framework along the route and at integral locations. It would be used to create robust planting in keeping with the surrounding native woodland and vegetation that would have been the visually dominant habitat type prior to the establishment of successful pastoral activity;
- Shrubs (LE2.6) - Planting comprising native, lower growing shrub species common in the locality. This mix is proposed where taller tree species growth is not deemed necessary or where areas containing built form require softening. It is also applicable in areas proposed to provide some ecological diversity or foraging habitat for wildlife;
- Scattered Trees (LE2.7) - Planting comprising a mixture of transplants, whips and feathered native deciduous tree species, forming or capable of forming small scattered groupings. This type is proposed at interface locations such as hedgerows and along cutting slopes where dense planting is not deemed appropriate. Scattered trees are also proposed to augment lower growing shrub species, where appropriate, and;
- Native Hedgerow with Trees (LE4.4) - Planting comprising mixed hedgerows containing common individual hedgerow trees. This planting is proposed where linkages to existing field patterns are to be restored, and in locations where the route severs existing fields and boundaries. It would also be used to strengthen a pattern that has diminished in recent years, or where woodland planting would appear uncharacteristic with the open agricultural landscape that surrounds the road corridor. Mixed species hedgerows with hedgerow trees are also proposed to support the interests of landscape and ecological diversity.

Detailed Mitigation Proposals (see Figures 5.3.7-9, Volume 1a)

5.3.149 Mitigation measures for the Scheme have been developed as part of an iterative process informed by the results of surveys for landscape character, visual impacts and ecological impacts - all complementing the engineering requirements of the scheme. In developing specific mitigation proposals broad principles have been applied to landscape elements, these are:

Hedgerows

- Where feasible it is proposed to translocate (move back) an existing hedge along an approximately 860m length of the widened Roman Road (see also Chapters 5.2 and 5.4). Where this is not considered feasible hedgerows would be replanted using existing locally occurring species. Existing gaps in the hedgerows would also be in-filled with species in keeping with the adjacent hedgerow;
- Hawthorn is the dominant hedge species and would remain as such, whilst other species, including Elder (*Sambucus nigra*), Dog-rose (*Rosa canina*), Hazel (*Corylus avellana*), Holly (*Ilex aquifolium*) and Sessile oak (*Quercus petraea*), may be included to enrich the species diversity. Other species such as honeysuckle (*Lonicera periclymenum*), Field rose (*Rosa avensis*), Field

maple (*Acer campestre*), Wild privet (*Ligustrum vulgare*) and Crab apple (*Malus sylvestris*) may also be included within hedgerow mixes although at much lower proportions;

- Ash (*Fraxinus excelsior*), Ivy (*Hedera helix*), Blackthorn (*Prunus spinosa*) and Blackberry (*Rubus fruticosus*) would not be introduced, although it is recognised that these may well establish naturally over time;
- Sessile oak would also be planted and managed as hedgerow trees in some hedgerows to reflect typical hedgerow structure and local occurrence in the wider hedgerow network, and;
- Planting density: two offset rows of plants are proposed, with 200 – 300mm between rows and plants at 330mm centres along the rows, yielding a planting density of 6 plants per metre run.

Woodland

- Woodland planting would be based on existing locally occurring species, based on a survey of locally occurring adjacent woodland.

Tree Groups

- Occasional individual specimens of Oak and Ash exist on both sides of the road and would be lost to the scheme. It is not proposed to replicate these but to introduce small groups of trees within the hedgerow mix and maintain to promote the establishment of these as hedgerow trees, and;
- Larger numbers of trees, comprising replacement Oak (Sessile) and Field maple are proposed to the west of No's 1 and 2 Bryn Meddyg to reflect the existing occurrence of Oak and Ash along the cutting slope, which would also add interest and diversity to the views from the A55(T).

5.3.150 In translocating/replanting the hedgerow along Roman Road a number of mature trees would require removal. These would be replaced using feathered stock appropriate to the location in order that they can be easily recognised as such during routine hedgerow trimming operations.

5.3.151 The generally small scale nature of the Scheme requires a subtle approach to the mitigation. As a result of this the main strategy in the development of the landscape mitigation proposals has been the retention where possible of the existing hedgerow features that contribute significantly to the local landscape character. Where this is not feasible replacement hedgerows are proposed.

5.3.152 Along significant lengths of the scheme the new County road/PMA/NMU route would be placed immediately adjacent to the main alignment. The re-planting of the hedgerows would therefore move the hedgerow away from the existing carriageway by up to 10 metres to allow sufficient space for the new hard strips to be constructed. This would retain important landscape and ecological features and provide future screening and opportunities for wildflower seeding where appropriate (see also Chapter 5.4: Nature Conservation).

5.3.153 Notable new areas of planting include a belt of shrub and woodland planting proposed between the existing A55(T) and the new local access lane leading to No's 1 and 2 Bryn Meddyg. This belt of planting supplemented by scattered individual trees would, given a period of time, soften the appearance of the proposed screen fence and provide a visual screen to the access route, the A55(T) and the wider landscape. It would also provide a link with a small piece of woodland that extends to the back of the properties.

5.3.154 Improvements to the existing layby west of Tai'r Meibion would require the clearance of existing scrub and the widening of the existing embankment. Mitigation measures would comprise a new small block of woodland that would tie into the larger existing block that exists to the north.

5.3.155 A number of scattered trees are proposed elsewhere along the scheme to the north and south of the A55(T), and west of the properties at Bryn Meddyg and in field boundaries on higher ground to the south. These would seek to replace trees removed by the Scheme and provide some integration of the scheme into the local landscape, whilst providing some interruption to views of the A55(T) from higher ground and receptors to the south.

5.3.156 All planting would be subject to a three year establishment period, during which the planting would be monitored and additional or replacement planting would be provided where planting has failed to establish successfully.

Magnitude of Impacts and Significance of Effects (after mitigation)

5.3.157 Residual impacts are those that remain despite a mitigation strategy and measures aimed at alleviating identified impacts. The landscape and visual impact assessment and associated tables earlier in this chapter identify impacts in the Design Year for winter and summer; these impacts constitute the residual impact.

Summary

5.3.158 The assessment of landscape character and visual amenity has been undertaken in accordance with the guidance outlined in Interim Advice Note 135/10 (Wales)⁸⁵ that replaces the previous advice provided in the Design Manual for Roads and Bridges (DMRB) Volume 11: Environmental Assessment⁸⁶. The study area comprised a 1km buffer either side of the existing A55(T), beyond which it was decided that the scale of the proposed changes would be unlikely to result in a significant effect.

5.3.159 The assessment of effects on landscape character concluded that direct impacts would arise on two; LCA 1 Abergwyngregyn scarp slopes and lower plateau and LCA 2 Wig, open farmland (see Figure 5.3.1, Volume 1a). The resulting effects on these character areas would be no greater than slight adverse in the Year of Opening and would reduce to neutral in the Design Year (Year 15).

5.3.160 The effects anticipated to arise on visual receptors (property) (see Figure 5.3.6, Volume 1a) were identified as being no greater than moderate adverse during construction, with the majority of receptors subject to slight adverse effects. In the Year of Opening the adverse effects are likely to reduce with the majority of receptors subject to a neutral effect; this is anticipated to continue into the Design Year, with only three receptors anticipated to be subject to a slight adverse effect.

5.3.161 Due in main to the physical changes associated with the Scheme, particularly during construction, one footpath (Receptor A; PRoW No. 43) is anticipated to be the subject of significant effects (*i.e.* moderate adverse or greater). Post construction, and with the proposed mitigation measures establishing, the effects are anticipated to reduce, and in the Design Year the effects are not anticipated to be greater than slight adverse.

5.3.162 Considering the design and mitigation measures outlined in this chapter the Scheme is expected to accord with the objectives and policies relating to landscape identified in the Regulatory/Policy Framework section of this chapter.

⁸⁵ Interim Advice Note 135/10 (W): April 2014, Welsh Government

⁸⁶ Design Manual for Roads and Bridges: Volume 11 - Environmental Assessment (1993 - 2005), published by HMSO.

5.4 NATURE CONSERVATION

Introduction

- 5.4.1 This chapter documents the Ecological Impact Assessment (EclA) that has been completed for the Scheme. It summarises the key nature conservation legislation and policy, explains the survey and assessment methodologies that have been applied and describes the baseline condition of all important ecological features identified (including designated sites, habitats, species and ecosystem services). These features are described in terms of the geographic context of their importance. All potential impacts of the Scheme on these ecological features are then identified and described in detail, including the geographic context of their significance. Mitigation measures are identified where necessary (*i.e.* where significant negative impacts have been identified) and the significance of any residual effects is then assessed. Cumulative effects on nature conservation are also assessed (see Chapter 6.0: Assessment of Cumulative Effects) and compensation measures identified for any significant residual effects resulting from cumulative or scheme impacts. Enhancement measures are also outlined and a description of any monitoring required. To summarise, the overall ecological effects of the Scheme (both adverse and beneficial) are described in terms of their relevance to policy and legislation.

Policy Framework

- 5.4.2 This section summarises the key legislation, policies and plans in relation to nature conservation and ecology that is considered relevant to the Scheme, which primarily concerns protected sites and protected species/habitats. Policies and plans relating to the environment in general are summarised in Chapter 2.0.

Key Legislation

Environment (Wales) Act (2016)

- 5.4.3 This act became law in Wales on 21st March 2016, and includes legislation that supersedes the Natural Environment and Rural Communities (NERC) Act 2006. Part 1 of the Act sets out Wales' approach to planning and managing natural resources at a national and local level with a general purpose linked to statutory 'principles of sustainable management of natural resources' defined within the Act.
- 5.4.4 Section 6 of the Act places a duty on public authorities to 'seek to maintain and enhance biodiversity' so far as it is consistent with the proper exercise of those functions. In doing so, public authorities must also seek to 'promote the resilience of ecosystems.' Public authorities will be required to report on the actions they are taking to improve biodiversity and promote ecosystem resilience.
- 5.4.5 Section 7 replaces the duty in Section 42 of the NERC Act 2006. The Welsh Ministers will publish, review and revise lists of living organisms and types of habitat in Wales, which they consider are of principle importance for the conservation and enhancement of biodiversity in Wales. The Welsh Ministers must also take all reasonable steps to maintain and enhance the living organisms and habitats included in any list published under this section, and encourage others to take such steps. A number of habitats and species included under Section 7 of this act have been recorded in the vicinity of the Scheme and are therefore considered in the assessment.

Conservation of Habitats and Species Regulations (2010, as amended)

- 5.4.6 The Conservation of Habitats and Species Regulations 2010 (as amended) transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the EC Habitats Directive) into national law. The Regulations provide for the designation and protection of European sites and the protection of European protected species and habitats as listed in the EC Habitats Directive and EC Birds Directive (Council Directive 2009/147/EC). The regulations provide

guidance on undertaking assessment of impacts on European and Protected Sites (Special Areas of Conservation - SACs, Special Protection Areas – SPAs and Ramsar sites) through the Assessment of Implications on European Sites (AIES) process. A number of European protected sites are located within the Zone of Influence of the Scheme, as shown in Table 5.4.4 (see also Figure 5.4.1, Volume 1a) and have been assessed under this legislation (see the AIES for the Scheme for further details: 'A55 Chester to Bangor Trunk Road - Abergwyngregyn to Tai'r Meibion Improvement: Statement to Inform Appropriate Assessment' available as a separate document). European protected species previously recorded within the vicinity of the Scheme include otters and several bat species.

The Eels (England and Wales) Regulations (2009)

- 5.4.7 These regulations are the transposition into UK legislation of a European Council Regulation to establish measures for the recovery of the stock of European eel. Regulation 12 of this legislation requires the Environment Agency (now Natural Resources Wales in Wales) to be notified of the construction of any structure that could constitute an obstruction to eel passage and Regulation 14 gives NRW the right to serve notice for the construction of an eel pass following such a notification. Further regulations deal with the maintenance, repair, damage or obstruction of eel passes.

The Water Environment (Water Framework Directive) (England and Wales) Regulations (2003)

- 5.4.8 These regulations are the transposition into UK legislation of the EU Water Framework Directive (Council Directive 2000/60/EC). The basic principles are:
- Enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, which depend on the aquatic ecosystems.
 - Promote the sustainable use of water.
 - Reduce pollution of water, especially by 'priority' and 'priority hazardous' substances.
 - Ensure progressive reduction of groundwater pollution.

The Countryside and Rights of Way (CRoW) Act (2000)

- 5.4.9 The CRoW Act further enhances protection given to some species through the WCA by introducing an offence of recklessly disturbing a Schedule 5 animal. It also provides further guidance regarding the protection of SSSIs. The CRoW Act required the compilation of a list of species and habitats of principal importance for biodiversity in Wales but this was superseded by the NERC Act and subsequently the Environment (Wales) Act 2016 (see above).

The Hedgerow Regulations (1997)

- 5.4.10 This legislation governs the assessment and protection of hedgerows, although it should be noted that the Scheme does not fall within the requirements of the Hedgerow Regulations as it is consented under other legislation as a trunk road improvement. As good practice however, all affected hedgerows have been assessed against the Hedgerows Regulations criteria and appropriate mitigation undertaken where 'important' hedgerows have been recorded.

Wild Mammals Protection Act (1996)

- 5.4.11 This act operates in parallel with legislation listed above conferring specific protection on rare or threatened mammal species, by protecting all wild mammals from any actions intended to cause unnecessary suffering.

The Protection of Badgers Act (1992)

- 5.4.12 This legislation protects badgers against wilful killing, injury or ill-treatment, and disturbance in their setts, and also prohibits interference with or obstruction of badger setts. Although primarily intended to protect badgers against deliberate persecution, the legislation is also relevant in the context of development work. This Act is relevant to the scheme because badgers and their setts have been recorded within the corridor of the Scheme.

Wildlife and Countryside Act (1981, as amended)

- 5.4.13 The Wildlife and Countryside Act (WCA) governs the designation and protection of Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR), and protection of various plant and animal species. Schedule 1 of the Act lists protected bird species, Schedule 5 lists other protected animal species, and Schedule 8 lists protected plant species. Schedule 9 of the Act lists invasive alien species which it is an offence to introduce or allow to spread in the wild. A number of SSSIs and an NNR are located within the vicinity of the Scheme, as shown in Table 5.4.5 (see also Figure 5.4.3, Volume 1a), Schedule 1 bird species potentially nesting within the vicinity of the proposed scheme include barn owl and red kite and animals listed on Schedule 5 previously recorded within the vicinity of the Scheme include bat species, water vole and otter. *Rhododendrum ponticum*, a non-native invasive plant species listed on Schedule 9 of the Act has been recorded within the corridor of the Scheme.

National Parks and Access to the Countryside Act (1949)

- 5.4.14 This act makes provision for National Parks and the establishment of a National Parks Commission to confer on the Nature Conservancy Council (now NRW in Wales) and local authorities powers for the establishment and maintenance of nature reserves and to make further provision for the recording, creation, maintenance and improvement of public paths and securing access to open country and to amend the law relating to rights of way; to confer further powers for preserving and enhancing natural beauty, and other matters relating to these. National Nature Reserves and Local Nature Reserves can be designated under this act. Both an NNR and an LNR are located in the vicinity of the Scheme.

Key Policies and Plans

Wales National Transport Strategy

- 5.4.15 This strategy sets out to promote sustainable transport networks that safeguard the environment while strengthening Wales' economic and social life. It identifies a series of high-level outcomes and sets out the steps for their delivery. The following are of relevance to this chapter:

Outcome 13: Adapting to Climate Change

- 5.4.16 This outcome is to ensure that transport networks are adapted to cope with the impacts of climate change and support increased resilience. This includes changes to habitats and species and the role transport has to play in supporting habitat connectivity.

Outcome 17: Biodiversity

- 5.4.17 This outcome is to ensure that biodiversity, for both land and marine environments, is protected and enhanced when improving or developing transport measures. It states that mitigatory and compensatory measures are to be provided where transport has a significant negative effect.

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- 5.4.18 Of particular relevance to this assessment is PPW Chapter 5 - Conserving and Improving Natural Heritage and the Coast which outlines the Welsh Government's commitments to Nature Conservation. The Welsh Government's objectives for the conservation and improvement of the natural heritage are to:
- promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;
 - ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;
 - ensure that statutorily designated sites are properly protected and managed;
 - safeguard protected species, and;
 - promote the functions and benefits of soils, and in particular their function as a carbon store.

Technical Advice Note (TAN) 5: Nature Conservation and Planning (2009)

- 5.4.19 TAN 5 provides advice to local planning authorities on the application of the law relating to planning and nature conservation and its impact within the land use planning system. The most recent revision of TAN 5 brings it in line with the strategic policy in PPW 2016 and advises how planning policy with regard to ecology needs to be interpreted to be in compliance with Planning Policy Wales.
- 5.4.20 TAN 5 provides advice on the following:
- Positive planning for nature conservation;
 - Nature conservation and Local Development Plans;
 - Nature conservation in development management procedures;
 - Development affecting protected internationally and nationally designated sites and habitats;
 - Development affecting protected and priority habitats and species.

Wales Action Plan for Pollinators (2013)

- 5.4.21 The Action Plan for Pollinators in Wales recognises that:

'Pollinators are an essential component of our environment. Honey bees and wild pollinators including bumblebees, solitary bees, parasitic wasps, hoverflies, butterflies, moths and some beetles are important pollinators in Wales for crops such as fruit and oilseed rape, clovers and other nitrogen-fixing plants that are important to improving the productivity of pasture systems for livestock grazing and wildflowers.'

- 5.4.22 The Welsh Government has worked with industry and stakeholders to look in more detail at the evidence and issues around pollinators and their conservation in Wales. The action plan produced aims to reduce and reverse the decline in wild and managed pollinator populations.

Wales Environment Strategy (2006 to 2026)

- 5.4.23 The Environment Strategy is the Welsh Government's long-term strategy for the environment of Wales setting the strategic direction for the next 20 years. The strategy has five main themes:
- Addressing climate change;
 - Sustainable resource use;
 - Distinctive biodiversity, landscape and seascapes;
 - Our local environment; and
 - Environmental hazards.

United Kingdom Biodiversity Action Plan (UKBAP)

- 5.4.24 In 1992 the UK signed the Convention on Biological Diversity at the Rio Earth Summit pledging to develop national strategies for the conservation and sustainable use of biological diversity.
- 5.4.25 The UK Government subsequently produced *Biodiversity: The UK Biodiversity Action Plan* in 1994 which described the biological resources of the UK as a whole and in turn led to the production of Biodiversity Action Plans for individual habitats and species. A total of 1150 Priority Species and 65 Priority Habitats have been identified (following an update to the list in 2007) as those most in need of protection. The UKBAP lists of priority habitats and species have now been superseded by the country biodiversity lists (*i.e.* Section 7 in Wales) under the Environment (Wales) Act 2016 but they are a useful reference source.

Local Biodiversity Action Plans (LBAPs)

- 5.4.26 *Biodiversity: The UK Biodiversity Steering Group Report* was published in 1995. This recognised that to successfully implement the UKBAP at a local level and translate national policy into action, it would be necessary to produce Local Biodiversity Action Plans across the UK. In response to this, local authorities throughout the UK produced LBAPs; the Gwynedd LBAP (Natur Gwynedd) is of

relevance to the Scheme and the species and habitats included within it are summarized in Table 5.4.1 below.

Table 5.4.1: Summary of Gwynedd LBAP (Natur Gwynedd) Species and Habitats

Habitats	Species	
<ul style="list-style-type: none"> • Upland oakwoods • Wet woodland • Upland mixed ashwoods • Veteran trees, lowland wood-pasture & parkland • Hedgerows • Cloddiau • Arable field margins • Coastal and floodplain grazing marsh • Lowland meadows and pasture • Lowland dry acid grassland • Lowland heathland • Upland heathland • Wetlands • Rhos pasture • Wetlands • Lakes, ponds and ditches • Maritime cliff and slopes • Coastal sand dunes • Coastal saltmarsh • Seagrass beds • Maerl beds • Mudflats • Sheltered muddy gravels • Sublittoral sands and gravels • Saline lagoons • Tidal rapids • Horse mussel reefs • <i>Sabellaria alveolata</i> reefs 	<ul style="list-style-type: none"> • Otter • Red squirrel • Barbastelle bat • Brown hare • Hazel dormouse • Water vole • Lesser horseshoe bat • Pipistrelle bat • Bullfinch • Black grouse • Chough • Common scoter • Curlew • Grey partridge • Hen harrier • Lapwing • Linnet • Nightjar • Reed bunting • Skylark • Song thrush • Spotted flycatcher • Tree sparrow • Yellowhammer • Twait shad • A carder bee (<i>Bombus humilis</i>) • A ground beetle (<i>Tachys micros</i>) • A mason bee (<i>Osmia parietina</i>) • A mason bee (<i>Osmia xanthomelana</i>) 	<ul style="list-style-type: none"> • Ashworth's rustic • Common fan-foot • Desmoulin's whorl snail • Marsh fritillary • Hornet robberfly • Geyeri's whorl snail • Great yellow bumblebee (<i>Bombus distinguendus</i>) • High brown fritillary • Freshwater pearl mussel • Lunar yellow underwing • Narrow-bordered bee hawkmoth • Pale shining brown • Pearl bordered fritillary • Shriill carder bee • Silver studded blue • Square-spotted clay • Sword-grass • Floating water plantain • <i>Hygrocybe calyptriformis</i> • <i>Hygrocybe spadicea</i> • Pillwort • Shepherd's needle • Slender green feather moss • Small flowered catchfly • A red alga (<i>Anotrichum barbatum</i>) • Basking shark • Commercial fish species • Harbour porpoise • Marine turtles • Small dolphins • Toothed whales

Trunk Road Estate Biodiversity Action Plan (TREBAP)

5.4.27 The TREBAP is a biodiversity action plan produced by the Welsh Government to assist with the identification, management and provision of biodiversity within the Soft Estate of the Trunk Road Network in Wales. The objectives of the TREBAP, within the constraints of resources and road safety, are to:

- Set practical and realistic actions and targets for the period 2004 – 2014;
- Link with other relevant Biodiversity Action Plan targets for habitats and species;
- Increase awareness of the Transport Directorate's staff and contractors, its environmental partners and the general public, of the biodiversity interest of the trunk road and motorway network;
- Encourage the use, and dissemination, of best practice for biodiversity in the management and development of the trunk road and motorway network, and;
- Reflect the requirements of the Assembly's Sustainable Development Scheme and Action Plan where relevant.

5.4.28 The TREBAP includes eleven habitat action plans and seventeen species action plans, as well as two generic action plans (Ecological Survey and Education and Awareness). The list of Habitat and Species Action Plans is shown in Table 5.4.2 below.

Table 5.4.2: TREBAP Species and Habitat Action Plans

Habitats	Species
Boundary Features	Amphibians
Calcareous Grassland	Aquatic Species
Coastal and Estuarine Habitats	Barn Owl
Heathlands	Bats
Lowland Dry Acid Grassland	Dormouse
Lowland Meadows	Marsh Fritillary Butterfly
Purple Moor Grass and Rush Pastures	Otter
Rivers and Streams	Reptiles
Rock Faces and Scree	Water Vole
Water bodies	Welsh Clearwing Moth
Woodlands and Planted Native Trees and Shrubs	Native Black Poplar
	Bluebell
	Deptford Pink
	Limestone Woundwort
	Orchids
	Spreading bellflower
	Wood Bitter Vetch

Gwynedd Unitary Development Plan (2001 to 2016)

5.4.29 The Gwynedd Unitary Development Plan (UDP) includes a number of policies that provide planning guidance in respect of development that affects designated sites, habitats and species that are considered to be of importance to ecology and nature conservation. A summary of the relevant policies is provided as follows:

Policy B15 - Protection of international nature conservation sites

5.4.30 Proposals that are likely to cause direct or indirect significant harm (either individually or in combination with other plans or projects) to the integrity of SPAs (potential or classified), SACs (candidate or designated), RAMSAR sites (proposed or listed) will be refused unless:

- there is no alternative solution;
- there are imperative reasons of over-riding public interest for the development or land use change which override the ecological importance of the site;
- in the case of sites where priority habitats or species are affected, the only considerations which could justify granting planning permission are those associated with public health, public safety or those that bring benefits of primary importance for the environment and that proposals meet all the following requirements:
 - a the location, design and construction of the development is such that damage to nature conservation features are minimised, and opportunities for nature conservation gain are taken;
 - b compensating and equivalent nature conservation features are provided;
 - c the remaining nature conservation features are protected and enhanced and provision is made for their management;
 - d opportunities are provided for the public to enjoy and interpret the site.

Policy B16 - Protecting nationally important conservation sites

5.4.31 Proposals likely to cause direct or indirect significant harm to a SSSI or NNR (either individually or in combination with other plans or projects) will be refused unless, either

- damage to nature conservation features can be avoided and the developer takes steps to protect, enhance and manage nature conservation features, or

- the reasons for the proposals clearly outweigh the particular nature conservation importance of the site and the national policy of protecting such sites

and all of the following criteria can be met:

- the location, design and construction of the development is such that damage to nature conservation features are minimised, and opportunities for nature conservation gain are taken;
- compensating and equivalent nature conservation features are provided;
- the remaining nature conservation features are protected and enhanced and provision is made for their management;
- opportunities are provided for the public to enjoy and interpret the site.

Policy B17 - Protecting sites of regional or local significance

5.4.32 Proposals likely to cause direct or indirect significant harm to a Local Nature Reserve (LNR), or Non-statutory Nature Reserve (NsNR) or Wildlife Site (WS) will be refused unless:

- the damage to nature conservation features can be prevented and the developer takes steps to protect, enhance and manage the nature conservation features, or
- the proposal is required in order to fulfil social, environmental and/or economic needs that override the site's regional or local importance

and all the same criteria under Policy B16 (see above) can be met.

Policy B19 - Protected trees, woodlands and hedgerows

5.4.33 Proposals that lead to the loss or damage to a tree, woodland or hedgerow that is protected or lies within a designated ancient and semi-natural woodland will be permitted only where any harm is clearly outweighed by the economic and/or social benefits of the development.

Policy B20 - Species and their habitats that are internationally and nationally important

5.4.34 Proposals likely to result in direct or indirect unacceptable disturbance or harm to protected species and their habitats will be refused unless:

In the case of a species protected under European legislation:

- there is no other satisfactory alternative, and
- the development will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range and,
- the development will preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.

In the case of a species protected under national legislation:

- the effects will be minimised or mitigated through careful design, work arrangements or other actions or, when this is not practical and the following is likely to prove effective;
- the developer will take careful and effective steps to relocate the species or habitat.

Policy B21 – Wildlife corridors, habitat linkages and stepping stones

5.4.35 Development which may adversely affect the integrity or continuity of the landscape features which are of major importance for wild flora and fauna will only be permitted if it can be shown that the reasons for the development clearly outweigh the need to retain the features and that mitigating measures can be provided, which would reinstate the integrity or continuity of the features.

Policy B35 - Avoiding the spread of invasive species

- 5.4.36 Where the development involves the disturbance of soil contaminated by invasive species, developers will be requested to state what measures will be taken to deal with the invasive species and/or move it to a certified site.

Anglesey and Gwynedd Joint Local Development Plan: 2011 – 2026 (deposit version), Isle of Anglesey County Council and Gwynedd Council, March 2015

- 5.4.37 The forthcoming JLDP aims to guide sustainable development over a 15 year period (2011 – 2026) within the Anglesey and Gwynedd Local Planning Authority areas and will eventually replace the Gwynedd UDP. While the JLDP has not yet been formally adopted a deposit draft has been prepared and this has been considered as a material planning policy document within this ES. The JLDP is currently anticipated to be formally adopted in July 2017. The JLDP policies relevant to Nature Conservation include:

Strategic Objective SO16:

- 5.4.38 *“Protect, enhance and manage the natural and heritage assets of the Plan area, including its natural resources, wildlife habitats, and its landscape character and historic environment”.*

Policy AMG4: Local Biodiversity Conservation

- 5.4.39 Proposals should protect and enhance biodiversity that has been identified as being important to the local area. Proposals will be refused unless they can conform to all the following criteria:
1. Ensure that there is no other satisfactory alternative site for the development.
 2. Ensure that the development is in a suitable location, avoiding locations that are of international, national and local biodiversity importance.
 3. Provide measures to mitigate potential detrimental impact.
 4. Protect and enhance the nature conservation features.
 5. Create, improve and manage wildlife habitats and natural landscape including wildlife corridors and stepping stones.
 6. Contribute towards achieving the targets set in the Local Biodiversity Action Plan.
- 5.4.40 Where necessary, an Ecological Assessment which highlights the relevant biodiversity issues should be included with the planning application.
- 5.4.41 When a development cannot protect or enhance biodiversity and the need for the development outweighs the importance of the site for nature conservation it should be clearly shown that there is no other appropriate location available and there are appropriate mitigation or compensation measures in place.

Policy AMG5: Protecting Sites of Regional or Local Significance

- 5.4.42 Proposals that are likely to cause direct or indirect significant harm to Local Nature Reserves (LNR), Wildlife Sites (WS) or regionally important geological / geomorphologic sites (RIGS) will be refused, unless it can be proven that there is an overriding social, environmental and/or economic need for the development, and that there is no other suitable site that would avoid having a detrimental impact on sites of nature conservation value and local geological importance.
- 5.4.43 When development is granted, assurance will be required that there are appropriate mitigation measures in place. It will be possible to use planning conditions and/or obligations in order to safeguard the site's biodiversity and geological importance.

Methodology

- 5.4.44 Specific guidance on ecological impact assessment was taken from the DMRB Volume 11, Section 3, Part 4: *Ecology and Nature Conservation* (Highways Agency, 1993), as updated by IAN 130/10 *Ecology and Nature Conservation: Criteria for Impact Assessment* (Highways Agency, 2010) and the

DMRB, Volume 11, Section 2, Part 5: HA 205/08: Assessment and Management of Environmental Effects. However, new guidelines on ecological impact assessment have recently been published by the Chartered Institute of Ecology and Environmental Management (CIEEM), namely the 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal' (CIEEM, 2016). Therefore, the ecological impact assessment process has been based on these, which propose an alternative method of characterising the value of ecological features, nature of potential impacts and significant effects. Instead of assigning a value for each receptor (*i.e.* low, medium, high, *etc.*), as previously described in DMRB guidance and still relevant for other environmental topics assessed in this ES, the 2016 CIEEM guidelines describe the identification of 'Important Ecological Features' in relation to the Scheme, characterising the importance of each feature in terms of its geographical context (*i.e.* internationally important, nationally, regionally, *etc.*). Any activities arising from the Scheme that could impact on the important ecological features are identified and described in detail in terms of magnitude and other characteristics, including whether or not they are likely to be significant and on what geographical level, rather than using the Value x Impact Magnitude matrix approach to determine level of significance, as described in the DMRB. Mitigation measures are proposed for all significant adverse impacts identified and then any likely residual effects are assessed in terms of the geographic context of their significance. Compensatory measures are proposed for any significant adverse residual effects and enhancement measures are also identified. Any monitoring required to assess the success of mitigation, compensation or enhancement is also identified and the overall residual significance of the proposed scheme in relation to policy and legislation is described. The methodology is described in more detail as follows.

Scoping

- 5.4.45 In accordance with the Highways (Environmental Impact Assessment) Regulations 2007 and the guidance set out by the DMRB (including IAN 130/10) and CIEEM (2016), it is considered inappropriate to attempt to investigate in detail all potential ecological issues in relation to a proposed development. Instead it is necessary to focus on those activities that potentially could generate significant ecological effects on key ecological receptors, through a process called 'scoping'.
- 5.4.46 An EIA Scoping report was produced for the Scheme in March 2016, describing the process and outcomes of an EIA scoping exercise undertaken to determine the topics to be included in the Environmental Statement (ES) for the Scheme and the scope of surveys required for completion of the EIA assessment. The scoping exercise was based on data from the local biological records centre, previous survey data and consultation with NRW, Gwynedd Council's Regulatory Department and the North and Mid Wales Trunk Road Agent (NMWTRA). The scoping process was undertaken with regard to guidance provided by the DMRB, Volume 11, Section 2, Part 4, HA204/08 and Part 6, HD48/08. It is also acknowledged that scoping is an iterative ongoing exercise that can contribute to EIA as further information about the project design and receptors becomes available. The 'A55 Abergwyngregyn to Tai'r Meibion Scheme: EIA Scoping Report' (YGC, March 2016) provides further details of the scoping exercise.
- 5.4.47 A consultation response was received from NRW regarding the proposed scope of ecological surveys. A response was also obtained from Gwynedd Council's Regulatory (biodiversity) department regarding recommendations for Local Wildlife Sites, trees and hedgerows potentially affected. Discussions have been ongoing with the NMWTRA Ecologist regarding the potential impacts on ecological receptors as a result of the Scheme, and potential biodiversity enhancement measures that could be incorporated within the project.
- 5.4.48 NRW also requested that migratory fish are considered within the assessment. These were not surveyed for, but are assumed to be present within the affected watercourses, and particularly the Afon Wig as the largest watercourse within the corridor of the Scheme. Updated surveys for water vole, dormouse and great crested newt were scoped out on the basis of information obtained from

previous surveys and the local biological records centre, indicating an absence of these species from the Zone of Influence (see paragraph 5.4.50) of the Scheme. However, evidence of water voles was searched for during subsequent otter surveys. An updated breeding bird survey was initially scoped out as previous breeding bird survey data did not indicate the likelihood of significant impacts on sensitive species. However, an updated breeding bird survey has since been completed and informed this assessment.

- 5.4.49 As part of the ecological impact assessment, further scoping has been undertaken to identify important ecological features that could be significantly affected by the Scheme, thus requiring mitigation, and those that would not be significantly affected.

Zone of Influence

- 5.4.50 Following the latest CIEEM (2016) guidance, it is necessary to establish a Zone of Influence (Zoi) for the Scheme, identifying the area over which important ecological features may be subject to significant effects. For the Scheme, this extends beyond the site boundaries, for example where there are ecological or hydrological links to sites, habitats or species elsewhere. The Zoi varies for different ecological features depending on their sensitivity to an environmental change. SACs designated for the highly mobile species lesser horseshoe bat and otter have been considered within a Zoi of 30km and 25km respectively, a much greater distance from the proposed scheme than SACs and other protected sites designated for more sedentary species or habitats that have been considered within 2km, and other important areas such as ancient woodland, which have been considered within a Zoi of 1km. The majority of habitats and species have been considered within a Zoi comprising the footprint of the Scheme and its immediate surroundings, including a corridor of land extending approximately 360m to the north and between 200m and 560m to the south of the existing A55(T), with a buffer of approximately 300m to the south-west and to the Abergwyngregyn interchange (junction 13) approximately 230m to the north-east of the Scheme. This allows for the assessment of direct impacts on species and habitats within the proposed scheme footprint during construction and indirect impacts relating to pollution or disturbance for example, during both the construction and operational phases of the Scheme.

Selection of Important Ecological Features

- 5.4.51 According to the CIEEM (2016) guidance it is necessary to undertake a systematic assessment of 'important' ecological features that could be affected (including negative and positive effects), based on the likely direct and indirect impacts of the Scheme. Important ecological features have been identified based on the key sites, habitats and species for nature conservation in the UK listed in the CIEEM (2016) guidance, as follows:

Designated Sites

- Statutory sites designated or classified under international conventions or European legislation, for example:
 - World Heritage Sites, Biosphere Reserves, Wetlands of International Importance (Ramsar sites), Special Areas of Conservation, Special Protection Areas⁸⁷
- Statutory sites designated under national legislation, for example:
 - Sites of Special Scientific Interest
 - National Nature Reserves
 - Local Nature Reserves
- Locally designated wildlife sites

⁸⁷ Including candidate SACs and proposed SPAs, SACs and Ramsar sites

Country Biodiversity Lists

- Habitats and species of principal importance for the conservation of biodiversity in Wales (Section 7 lists)

Biodiversity Action Plan lists

- UK BAP⁸⁸ priority habitats and priority species
- Local BAP priority species and habitats (specifically, Natur Gwynedd – the Gwynedd LBAP, and the TREBAP are of relevance to the Scheme)

Red Listed, Rare, Legally Protected Species

- Species of conservation concern, Red Data Book (RDB) species (UK and Wales)
- Birds of Conservation Concern (UK)
- Nationally rare and nationally scarce species (UK)
- Legally protected species (UK and European)

5.4.52 Other ecological features not included in the list above have also been considered for other reasons where relevant, such as features that might play a key functional role in the ecological landscape allowing species to move between sites (*e.g.* 'stepping stone habitat'). Legally controlled species are also considered, such as the non-native invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981. According to the CIEEM (2016) guidelines, ecosystem services and natural capital have also been considered in the compilation of a list of ecological features potentially affected. These could include supporting services (*e.g.* photosynthesis and water cycling), provisioning services (including products such as food, fuel and natural medicines), regulating services (*e.g.* air quality or erosion regulation) and cultural services (*e.g.* recreation and aesthetic experiences).

5.4.53 A list of important ecological features to be included in the impact assessment has then been produced by scoping out any features that are not considered important enough to warrant further consideration in the assessment process or which would clearly not be significantly affected. This is consistent with EIA Regulations, DMRB guidance (including IAN 130/10) and CIEEM guidance (2016) which only require investigation of likely significant effects. Where impacts on a feature are uncertain the feature has been 'scoped-in' for more detailed assessment.

5.4.54 The importance of each 'important ecological feature' has been defined in a geographical context, based on the CIEEM (2016) guidance, with the following categories used in this assessment:

- International
- National
- Regional
- County (including Vice-County)
- Local.

5.4.55 CIEEM (2016) guidance recommends that for designated sites, importance should reflect the geographical context of the designation. For example, Local Wildlife Sites may be designated according to criteria applied in a county or district context, and should be considered important accordingly. Similarly, internationally and nationally designated sites such as SACs and SSSIs respectively should be classified accordingly.

5.4.56 For other features including habitats and species, legislative lists such as Annex I, II, IV and V of the Habitats Directive, Annex I of the Birds Directive and Section 7 of the Environment (Wales) Act, have been used as a guide for determining scale of importance, but these features are

⁸⁸ The UK BAP lists of priority habitats and species have been superseded by the country biodiversity lists, but they are a useful reference source.

predominantly considered in the context of the site and locality. In this way it is possible to provide a more accurate assessment of the impacts and their potential significance in the context of local resources.

Desk Study

5.4.57 A desktop study was undertaken to inform the baseline conditions, impact assessment and scoping process, including data from the following sources:

- A search of biodiversity records held by the North Wales Environmental Information Service (Cofnod) was undertaken in May 2015, providing records of Category 1 species within a 2km buffer of the scheme centre point at SH639722; Category 2 and 3 species within a 500m buffer; and non-native invasive plant species within a 500m buffer;
- Gwynedd Council's GIS system (Map Gwynedd) provided information on statutory⁸⁹ and non-statutory designated sites (2km buffer for statutory internationally and nationally protected sites; internationally protected sites with otter or lesser horseshoe bat as a mobile species feature within a 25km and 30km buffer respectively; non-statutory sites including County Wildlife Sites and Ancient Semi-Natural Woodland sites within a 1km buffer);
- Detailed information about protected sites was obtained from the JNCC (Joint Nature Conservation Committee) and NRW websites;
- Information about current baseline populations and conservation status was obtained from JNCC, NRW, Natur Gwynedd, Bat Conservation Trust, RSPB and Birdlife International websites; the European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC), and the Second Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2001 to December 2006: Conservation status assessment for Species;
- Information about future baseline conditions was obtained from MONARCH: Modelling Natural Resources Responses to Climate Change: a Synthesis for Biodiversity Conservation; The Climate Change Risk Assessment for Wales (Welsh Government and DEFRA, 2012); The Terrestrial Biodiversity Climate Change Impacts Report Card 2012-13 (Living with Environmental Change Partnership, 2013); and the Biodiversity Impacts Climate Record Card Technical Paper: 2. The Implications of Climate Change for Terrestrial UK Mammals (Newman and MacDonald, 2015);
- Information about drainage and watercourses was obtained from Map Gwynedd⁹⁰
- Wetland Bird Survey (WeBS) data was obtained from the British Trust for Ornithology (BTO) for wetland birds using the areas of Traeth Lafan SPA closest to the Scheme between 2010 and 2015.

Previous Field Surveys

5.4.58 Detailed ecological information has been gathered from the site by experienced ecologists during the development of the proposals at this location and has contributed to informing the assessment. Detailed methodology can be found within the survey reports located in Technical Appendix C, Volume 2. A summary is given as follows:

Phase 1 Habitat Survey

5.4.59 A Phase 1 Habitat survey was conducted in September 2001 to establish the baseline ecology of the area and its features. This was undertaken according to an extended Phase 1 Methodology based on recognised Nature Conservancy Council (NCC) guidelines (1990). In 2006, a Phase 1 habitat and protected species survey was undertaken for the proposed Private Means of Access (PMA) linking the Roman Road (Henffordd) to Wig Farm underpass and widening of a section of the Roman Road. This also followed the NCC guidelines for Phase 1 Habitat survey, but was extended to include evidence and potential for protected species. The study area included approximately 800m of the

⁸⁹ Statutory sites data originally sourced from NRW

⁹⁰ Watercourse data originally sourced from NRW

Roman Road (Henffordd) between SH628716 and SH636715 including land 5m to the north of the road boundary. The survey was undertaken in November and was therefore limited to some extent by seasonal constraints.

Protected Species Surveys

5.4.60 A number of surveys within a 14 year period have been carried out for protected species. Otter and water vole surveys were conducted in 2002 and 2003. A further protected species survey was carried out in March 2005 to update the potential impacts of the Scheme. This included a walkover survey to assess potential for protected species with thorough searches for evidence of water vole, otter and badger in targeted areas providing suitable habitat. The study area included the 2km section of the A55(T) to be affected by the Scheme, extending to the railway line to the north and the Roman Road (Henffordd) to the south. A supplementary protected species survey to include additional land required to widen part of the Roman Road (Henffordd) was carried out in 2006 (as described above). A further survey covering additional land required for the proposed new county road on the northern side of the A55(T) from opposite Tai'r Meibion Farm to the Tal-y-Bont Interchange (Junction 12), and for the proposed access track from Roman Road (Henffordd) to the south of Coed Wern-Porchell was carried out in February 2007. This followed the same methodology as the 2005 survey. An additional badger and otter survey of the corridor of the Scheme was undertaken in August 2007 to provide a detailed record of evidence of these species and detailed otter and water vole surveys of all watercourses within the corridor of the Scheme were carried out in spring/summer 2008. The badger survey in August 2007 was limited to some extent by access restrictions due to the foot and mouth disease epidemic at this time.

Great Crested Newts

5.4.61 A survey of the ponds in the vicinity of the proposed scheme for great crested newts was undertaken in April 2008. The ponds were surveyed using bottle trapping and night-time torch surveys.

Bats

5.4.62 Surveys were undertaken in 2002 to identify bat roosts in trees adjacent to the A55(T) within the proposed scheme corridor and also any use of the cattle underpasses at Tai'r Meibion and Wig Farm by bats. The protected species surveys undertaken in 2005 and 2007 also included an assessment of potential bat roosting and foraging habitat. Surveys were undertaken in June 2008 to establish bat activity levels adjacent to the northern and southern side of the proposed scheme. Potential roosting habitat was recorded during a site walkover and then standard transect methodology was adopted, with static monitoring and emergence surveys of identified roosts and logging activity using frequency division detectors and recording devices to enable sonograph analysis. These surveys were updated in 2011 with further transect surveys using the same methodology.

Breeding Birds

5.4.63 A breeding bird survey was carried out in June 2008 using linear transect methods set out in the BTO/JNCC/RSPB breeding bird survey methodologies to identify breeding birds on both sides of the A55(T) carriageway within the corridor of the Scheme.

Aquatic Invertebrates

5.4.64 Aquatic invertebrates were sampled from streams and ditches within the survey area in 2002 and 2003. Samples were collected from Streams 5, 6 and 7 (see Figure 5.10.1, Volume 1a) by three minutes of active sampling with a pond net. Every sample was supplemented with a one minute visual search for individual animals living on the water surface or attached to rocks, logs or vegetation. Each aquatic invertebrate sample was analysed in the laboratory to confirm which species were present and to provide an indicator of water quality.

Trees and Hedgerows

- 5.4.65 A hedgerow survey was conducted in 2003. This identified the species present within each of the hedgerows likely to be affected by the Scheme and the percentage abundance of each species.

2015 to 2017 Surveys

- 5.4.66 Information from the previous surveys conducted for this scheme, consultation with NRW and a review of updated Local Environmental Records Centre (Cofnod) data assisted in scoping the ecological surveys required to update the ecological information for the current Scheme in 2015 and 2016.
- 5.4.67 A specific Otter and Badger survey was carried out within the footprint of the Scheme in May 2015, to gather current information on these two receptors. The survey methodology followed for both otter and badger conforms to that described in DMRB Volume 10, Section 4, Part 4, HA81/99 and Volume 10, Section 1, Part 5, HA 59/92 (Amendment to Chapter 5.3), February 1997 respectively. During this survey, evidence of water voles was also considered, in addition to any other notable and invasive species (see Volume 2, Technical Report C for survey report).
- 5.4.68 An updated suite of bat surveys was conducted in 2015 within the footprint of the Scheme. This involved an up-to-date desk study assessing any impacts on protected sites within 30km with bats as a feature, daytime inspections of buildings adjacent to the scheme, dusk transect surveys during May, July and September using standard methodology, static monitoring of the Tai'r Meibion and Wig Farm cattle underpasses in May, July and September and emergence surveys of Wig Farm, Wig Crossing Cottages and Tai'r Meibion Farm, using frequency division detectors and recording devices to enable sonograph analysis. The transect surveys used both heterodyne and frequency division (Anabat) detectors linked to a GPS unit. Anabat Express static frequency division detectors were placed inside the cattle underpasses for the duration of the transect surveys.
- 5.4.69 As evidence of bats (including lesser horseshoe) using the cattle underpasses was identified during the 2015 surveys further surveys were undertaken, involving constant static monitoring over a four-week period between 12th October and 10th November 2015 using an Anabat Express static frequency division detector within each of the underpasses. However, as static recording is limited to recording passes, with little information about behaviour and number of bats passing through, further survey work was arranged for the 2016 bat active season using surveyors at each end of the two underpasses with manual heterodyne detectors. This was required to clarify the nature of the use of the underpasses by lesser horseshoe and other bat species and the quantities of bats passing through during the main bat active season. The additional surveys involved dusk activity surveys in the months of May and July 2016 and a dusk and dawn survey in September 2016, with static recording using an Anabat Express in place for the duration of the surveys in addition to the manual detectors, in order to confirm species identification. Static monitoring of the underpasses using Anabat Express detectors was also undertaken for a week from 7th to 14th October 2016, to allow some comparison with the autumn 2015 data.
- 5.4.70 A tree and hedgerow survey to BS5837:2012 "*Trees in relation to design, demolition and construction. Recommendations*" was carried out during the summer of 2015 covering the trees and hedgerows within the footprint of the Scheme. This was updated in September 2016 to include an additional area to the east previously not included.
- 5.4.71 A further Phase 1 Habitat Survey was undertaken for the whole corridor of the Scheme in April 2016, to update the habitat data collected previously. This identified the habitat types and current land use present within the survey area and mapped them according to the standard Phase 1 methodology provided in the Nature Conservancy Council's 'Handbook for Phase 1 Habitat Survey (1990).

5.4.72 A further breeding bird survey was undertaken in April/May 2016 to update the breeding bird data previously recorded in 2008, using BTO/JNCC/RSPB breeding bird survey methodology. A red kite survey was undertaken in March-April 2017 to ascertain the presence of red kite nest sites within the vicinity of the proposed works following records of red kites exhibiting potential breeding behaviour during the 2016 breeding bird survey. The methodology used was based on 'Raptors: A Field Guide to Surveys and Monitoring' (Hardy et al, 2006) and 'Bird Monitoring Methods' (Gilbert et al, 1998), with two four-hour survey visits utilising a number of vantage points. 2015 Cofnod data and BTO Wetland Bird Survey (WeBS) data for 2010-2015 were also used to inform the assessments on breeding birds and the bird features of Traeth Lafan SPA respectively.

Limitations and Assumptions

5.4.73 A number of limitations apply for the ecological surveys and desk study that have been undertaken. Many species are only apparent seasonally, so surveys at certain times of year are better able to detect them. Some species or evidence of their field signs are also affected by weather conditions and may not be recorded during adverse weather even if usually present at that time of year. Access restrictions also created limitations for at least one of the surveys. As far as possible all surveys were undertaken during optimal times and conditions for recording the target species, although this was sometimes not possible for some of the earlier surveys. However, wherever possible this was compensated by increased survey effort at an alternative time of year or further surveys the following season. A precautionary approach has also been taken where there is any uncertainty to allow a realistic assessment of potential impacts and mitigation required.

5.4.74 A limitation of the desk study undertaken is that the distribution of records obtained from the Environmental Information Service is determined by the level of survey effort undertaken in a given area and may also be skewed towards areas where people are more likely to come into contact with certain species, such as road casualties and bat roosts in houses. The records do not show where a species is absent and therefore the findings of the desk study have not been relied on alone, but have been used as a guide to identify areas where further survey is required or to indicate the likelihood of a species being present within the general area. For further details of the limitations of specific surveys, see Technical Appendix C, Volume 2.

Assessment

Baseline Conditions

5.4.75 The baseline conditions have been described within the Zone of Influence of the Scheme, both generally and in relation to each of the 'Important Ecological Features' identified from the consultations, desk study and field surveys undertaken.

5.4.76 The 2016 CIEEM guidance describes how the baseline conditions must constitute the conditions predicted to exist at the expected time of the different phases of the scheme to be assessed, *i.e.* construction and operation in this case, in the absence of the Scheme. This is due to the dynamic nature of ecosystems due to a number of natural and human-influenced factors, including the following:

- Trends in species population and distribution;
- Rates of potential colonisation by new species and habitats;
- Ecological processes, such as succession;
- Likely changes in agricultural practice, including agri-environment schemes;
- Expected outcomes from current and predicted management practices;
- Trends in habitat quality *e.g.* resulting from pollution or pollution control;
- Environmental trends *e.g.* climate change;
- Management plans and conservation objectives for designated sites; and
- The effects of other projects.

- 5.4.77 The factors listed above and anything else that could cause a change in the condition of species populations, habitats and sites identified as important ecological features affected by the proposed scheme, have been used to assess the baseline conditions at the time of construction and operation of the Scheme.
- 5.4.78 As there is not expected to be a significant delay between the publishing of this document and construction of the Scheme, the baseline projection for construction is generally based on the assumption that the present management regime continues and other factors are unlikely to have a significant effect on the condition of the important ecological features identified (unless an external factor is identified as likely to have a significant impact on an ecological feature).
- 5.4.79 According to the DMRB (Volume 11, Section 2, Part 5, HA 205/08), the assessment of the operational phase of the Scheme should consider conditions expected in Year 15 of operation. Therefore, the impacts described for the operational phase have been based on any differences predicted with the proposed scheme in Year 15 of its operation, compared with the predicted baseline 15-20 years from now (allowing time for construction and any delays following publication of this ES). Therefore baseline conditions have been projected for Year 15 of the Scheme, or 17-20 years from now, in the absence of the Scheme.

Identification and Characterisation of Impacts

- 5.4.80 For each important ecological feature that would potentially be significantly affected by the Scheme, likely impacts have been described for both the construction and operational phases, including consideration of the following aspects, as described in the CIEEM (2016) guidance:
- Available resources;
 - Environmental processes;
 - Ecological processes;
 - Human influences;
 - Historical context;
 - Ecological relationships;
 - Ecological role or function;
 - Ecosystem properties;
 - Other environmental influences.
- 5.4.81 Each potential impact identified has then been characterised according to the following criteria (as described in the CIEEM 2016 guidance):
- Positive (beneficial) / negative (adverse);
 - Extent (area over which the impact may occur);
 - Magnitude (severity, e.g. size/amount/intensity/volume);
 - Duration (e.g. permanent/temporary);
 - Timing (in relation to ecologically sensitive periods);
 - Frequency;
 - Reversibility (whether recovery is possible within a reasonable timescale).
- 5.4.82 All impacts have been assessed in relation to the baseline conditions as projected to occur at the time of construction and Year 15 of operation of the Scheme. They are described according to how these baseline conditions will change as a result of the Scheme and associated activities, and include any cumulative impacts of the Scheme and those arising from other developments.

Cumulative Impacts

- 5.4.83 Assessment of cumulative effects and impacts has been undertaken, considering both additional and incremental effects and effects that are associated or connected with the Scheme as well as those that are associated with other unrelated developments.

- 5.4.84 Developments considered in the cumulative impact assessment have included the following types:
- Planning applications and other proposals for which consent has been applied and which are awaiting determination;
 - Projects which have been granted consent but which have not yet been completed;
 - Proposals which have been refused permission but which are subject to appeal and the appeal is undetermined;
 - Proposed projects that will be implemented by a public body but for which no consent is needed from a competent authority;
 - Constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline;
 - Developments specifically referenced in a National Policy Statement, a National Plan or a Local Plan.
- 5.4.85 Consultation with Gwynedd Council, Conwy County Borough Council, Denbighshire County Council, Flintshire County Council, Anglesey Council, NRW, North and Mid Wales Trunk Road Agency (NMWTRA), Highway Services UK and Snowdonia National Park Authority (SNPA) was undertaken to assist in the compilation of developments to be considered.

Residual Impacts

- 5.4.86 Avoidance or mitigation measures for all impacts considered to be significant (see paragraph 5.4.87-5.4.88 below) are described where these are possible and any residual impacts are then assessed to determine the significance of their effects on ecological features. Where significant residual effects remain, compensatory measures would be required proportional to the scale of significance and these have also been described.

Determination of Significant Effects

- 5.4.87 According to the CIEEM (2016) guidance, for the purpose of Ecological Impact Assessment a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. These conservation objectives may be specific (*e.g.* for a designated site), broad (*e.g.* national/local nature conservation policy) or more wide-ranging (*e.g.* enhancement of biodiversity).
- 5.4.88 Effects can be considered significant at a wide range of scales from international to local level and therefore the significance of any effects considered to be significant has been qualified in a geographical context, which may not be the same as the geographical context in which the feature is considered important. For example, an effect on a species which is on a national list of species of principal importance for biodiversity may not have a significant effect on its national population. The terminology used to describe the geographical scale of the significance is the same as that used to describe the scale of importance of the ecological features (see paragraph 5.4.54 above). The determination of the scale of significance has been based on the CIEEM (2016) guidance.

Limitations and Assumptions

- 5.4.89 A number of limitations apply for the assessment methodology described above. When predicting the baseline conditions at Year 15 of operation, it is obviously not possible to accurately predict the impact or magnitude of every factor influencing population trends or habitat condition and in what way they would act together on a species, habitat or site in this timeframe. It is therefore only discussed as a guide in the assessment, with no solid predictions made. Equally, it is very difficult to identify every other scheme or project that could combine to act on each of the important ecological features identified in this assessment for the assessment of cumulative effects. This section will therefore represent an estimate of possible external influences resulting from other major schemes that have been identified.

Baseline Conditions

Important Ecological Features

5.4.90 As previously stated, according to the CIEEM (2016) guidance, the selection of Important Ecological Features should be based on those features considered to be of importance to nature conservation that could be affected by the likely direct or indirect impacts of the Scheme. A list of such impacts likely to occur during the construction and operational phases of the Scheme is provided below:

Construction Impacts

- Temporary disturbance/disruption to protected species during construction work (e.g. badgers, otters, bats and breeding birds);
- Loss of habitats through soil stripping and hedge and tree removal. This would include for example reptile habitat and breeding bird habitat;
- Injury or mortality of individuals which are in their habitats at the time of removal (e.g. badgers, amphibians and reptiles);
- Pollution incidents which could affect watercourses, waterbodies and protected sites located downstream of the pollution incident.

Operational Impacts

Adverse:

- Increased risk of road mortality for a number of species during operation of the scheme (e.g. Badgers, otters, small mammals, reptiles and amphibians) as the new concrete central reserve safety barrier could trap animals on the carriageway;
- Continued reduction in habitat such as woodland, mature trees and hedgerows until regeneration occurs. In addition to the innate value of these habitats, this would have adverse consequences for a range of wildlife, including bats, badgers, birds, reptiles, amphibians, and invertebrates due to loss of connectivity and foraging, commuting and roosting habitat.

Beneficial:

- Improved passage for wildlife including mammals, reptiles and amphibians under the A55(T) as a result of the provision of a larger culvert for the Afon Wig (Stream 5).

5.4.91 Based on the data collated from surveys, consultation, historical records and GIS systems, a list of ecological features considered to be of importance within the Zol and potentially affected by the Scheme is provided in Table 5.4.3 below. Features that were initially considered to be potentially present and were therefore surveyed for but not recorded have been scoped out and are therefore not included on this list (water voles and great crested newts for example). The geographical scale of the importance of these features is also provided in the table.

Table 5.4.3: Summary of Important Ecological Features

Ecological Feature	Reason for inclusion as an Important Ecological Feature in relation to the Scheme	Geographical Scale of Importance
Sites:		
Traeth Lafan SPA	410m to the northwest. A European Protected Site under the EU Habitats Directive within 2km of the Scheme.	International
Y Fenai a Bae Conwy SAC	410m to the northwest. A European Protected Site under the EU Habitats Directive within 2km of the Scheme.	International
Coedydd Aber SAC	635m to the east. A European Protected Site under the EU Habitats Directive within 2km of the Scheme.	International
Eryri SAC	1.2km to the south. A European Protected Site under the EU Habitats Directive within 2km of the Scheme.	International
Mwyngloddiau Fforest Gwydir	15km to the southeast. A European Protected Site (EU Habitats Directive) with lesser horseshoe bat as a feature within 30km of the	International

SAC	Scheme.	
Afon Gwyrfai a Llyn Cwellyn SAC	15km to the southwest. A European Protected Site (EU Habitats Directive) with otter as a feature within 25km of the Scheme.	International
Coedydd Derw a Safleoedd Ystumod Meirion SAC	17km to the south. A European Protected Site (EU Habitats Directive) with lesser horseshoe bat as a feature within 30km of the Scheme.	International
Glynllifon SAC	19km to the southwest. A European Protected Site (EU Habitats Directive) with lesser horseshoe bat as a feature within 30km of the Scheme.	International
Traeth Lafan SSSI	410m to the north. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Scheme.	National
Coedydd Aber National Nature Reserve	635m to the southeast. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) and National Parks and Access to the Countryside Act 1949 within 2km of the Scheme.	National
Coedydd Aber SSSI	635m to the east. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Scheme.	National
Eryri SSSI	1.2km to the south. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Scheme.	National
Traeth Lafan Local Nature Reserve	410m to the north. A regionally important designation under the National Parks and Access to the Countryside Act 1949	Regional
Ancient Semi-Natural Woodland Sites	Five sites listed on the Ancient Woodland Inventory (NRW) including four Ancient Semi-Natural Woodland (ASNW) sites and one Plantation on an Ancient Woodland Site (PAWS) within 1km of the Scheme.	Regional
County Wildlife Sites	12 County Wildlife Sites, designated according to criteria applied in a county context, located within 1km of the Scheme, including two immediately adjacent to the existing A55(T) within the area to be affected.	County
Habitats:		
Trees and Hedgerows	Trees and hedgerows are present throughout the footprint of the Scheme. Hedgerows are a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act, are listed on Gwynedd LBAP and boundary features are included on the TREBAP. Veteran trees are listed on the Gwynedd LBAP and the TREBAP includes planted native trees and shrubs. Trees and hedgerows can also provide important connecting habitat, acting as a wildlife corridor for a range of other species.	County
Lowland mixed deciduous woodland	Pockets of mixed deciduous woodland are present within the scheme boundary, small areas of which would be affected by the proposed works. Lowland mixed deciduous woodland is a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and the TREBAP also includes woodlands.	County
Rivers and streams	Eight watercourses and two field drainage features pass underneath the A55(T) within the proposed scheme corridor, one of which (the Afon Wig) is classified as a main river immediately downstream of the highway. Rivers are considered a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and the TREBAP includes rivers and streams.	County
Species:		
Bats	Previous records of various bat species within the Zone of Influence, including less common species such as lesser horseshoe and serotine. All bat species are European Protected Species and many are also Species of Principal Importance in Wales under Section 7 of the	Regional

	Environment (Wales) Act. Lesser Horseshoe and pipistrelle bats are also Gwynedd LBAP species. Bats are also listed on the TREBAP.	
Otters	A low level of otter evidence was found downstream of the A55 within the scheme corridor on streams crossing under the A55 which would be affected by the proposal. Otter is a European protected species, Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act, TREBAP and Gwynedd LBAP species.	Regional
Badgers	An active badger population is known to be located within the Zone of Influence. Badgers are UK protected species under the Badger Protection Act 1992.	Local
Polecat	There are two records of this species within 1km of the Scheme, the most recent being a road mortality within the scheme boundary in 2010. A Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and a Gwynedd LBAP species.	County
Brown hare	There are records of this species within 1km of the scheme boundary. A Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and a Gwynedd LBAP species.	County
Hedgehog	There are records of this species within 1km of the scheme boundary. A Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and a Gwynedd LBAP species.	County
Breeding birds	Mature and semi-mature woodland, scrub and boundary habitats and farm and residential buildings provide suitable habitats for a variety of breeding birds within the Zone of Influence. All nesting birds are protected under the Wildlife and Countryside Act 1981, with higher protection for those listed on Schedule 1. Some of the species recorded within the scheme corridor are listed as Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and also on Gwynedd LBAP.	County
Red kite	A pair of red kites was recorded during the 2016 breeding bird survey and the red kite survey in 2017. Protected under the Wildlife and Countryside Act 1981 (Schedule 1, Part 1), as amended, which prohibits disturbance of nesting birds and their young. Also included in Gwynedd LBAP.	County
Barn owl	Two mortality records of barn owls on the A55(T) exist within the scheme boundary. Protected under the Wildlife and Countryside Act 1981 (Schedule 1, Part 1), as amended, which prohibits disturbance of nesting birds and their young. Also included in Gwynedd LBAP and the TREBAP.	County
Reptiles	There is potential reptile habitat within the study area for the more common species, including slow worm, common lizard and grass snake. The Wildlife and Countryside Act 1981 prohibits the intentional killing, injury and trade of these species. They are also all Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and are included on the TREBAP.	County
Amphibians	There is potential amphibian habitat within the footprint of the Scheme. Common toad is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and all amphibians are listed on the TREBAP.	Local
Migratory fish	The scheme affects several watercourses. NRW have noted in their scoping response that migratory fish should be considered in the watercourses affected. Salmonids and European eel are Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and aquatic species are also listed on the TREBAP. Provision for the European eel is also made under the Eels (England and Wales) Regulations 2009.	County

Bluebell	Bluebells have been recorded within some of the woodland areas to be affected by the Scheme and also low numbers scattered throughout the verges. Bluebell is included on the Gwynedd LBAP and the TREBAP	Local
Non-native invasive plant species	<i>Rhododendron ponticum</i> is present within the footprint of the Scheme. This is a non-native invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981. There is a Topic Action Plan for Invasive Plants on the Gwynedd LBAP.	Not applicable

Describing the Baseline

- 5.4.92 This section describes the general baseline conditions within the Zone of Influence of the Scheme along with those of the important ecological features identified within Table 5.4.3 above.
- 5.4.93 As mentioned previously, species and habitats are dynamic, affected by natural processes as well as human intervention. Consequently the presence or distribution of species and habitats is likely to change over time. Where possible and if relevant, an indication of likely future baseline conditions for the features described below is provided, to allow a comparison of potential conditions during construction and operation (Year 15) of the Scheme with the predicted conditions of ecological features at those respective future time periods without the scheme in place. As the construction period is likely to occur within the next couple of years, the baseline conditions at construction are not considered likely to differ significantly from those at the time of this assessment, so this is assumed to be the case. Year 15 of operation has been assumed to be 2035 based on the likely timescale of construction if no significant delays are incurred.

General

- 5.4.94 The area of the Scheme predominantly consists of a section of the A55(T) corridor and associated species-poor grassland verge habitat, but also incorporates a small offline area for the proposed county road, PMA and NMU route and an area to the south for the proposed agricultural PMA before this joins a section of the county road known as Roman Road (Henffordd). The road corridor lies within an area along the North Wales coast dominated by agriculturally improved pasture, with occasional arable fields, bounded and intersected by a network of hedgerows, occasional mature trees and small woodland blocks. A number of small watercourses flow from the hills and mountains of Snowdonia National Park to the southeast, beneath the A55(T) to the sea located between 410m and 1.3km to the northwest. The area of the Scheme does not lie within any statutory designated sites, although there are two county wildlife sites likely to be directly affected.

Internationally Designated Sites

- 5.4.95 Internationally protected sites considered to potentially fall within the Zol of the Scheme include all those within 2km and any additional sites with otter as a feature within 25km and lesser horseshoe bats as a feature within 30km, due to the highly mobile nature of these particular features. These sites are summarised in Table 5.4.4 below and shown on Figures 5.4.1 and 5.4.2, Volume 1a. See also the Assessment of Implications on European Sites (AIES) that has been prepared for this scheme, 'A55 Chester to Bangor Trunk Road - Abergwyngregyn to Tai'r Meibion Improvement: Statement to Inform Appropriate Assessment', available as a separate document. These sites are all of importance at an **international** level.

Table 5.4.4: Internationally designated sites potentially within the Zol of the Scheme

Site	Approximate Distance from Scheme	Qualifying Features Potentially Affected
Traeth Lafan SPA	410m to northwest	Oystercatcher; Curlew; Great crested grebe
Y Fenai a Bae Conwy SAC	410m to northwest	Sandbanks which are slightly covered by seawater all the time; Mudflats and sandflats not covered by seawater at low tide; Reefs; Large shallow inlets and bays; Submerged or partially submerged sea caves
Coedydd Aber SAC	635m to southeast	Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles; Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)
Eryri SAC	1.2km to south	Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i> ; Siliceous alpine and boreal grasslands; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galiopsietalia ladani</i>); Calcareous rocky slopes with chasmophytic vegetation; Siliceous rocky slopes with chasmophytic vegetation; Northern Atlantic wet heaths with <i>Erica tetralix</i> ; European dry heaths; Alpine and boreal heaths; Alpine and subalpine calcareous grasslands; Species-rich <i>Nardus</i> grasslands on siliceous substrates in mountain areas; Blanket bogs; Depressions on peat substrates of the Rhynchosporion; Petrifying springs with tufa formation (Cratoneurion); Alkaline fens; Alpine pioneer formations of the of the <i>Caricion bicoloris-atrofuscae</i> ; Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles; Slender green feather-moss; Floating water-plantain
Mwyngloddiau Fforest Gwydir SAC	15km to southeast	Lesser horseshoe bat
Afon Gwyrfaï a Llyn Cwellyn SAC	15km to southwest	Otter
Coedydd Derw a Safleoedd Ystumod Meirion SAC	17km to south	Lesser horseshoe bat
Glynllifon SAC	19km to southwest	Lesser horseshoe bat

Traeth Lafan SPA

Construction

- 5.4.96 This site is located in Conwy Bay between Bangor and Llanfairfechan and comprises a large area of intertidal mud and sand flats lying at the north eastern edge of the Menai Strait. It is important for its wintering waterbirds, especially oystercatcher and curlew. In severe winter weather, Traeth

Lafan SPA acts as a refuge area for oystercatchers displaced from the Dee estuary and the site is also an important moulting roost for great crested grebe in late summer / early autumn.

- 5.4.97 Unit 9 is the Management Unit of the SPA closest to the Scheme, that each of the watercourses passing through the corridor of the Scheme flows into, and is located approximately 410m to the northwest.
- 5.4.98 The improved fields adjacent to the Scheme (to the north), although located outside the SPA boundary, provide potential foraging habitat for two of the mobile features of the SPA, Oystercatcher and Eurasian curlew. Some of this habitat would be lost to the Scheme and there is also potential for disturbance of these areas during construction and operation, due to the construction of the proposed county road, PMA and NMU route along the northern edge of the Scheme. However, data obtained from WeBS (Wetland Bird Survey, BTO) indicates that the closest high tide roosts of these species are located along the edge of the Menai Strait at Ogwen, Wig and Aber, all over 700m to the north of the Scheme.
- 5.4.99 As outlined in the Core Management Plan (CMP) for the site, the Conservation Objectives for Feature 1, overwintering oystercatcher, are to maintain the feature at Favourable Conservation Status by maintaining the following conditions:
1. The 5 year mean peak of the number of wintering oystercatchers is at least 4,000.
 2. The abundance and distribution of cockles of 15mm or larger and other suitable food are maintained at levels sufficient to support the population with a 5 year mean peak of 4,000 individuals.
 3. Oystercatchers are not disturbed in ways that prevent them spending enough time feeding for survival.
 4. Roost sites, including high tide roost sites, remain suitable for oystercatchers to roost undisturbed.
 5. The management and control of activities or operations likely to adversely affect the oystercatchers, is appropriate for maintaining the feature in favourable condition and is secure in the long term.
- 5.4.100 According to the CMP for the site, the Conservation Status of the oystercatcher feature was Favourable at the time that this document was published (2008). According to the BTO WeBS count data, the 5 year mean peak of overwintering oystercatchers between 2010/11 and 2014/15 was 7794, exceeding the threshold for Conservation Objective 1 above, and indicating that the feature is likely to be at a favourable conservation status currently. Conservation Objectives were not available for the other features of the SPA (curlew and great crested grebe) but it is likely that although Objective 1 is likely to differ for each species, Objectives 2 - 5 would be similar to those for the oystercatcher feature.

Operation (Year 15)

- 5.4.101 The CMP identifies a number of Conservation Management Issues for each of the Management Units of the site, with those for Unit 9 described as follows:
- Commercial gathering of cockles occurring seasonally on Traeth Lafan results in disturbance and damage to benthic habitats and species;
 - Vehicular access (particularly quad bikes used to access the cockle fishery) has damaged sensitive benthic habitats and species on Traeth Lafan in the past. Efforts to restrict access, to avoid particularly sensitive areas of the foreshore and limit damage have been of some success;
 - The SPA feature overwintering oystercatcher population is in favourable condition;
 - It is therefore considered that there is some scope for restoration of areas and improvement of management of certain activities within this unit.

- 5.4.102 The CMP states that this information is also held on CCW's Actions Database for Sites that will be used by CCW and partner organisations to plan future work to meet the Wales Environment Strategy targets for sites. The Wales Environment Strategy (see paragraph 5.4.23) was published in 2006 and sets out the strategic direction for the 20 years following this date (*i.e.* to 2026). Year 15 of Operation is likely to be around 2035 but it is assumed that the Welsh Government and NRW will provide a strategy to replace this when the current strategy comes to an end (2026), which provides similar targets to maintain features of protected sites at Favourable Conservation Status.
- 5.4.103 The population of oystercatchers in the UK is stable or increasing (JNCC) with the main reason for population increase thought to be behavioural adaptations to exploit inland areas for foraging in addition to coastal habitats. The oystercatcher has been assigned amber status in the UK according to the most recent Birds of Conservation Concern (BoCC) criteria (BoCC 4, British Birds, 2015). It is therefore possible that there could be more oystercatchers foraging within fields adjacent to the SPA in the future but this is unlikely to extend much further than the fields immediately adjacent to the SPA by 2035 considering the abundance of suitable foraging habitat likely to remain in the vicinity, with no significant increase anticipated within areas adjacent to the Scheme.
- 5.4.104 The population of curlews is declining, with an overall decline in the UK of 42% between 1995 and 2008 (RSPB) and the species is now on the red list according to Birds of Conservation Concern (BoCC 4, 2015). Likely causes for this decline have been identified as agricultural intensification of upland farmland, afforestation and increases in predator populations such as foxes and crows, all of which may continue to exert pressure on the species in the future.
- 5.4.105 Estimates of the great crested grebe population made from surveys in Britain indicate a 73% increase between 1965 and 1991 (JNCC) contributed mainly to an increase in the availability of gravel pits in England and Wales for breeding, as well as an increased tendency to breed on lowland rivers. The species has now been assigned green status in the UK according to Birds of Conservation Concern (BoCC 4, 2015).
- 5.4.106 Sea level rise due to global warming is likely to push the populations of foraging oystercatcher and curlew closer to the Scheme in the future but given the minimal increase likely to occur by 2035, this is not considered likely to be significant. It has also been estimated that UK sea temperatures could rise by a further 2°C by 2050, likely to result in changes in the relative abundance and distribution of the marine species, such as cockles and other prey items associated with the SPA features and ocean acidification is also likely to have adverse impacts on shellfish. Milder winters could also mean that oystercatchers are able to remain at their wintering site in the Dee Estuary, rather than being forced west to overwinter in Traeth Lafan SPA, thus reducing the population within the SPA.
- 5.4.107 It is therefore assumed that the baseline conditions at Year 15 of operation of the Scheme will be in a similar condition to those at the time of this assessment, although curlews may have a reduced conservation status if current trends continue, oystercatchers could decrease in number within the SPA and all three features may be adversely affected by a potential reduction in shellfish.

Y Fenai a Bae Conwy SAC

Construction

- 5.4.108 The boundary of this SAC extends along the Menai Straits, and into Conwy Bay as far as Little Orme's Head on the Conwy coast while extending past Moelfre and up to (although not including) Traeth Lligwy on the Anglesey coast. Much of the site is subtidal but there are also extensive intertidal areas included.
- 5.4.109 Of the five habitats for which the site is designated (see Table 5.4.4 above), those in the vicinity of the Scheme are 'large shallow inlets and bays', namely Conwy Bay; 'intertidal mudflats and

sandflats'; and 'reefs', extending from Aber Ogwen, to the northwest of the Scheme. Conwy Bay 'large shallow bay' and the 'intertidal mudflats and sandflats' are both located within the closest part of the site to the Scheme, 410m to the north at the closest point, while the 'reefs' are located approximately 1.3km to the northwest. There are fluvial pathways linking the site of the Scheme to Conwy Bay and the intertidal mudflats and sandflats (410m away at the closest) as all of the watercourses passing through the corridor of the Scheme flow into these features of the site. It is therefore considered that only these two features could potentially be affected by the Scheme.

5.4.110 As outlined in the CMP for the site (published in 2009), the Conservation Objectives for the 'large shallow bay' and 'intertidal mudflats and sandflats' features of the SAC are that the following must be fulfilled and maintained in the long-term:

1. **Range:** The overall distribution and extent of the habitat features within the site, and each of their component parts is stable or increasing.
 - For the 'intertidal mudflats and sandflats' feature, these include:
 - Muddy gravel communities
 - Dwarf eelgrass, *Zostera noltei* beds
 - Sediment communities at Traeth Lafan
 - For the 'large shallow bay' feature, these include:
 - Organically enriched muddy sediment areas.
2. **Structure and Function:** The physical, biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded. Important elements include:
 - Geology
 - Sedimentology
 - Geomorphology
 - Hydrography and meteorology
 - Water and sediment chemistry
 - Biological interactions

This includes the need for restoration of some 'mudflat and sandflat' features such as the muddy gravel habitats and sheltered muddy habitats. These habitats are also part of the 'large inlets and bays' feature.
3. **Typical Species:** The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded. Important elements include:
 - Species richness
 - Population structure and dynamics
 - Physiological health
 - Reproductive capacity
 - Recruitment
 - Mobility
 - Range

5.4.111 Both the 'intertidal mudflats and sandflats' and 'large shallow bay' features of the site were considered to be at Unfavourable Conservation Status in the 2009 CMP for the site. This status was due to a number of pressures acting on the 'intertidal and mudflat' feature that forms part of the 'large shallow bay' feature. These include the following:

- The use of vehicles on the foreshore, including quadbikes used for the commercial cockle fishery at Traeth Lafan;
- Bait digging in some muddy gravel and sheltered mud habitats; and
- The possible invasion of the slipper limpet.

5.4.112 For the purposes of this assessment, it is assumed that these conditions remain in a similar state at the current time and also at the likely time of construction of the Scheme.

Operation (Year 15)

5.4.113 According to the CMP, there is considered to be some scope for the restoration of the 'intertidal mudflats and sandflats' feature and measures to prevent damage to the feature in the future through:

- The use of agreed routes by vehicles across the foreshore to avoid sensitive areas;
- Co-operative working with the angling and bait collecting community;
- The introduction of 'Codes of Good Practice' and other measures to prevent against future introductions of non-native species.

5.4.114 Assuming that actions to meet these requirements will be implemented in a similar way to those for Traeth Lafan SPA (see paragraph 5.4.102 above) by NRW in conjunction with the Welsh Government, it is assumed that the condition of the 'intertidal mudflats and sandflats' and 'large shallow bay' features of the SAC would remain in at least the same, if not better, condition in Year 15 of operation. Global warming trends indicate a slight rise in sea level by this time, which would increase the area of the SAC slightly but this is not considered likely to be a significant increase by 2035. However, sea level rise is also likely to result in a reduction in intertidal area and consequently a reduction in intertidal mudflats (The Climate Change Risk Assessment for Wales, Welsh Government and DEFRA, 2012). It has also been estimated that UK sea temperatures could rise by a further 2°C by 2050, likely to result in changes in the relative abundance and distribution of the marine species associated with the SAC features, but it is not clear what effect this would have on their condition apart from a likely increase in disease hosts and pathogens, harmful algal blooms and invasive species. As mentioned previously, there could also be an adverse effect on shellfish due to ocean acidification.

Coedydd Aber SAC

5.4.115 According to the Core Management Plan for the Coedydd Aber SAC (Countryside Council for Wales, February 2008), the site is of special interest for its botanical, ornithological and entomological interest. It supports a mosaic of native broadleaved woodland types of international importance including alluvial forests with alder and ash, and old sessile oak woods, which form a natural elevation-dependent habitat transition from coast to open mountain. The transition zones include stands of mixed oak, ash, alder and birch woodland, some of which can be classed as ancient, open hawthorn scrub, sub-montane heath, cliffs and acidic grassland. The tree dwelling or epiphytic lichen communities that the woodland communities support are also of national importance. The transition from woodland to mountain vegetation is also reflected in the diverse array of bird species assemblages from woodland, through torrent river, woodland edge, ffridd and heath to open species assemblages. The woodland, montane heath and grassland breeding bird assemblages qualify the site. The Afon Rhaeadr Fawr is one of the most precipitous rivers in Britain outside Scotland and is of national importance as a representative of this river type.

5.4.116 The features of the SAC, namely old sessile oak woods and alluvial forests are static habitat features. As such they could only be affected by the Scheme along potential pollution pathways. There are no fluvial pollution pathways connecting the site to the Scheme and it is considered that due to the distance (635m) from the proposed works and the scale and nature of the activities proposed, it is very unlikely that there would be any impact from air pollution (on lichen communities) or noise (on breeding birds for example). The loss of hedgerows that could be used as foraging habitat by the breeding bird assemblage of the site is unlikely to constitute a significant loss due to the abundance of similar or better habitat in the area. During operation, the Scheme is not expected to cause any significant changes in air quality (see Chapter 5.1: Air Quality) as it not likely to create any significant changes in traffic flow or volume. It is therefore considered that this site is unlikely to be significantly affected by the Scheme and can be scoped out of the assessment.

Eryri SAC

5.4.117 This large site comprises 17 habitat features and two plant species features (see Table 5.4.4 above), so as these are all static features and there are no fluvial pathways leading from the Scheme to the SAC, it is very unlikely that the Scheme would have a significant effect on any of them due to its distance from the site (1.2km) and the scale and nature of the proposed works. Eryri SAC can therefore be scoped out of the assessment.

Mwngloddiau Fforest Gwydir SAC

Construction

5.4.118 Due to its distance approximately 15km to the southeast of the proposed scheme, the only feature of this SAC with potential to be significantly affected by the Scheme is the lesser horseshoe bat, as a highly mobile species feature.

5.4.119 Although lesser horseshoe bats have been recorded within the corridor of the Scheme, this SAC is located approximately 15km away to the southeast, with the Carneddau range acting as a natural topographical barrier in between. It is therefore unlikely that a significant proportion of the local lesser horseshoe population would be connected with the SAC population, particularly as there is an abundance of better foraging habitat located in other areas closer to the SAC. However, due to the large range of the species, it is possible that a small number of the bats recorded within the corridor of the Scheme could have links with the SAC, such as utilisation of hibernation roosts within the mines.

5.4.120 The Conservation Status of the lesser horseshoe bat feature of this SAC is described as Unfavourable in the 2008 CMP for the site. This was due to the unmanaged access impacting on the mine entrance integrity. For the purposes of this assessment, it is assumed that this condition remains in a similar state at the current time and also at the likely time of construction of the Scheme.

5.4.121 The Conservation Objectives for the lesser horseshoe bat feature of the SAC are for it to achieve Favourable Conservation Status where all of the following conditions are satisfied:

- The site will support a sustainable population of lesser horseshoe bats in the Gwydyr Forest area;
- The population will be viable in the long term, acknowledging the population fluctuations of the species;
- The natural range of lesser horseshoe bats is neither being reduced nor is likely to be reduced for the foreseeable future;
- Mines on the site will be in optimal condition to support the populations;
- Sufficient foraging habitat is available, in which factors such as disturbance, interruption to flight lines, and mortality from predation or vehicle collision, changes in habitat management that would reduce the available food source are not at levels which could cause any decline in population size or range;
- There is a sufficiently large area of suitable habitat surrounding the roosts to support the bat population, including continuous networks of sheltered broadleaved and coniferous woodland, and tree lines, connecting the various roosts with areas of insect rich grassland and open water;
- Management of the surrounding habitats is of the appropriate type and sufficiently secure to ensure there is likely to be no reduction in population size or range, nor any decline in the extent or quality of breeding, foraging or hibernating habitat;
- All factors affecting the achievement of the foregoing conditions are under control.

Operation (Year 15)

5.4.122 According to the 2008 CMP for this SAC, the actions required to fulfil the Conservation Objectives outlined above in relation to the lesser horseshoe bat feature, all involve the repair of damaged mine entrance grilles in order to safeguard bat roosts. Assuming that these actions are implemented by NRW, it is likely that the lesser horseshoe bat feature of the SAC would remain at least in the same condition as it is at present by Year 15 of operation of the Scheme without the scheme in place if all other factors remained the same. This projection is supported by changes in suitable climate space of lesser horseshoe bats as predicted by the 'Monarch 3: Modelling Natural Resource Responses to Climate Change' project (UK Climate Impacts Programme - UKCIP, 2007) that indicates that the area of suitable climate conditions available to the species in Britain is likely to increase by 140 – 150%; including an increase in suitability within the area of the Scheme as currently they are at the northern limit of their range in this location. Welsh-level population trends for lesser horseshoe bat obtained from the Bat Conservation Trust also show a steady increase since 1990 of about 5.8% per year. Conversely, increases in the human population of Wales (projected to increase by 5-6% by 2035) may lead to increased pressures on the species such as habitat loss and fragmentation. However, overall it is assumed, as a worst case scenario and assuming that other factors do not change significantly from the current situation, that the condition of the lesser horseshoe bat feature of this SAC is unlikely to degrade significantly by Year 15 of operation, and may well improve.

Afon Gwyrfaï a Llyn Cwellyn SAC

5.4.123 Due to its distance approximately 15km to the southwest of the Scheme, the only feature of this SAC with potential to be affected is the otter. The Afon Gwyrfaï a Llyn Cwellyn SAC is known to support a high density of otters, with good quality habitat features for feeding and breeding. Although otters have been recorded within the corridor of the Scheme, and it is possible that occasionally otters might disperse from the SAC to habitat within the corridor of the Scheme, it is unlikely that otters using the habitat in the vicinity of the Scheme form part of the otter population of the SAC. The Afon Gwyrfaï a Llyn Cwellyn SAC can therefore be scoped out of the assessment, with otters being considered separately as an Important Ecological Feature.

Coedydd Derw a Safleoedd Ystumod Meirion SAC

Construction

5.4.124 Due to its distance approximately 17km to the south of the Scheme, the only feature of this SAC with potential to be affected is the lesser horseshoe bat, as a highly mobile species feature.

5.4.125 Although lesser horseshoe bats have been recorded within the corridor of the Scheme, with the distance, abundance of good foraging habitat in closer proximity to the SAC and mountains of northern Snowdonia acting as a natural topographical barrier in between, it is unlikely that a significant proportion of the local lesser horseshoe population would be connected with the SAC population. However, due to the large range of the species, it is possible that a small number of the bats recorded within the corridor of the Scheme could have links with the SAC, such as utilisation of maternity or hibernation roosts within the site.

5.4.126 The Conservation Status of the lesser horseshoe bat feature of this SAC is described as Favourable in the 2008 CMP for the site. For the purposes of this assessment, it is assumed that this condition remains in a similar state at the current time and also at the likely time of construction of the Scheme.

5.4.127 The Conservation Objective for the lesser horseshoe bat feature of the SAC is to maintain the species at Favourable Conservation Status where all of the following conditions are satisfied:

- The population of lesser horseshoe bats should be maintained at its current size and encouraged where possible to increase. As there has been an upward trend in lesser

horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase.

- There are sufficient breeding roosts (buildings, structures and trees) and hibernation roosts (mines and buildings) of appropriate quality. The other types of roost such as night, transitional, leks and swarming sites, should also be maintained as our knowledge of these often significant roosts improves.
- Foraging or feeding habitat in the SAC and surrounding countryside, including grasslands and some gardens, is of appropriate quality, extent and connectivity across the range.
- The range of the population within the SAC/Gwynedd is stable or increasing.
- All factors affecting the achievement of these conditions are under control.

Operation (Year 15)

5.4.128 The management requirements identified in the 2008 CMP for the site include two relating to the maintenance and prevention of disturbance of the roosts and two relating to flight lines and road developments are as follows:

- There should be no loss or decline in the quality of physical features used as flight lines. There should be no clearance of vegetation, trees or shrubs right by the roost without assessment of likely impact. New planting of hedgerows/rows of trees could be considered in places where few other flight lines exist.
- Maintain closed canopy crossings over roads with connectivity to hedges and tree lines to foraging sites and roosts. Lighting should be avoided.

5.4.129 Taking into account the general trends and predictions for the lesser horseshoe bat population identified in paragraph 5.4.122 above and assuming that NRW will work to attain the management requirements from the CMP as identified above, it is assumed that the condition of the lesser horseshoe bat feature of this SAC is unlikely to degrade significantly by Year 15 of operation, and may well improve.

Glynllifon SAC

Construction

5.4.130 Due to its distance approximately 19km to the southwest of the Scheme, the feature of this SAC with potential to be significantly affected by the Scheme is the lesser horseshoe bat, as a highly mobile species feature and the only feature of the SAC.

5.4.131 As with the other two SACs with lesser horseshoe bat as a feature identified above, due to the distance and topographical barriers between this SAC and the Scheme, it is unlikely that a significant proportion of the local lesser horseshoe population would be connected with the SAC population. However, due to the large range of the species, it is possible that a small number of the bats recorded within the corridor of the Scheme could have links with the SAC, such as utilisation of maternity or hibernation roosts within the site.

5.4.132 The Conservation Status of the lesser horseshoe bat feature of this SAC is described as Unfavourable in the 2008 CMP for the site, based on suboptimal summer roost counts at two of the roosts in 2007 and a lack of entrance grilles to secure one of the hibernation roosts. For the purposes of this assessment, it is assumed that this condition remains in a similar state at the current time and also at the likely time of construction of the Scheme.

5.4.133 The Conservation Objectives (Vision) for the lesser horseshoe bat feature of Glynllifon SAC are as follows:

- The natural range of lesser horseshoe bats will not be reduced, nor be likely to be reduced for the foreseeable future.

- There is, and will continue to be, sufficient habitat to maintain the lesser horseshoe bat population on a long-term basis.
- The following three maternity roosts will continue to be occupied annually by lesser horseshoe bats and their babies:
 - Glynllifon Mansion (Unit 16)
 - Melin y Cim (Unit 32)
 - Pen y Bont (Unit 36)
- There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved and coniferous woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.
- All factors affecting the achievement of these conditions are under control.

Operation (Year 15)

5.4.134 The management requirements for this SAC, as identified in the 2008 CMP include active management of the three buildings housing maternity roosts, installation of security grilles and monitoring of hibernation roosts, flight path maintenance within and outside the SAC, annual monitoring of the lesser horseshoe bat population, and extension of the SAC to include other nearby roosts with populations likely to be linked to the SAC.

5.4.135 Taking into account the general trends and predictions for the lesser horseshoe bat population identified in paragraph 5.4.122 above and assuming that NRW will work to attain the management requirements from the CMP as identified above, it is assumed that the condition of the lesser horseshoe bat feature of this SAC is unlikely to degrade significantly by Year 15 of operation and may well improve.

Nationally Designated Sites

5.4.136 Nationally protected sites considered to potentially fall within the Zone of Influence of the Scheme include all those within 2km of the proposed scheme footprint. These sites are summarised in Table 5.4.5 below and shown on Figure 5.4.3, Volume 1a. These sites are all of importance at a **national** (UK) level.

Table 5.4.5: Nationally Designated Sites within 2km of the Scheme

Site	Distance	Qualifying Features
Traeth Lafan SSSI	410m to north	Eel grass; Moderately exposed sand; Rock pools; Oystercatcher; Curlew; Redshank; Red-breasted merganser; Great crested grebe; Running water; Saltmarsh
Coedydd Aber NNR	635m to southeast	Old sessile oak woodland; Alluvial forests; Wet woodland; Upland oak woodland; Upland ash woodland; Bark-dwelling lichens; Woodland breeding birds; A number of geological features
Coedydd Aber SSSI	635m to southeast	Wet woodland; Upland oak woodland; Upland ash woodland;

		Bark-dwelling lichens; Woodland breeding birds; A number of geological features
Eryri SSSI	1.2km to south	Lichen, bryophyte and montane heath; Dry dwarf shrub heath; Wet heath; Blanket bog; Flush and spring (soligenous mire); Calcareous grassland; Upland species-rich ledges; Tall herb and fern; Vegetated scree and boulders; Inland cliffs and rock exposures and crevice vegetation; Broad-leaved woodland; Oligotrophic standing water; Snowdon lily; A number of rare plant species and assemblages, including lichens, bryophytes, charophytes, pteridophytes and flowering plants; Chough; Upland moorland and grassland breeding bird assemblage; Rainbow leaf beetle; Montane invertebrate assemblage; Salmon; A number of geological features

Traeth Lafan SSSI

Construction

5.4.137 According to the citation for this site, Traeth Lafan SSSI is a large intertidal area containing a range of habitats from sands exposed to waves and tidal currents at the seaward edge to sheltered sands and mudflats. Freshwater streams flowing through the area add to the diversity. Dwarf eelgrass *Zostera noltii* occurs near Aber. The abundant invertebrate fauna of species such as *Cyathura* and *Scrobicularia* attracts large flocks of birds. For wintering waders this is the third most important ground in Wales, with an annual peak of 10,000-14,000 waders of ten species. In addition, there are up to 1,500 wintering duck. The sands are of national importance for their assemblies of moulting great-crested grebes and red-breasted mergansers, and are regionally important for shelduck.

5.4.138 Of the features for which the site has been designated (see Table 5.4.5 above), some are considered as part of the Y Fenai a Bae Conwy SAC or Traeth Lafan SPA and are therefore not considered again here, but the following will need assessment as features of the SSSI not assessed elsewhere:

- Redshank;
- Red-breasted merganser;
- Running water, and;
- Saltmarsh.

5.4.139 Of these four features, within the Zone of Influence of the Scheme, running water can be found at each of the confluences of the watercourses flowing through the scheme corridor with the site and a small area of saltmarsh is located in the vicinity of the most easterly of these confluences. The redshank is an overwintering migratory wader that can be found along the shoreline and red-breasted merganser are also present at the site during the winter as well as potentially breeding along the shoreline of the Menai Straits but not further inland.

Operation (Year 15)

- 5.4.140 The actions proposed to deal with the issues identified in the Core Management Plan for Traeth Lafan SPA described in paragraph 5.4.101 above will also help to conserve the features of the SSSI. The UK and European redshank population has been decreasing for the last few decades but due to its large size is of least conservation concern according to Birdlife International and amber status in the UK according to Birds of Conservation Concern (BoCC) criteria (BoCC 4, British Birds, 2015). This decline is thought to be due to changes in agricultural practices including drainage of grassland areas and overgrazing of saltmarshes. Between the 1950s and 1980s there was an increase in the population of red-breasted mergansers in Britain, although the population may have stabilised since then (JNCC), and the European and global population currently remains stable (Birdlife International). The red-breasted merganser has been assigned green status on the BoCC 4 list. It is suggested that climate change could have a detrimental impact on redshank and other wetland birds due to inundation and erosion of saltmarsh habitat, while moors and wet grassland could dry up during hot summers (RSPB).
- 5.4.141 Taking into account the trends and predictions identified above, it is possible that by 2035 there could be a slight decrease in the conservation status of saltmarsh and redshank, with red-breasted merganser and running water unlikely to change significantly from their current condition.

Coedydd Aber SSSI

- 5.4.142 According to the citation, Coedydd Aber is of interest for its botanical and ornithological interest. The site supports a mosaic of native broad-leaved woodland types of international importance including alluvial forests of alder and ash and old sessile oak woods. The epiphytic lichen communities that the woodland communities support are also of national importance. The site also supports a breeding bird assemblage which is of special interest and which is associated with the woodland habitats and their fringes. Geologically, Coedydd Aber is underlain by Cambro-Ordovician sediments and igneous intrusions. Geomorphological features include Aber Falls, glacial moraines, river terraces and scree slopes.
- 5.4.143 There are no fluvial pathways connecting the site to the Scheme, and it is considered that due to the distance (635m) from the proposed works and the scale and nature of the activities proposed, it is very unlikely that there would be any impact from air pollution (on lichen communities) or noise (on breeding birds for example). The loss of hedgerows that could be used as foraging habitat by the breeding bird assemblage of the site is unlikely to constitute a significant loss due to the abundance of similar or better habitat in the area. During operation, the Scheme is not expected to cause any significant changes in air quality (see Chapter 5.1: Air Quality) as it not likely to create any significant changes in traffic flow or volume. It is therefore considered that this site is unlikely to be significantly affected by the Scheme and can be scoped out of further assessment.

Coedydd Aber NNR

- 5.4.144 National Nature Reserves are all legally protected as SSSIs and sometimes SACs as well (as in this case), so the features of Coedydd Aber NNR are the same as those described above for Coedydd Aber SSSI and Coedydd Aber SAC. Therefore, there is unlikely to be a significant effect on Coedydd Aber NNR due to the reasons described for the SSSI and SAC and it can be scoped out of further assessment.

Eryri SSSI

- 5.4.145 This site has been selected for its features of geological, geomorphological and biological interest. The biological features of interest include upland habitats, vascular and lower plant species and assemblages, as well as chough, an assemblage of upland moorland and grassland birds, salmon, rainbow leaf beetle and an upland invertebrate assemblage.
- 5.4.146 There are no fluvial pathways connecting the site to the Scheme, and it is considered that due to the distance (1.2km) from the proposed works and the scale and nature of the activities proposed,

it is very unlikely that there would be any impact from air pollution (on lower plant species/communities) or noise (on breeding birds for example). It is therefore considered that this site is unlikely to be significantly affected by the Scheme and can be scoped out of further assessment.

Other Sites

Traeth Lafan Local Nature Reserve (LNR)

5.4.147 Traeth Lafan LNR is located approximately 410m to the north of the Scheme (see Figure 5.4.3, Volume 1a) and the features are the same as those described above for Traeth Lafan SSSI, SPA and the associated part of Y Fenai a Bae Conwy SAC. The potential impacts discussed for those sites are therefore the same for this site which is considered to be **regionally** important.

County Wildlife Sites

5.4.148 County Wildlife Sites are sites designated by the local planning authority to highlight areas of importance and value for wildlife in a county context. They are not legally protected but form a network of non-statutory sites that often include Section 7 or LBAP habitats or species and are considered to be of **county** importance. There are 12 county wildlife sites within 1km of the Scheme, as follows (see also Figure 5.4.4, Volume 1a):

- Woodlands in Penrhyn Park 3
- Tan-y-Lon
- Glan-y-Mor Isaf Copses
- Railway Line Wood 1
- Railway Line Wood 2
- Wig Crossing
- Traeth Lafan
- Afon Aber Copse
- Coed Bryn Meddyg
- Coed Wern-Porchell
- Coed Ty'n-yr-Hendre
- Tan-y-Marian Bach.

5.4.149 Of these sites, only two, 'Railway Line Wood 2' and 'Coed Bryn Meddyg', fall partially within the footprint of the Scheme and would therefore be directly affected by the works. Railway Line Wood 1, Railway Line Wood 2, Glan-y-Mor Isaf Copses, Wig Crossing and Traeth Lafan are fluviially connected to the Scheme, but the other sites listed above would remain unaffected by the Scheme and can be scoped out of any further assessment.

Construction

5.4.150 **Railway Line Wood 2:** This site has been selected for its broad-leaved woodland habitat and has an area of 2.8ha. A small part of the site, on the northwest side of the A55(T), is within the footprint of the Scheme and would therefore be lost. This area of mature mixed woodland comprises mature, semi-mature and young trees, including beech, sycamore, silver birch, Corsican pine, ash and sessile oak. The area also contains scattered individuals of the non-native invasive plant species, *Rhododendron ponticum*, which becomes much denser further into the woodland, away from the A55(T). Stream 3 flows through this site, which lies downstream of the Scheme.

5.4.151 **Coed Bryn Meddyg:** This site has been selected for its broad-leaved woodland habitat and has an area of 1.9ha. Part of the site, to the east of the Bryn Meddyg properties, lies immediately adjacent to the footprint of the Scheme, which would fall within the root protection area of a small strip of trees at the edge of this woodland. These trees comprise semi-mature wych elm, hawthorn and sycamore and are therefore not considered to be of significant ecological importance at present,

although they will mature with time and therefore have the potential to become mature broad-leaved woodland with its associated increase in diversity and ecological importance.

5.4.152 **Railway Line Wood 1:** This site has been selected for its broad-leaved woodland habitat, has an area of 5.6ha and is located approximately 40m to the northwest of the Scheme. Streams 1 and 2 flow through this site which lies downstream of the Scheme.

5.4.153 **Glan-y-Mor Isaf Copses:** This site has been selected for its broad-leaved woodland habitat, has an area of 2.5ha and is located approximately 595m to the northwest of the Scheme. Streams 1 and 2 flow through this site which lies downstream of the Scheme.

5.4.154 **Wig Crossing:** This site has been selected for its broad-leaved woodland habitat, has an area of 1ha and is located approximately 285m to the northwest of the Scheme. Stream 5 (Afon Wig) flows through this site which lies downstream of the Scheme.

5.4.155 **Traeth Lafan:** This site has been selected for its saltmarsh habitat, has an area of 8.5ha and is located approximately 550m to the northwest of the Scheme. A stream downstream of the confluence of streams 6, 7 and 8 flows into the sea through the south-western tip of this site.

Operation (Year 15)

5.4.156 In 2035 it is not expected that the habitats at these sites would differ substantially from their existing condition, except that the broad-leaved woodland would be a bit more mature and it is possible that there could be a very slight reduction in the area of saltmarsh habitat due to sea level rise. It is also possible that the Rhododendron present within Railway Line Wood 2 could have spread to cover a larger area of the site and it is possible that there could be a decline in condition of the woodland due to increases in pests and diseases exacerbated by the direct effects of climate change on tree function (The Terrestrial Biodiversity Climate Change Impacts Report Card 2012-13, Living with Environmental Change Partnership, 2013).

Ancient Semi-Natural Woodland Sites

5.4.157 NRW provide an inventory of ancient semi-natural woodland sites, including Ancient Semi-Natural Woodland (ASNW), Plantations on Ancient Woodland Sites (PAWS) and Restored Ancient Woodland Sites. These sites are not legally protected, but form a useful frame of reference for identifying ecologically important woodland areas. They are considered to be **regionally** important. Within 1km of the Scheme there are five sites listed on this inventory, as follows (and shown on Figure 5.4.4, Volume 1a):

- ASNW 5253
- PAWS 5872
- ASNW 5242
- ASNW 5247
- ASNW 5258

5.4.158 None of these sites are located within the footprint of the Scheme with the closest, ASNW 5242, located approximately 545m to the east on the other side of Abergwyngregyn. As there are no fluvial pathways leading from the Scheme to any of these sites, and it is very unlikely that there would be any significant air quality impacts due to the distance and nature of the proposals (see Chapter 5.1: Air Quality), they can be scoped out of the assessment.

Habitats

5.4.159 According to the Phase 1 Habitat Survey undertaken in April 2016 (see Technical Appendix C, Volume 2) the habitats within the survey corridor largely comprise improved pasture, heavily grazed by sheep and cattle, bounded by species-poor hedgerows and interspersed by pockets of mature and semi-mature broad-leaved woodland. Scattered mature trees, dominated by oak, are

present within many of the hedgerow boundaries and also occasionally within the fields. Areas of bramble, hawthorn and blackthorn scrub and pockets of bracken can also be found adjacent to some of the boundaries and within the wooded areas.

Trees and Hedgerows

Construction

5.4.160 The arboricultural survey carried out in 2015 and 2016 updated and added to the current Phase 1 Habitat survey information and can be found in Technical Appendix C (Volume 2). Figure 5.4.7 (Volume 1a) shows the locations of mature trees and hedgerows in relation to the proposed scheme.

Hedgerows

5.4.161 The majority of field boundaries in the area, including boundaries with the trunk road estate, consist of mature hedgerows. Those hedges which would be directly affected along the total length of the scheme, about 4.8km in length, are generally of low diversity and interest, being composed principally of Hawthorn (*Crataegus monogyna*), with other species present such as Blackthorn (*Prunus spinosa*), Sycamore (*Acer pseudoplatanus*), Elder (*Sambucus nigra*) and Ash (*Fraxinus excelsior*). However, it is likely that all these hedgerows will be used for foraging and commuting by a range of local wildlife.

5.4.162 The most biologically diverse hedge within the scheme corridor is that running along the northern boundary of the Roman Road (Henffordd) to the south of the A55(T) and previously identified as supporting the species shown in Table 5.4.6 below. This hedge meets the criteria under the Hedgerow Regulations 1997 to be classified as an 'important' hedgerow for wildlife and landscape reasons. The hedge has also been identified as being important for archaeological and historical reasons due to its being an integral part of a field system pre-dating the enclosure acts (see Chapter 5.2). On the road side, the southern side of the hedge displays a rich mix of flora at its base. The nature of the hedge with its stone banking in parts supports several fern species associated with marshland.

Table 5.4.6: Plant species previously recorded (Ecological Design Consultants, 2006) in northern section of Roman Road (Henffordd) hedgerow (important ecologically for 7.(1)d and 7.(4)abfi; also historically important, Hedgerow Regulations 1997)

Common Name	Scientific Name
Ash	<i>Fraxinus excelsior</i>
Blackthorn	<i>Prunus spinosa</i>
Black Spleenwort	<i>Asplenium adiantum-nigrum</i>
Bramble	<i>Rubus fruticosus</i>
Broad-leaved Dock	<i>Rumex obtusifolius</i>
Bush Vetch	<i>Vicia sepium</i>
Common Mallow	<i>Malva sylvestris</i>
Common Polypody	<i>Polypodium vulgare</i>
Foxglove	<i>Digitalis purpurea</i>
Greater Stitchwort	<i>Stellaria holostea</i>
Ground Ivy	<i>Glechoma hederacea</i>
Hart's Tongue	<i>Asplenium scolopendrium</i>
Hawthorn	<i>Crataegus monogyna</i>
Hazel	<i>Corylus avellana</i>
Hedge Woundwort	<i>Stachys sylvatica</i>
Herb Robert	<i>Geranium robertianum</i>
Ivy	<i>Hedera helix</i>
Lady Fern	<i>Athyrium filix-femina</i>
Pedunculate Oak	<i>Quercus robur</i>
Pennywort	<i>Hydrocotyle vulgaris</i>

Perennial Sow-thistle	<i>Sonchus arvensis</i>
Red Campion	<i>Silene dioica</i>
Sheep's Sorrel	<i>Rumex acetosella</i>
Slender Thistle	<i>Carduus tenuiflorus</i>
Spear Thistle	<i>Cirsium vulgare</i>
Common Nettle	<i>Urtica dioica</i>
Sycamore	<i>Acer pseudoplatanus</i>
Turkey oak	<i>Quercus cerris</i>
Wild Angelica	<i>Angelica sylvestris</i>
Wild Carrot	<i>Daucus carota</i>
Wild Strawberry	<i>Fragaria vesca</i>
Yarrow	<i>Achillea millefolium</i>

5.4.163 The hedgerow on the southern side of the Roman Road is also considered to be an 'important hedgerow' under the Hedgerow Regulations (1997), although this would be retained. None of the other hedgerows within the corridor of the Scheme can be classified as 'important' under the Hedgerow Regulations.

5.4.164 A Hedgerow Removal Licence would not be required for the removal of any of the hedgerows present on site as it is part of work which would be consented under other legislation. However, as good practice, appropriate mitigation measures will be incorporated where 'important' hedgerows would be affected by the Scheme (see also Chapter 5.2: Cultural Heritage).

5.4.165 Hedgerows are a Section 7 priority habitat under the Environment (Wales) Act 2016 and are also listed on Gwynedd LBAP and the TREBAP (under Boundary Features). The TREBAP includes the following objectives in order to conserve and enhance boundary features of conservation value wherever possible:

- Ensure that impacts of new developments on boundary features, particularly those which are considered 'ancient' or 'important', are avoided wherever possible;
- Mitigate against unavoidable impacts to boundary features;
- Document the current distribution of boundary features within the soft estate so as to develop targeted management plans; and
- Raise awareness of those involved in design, construction and maintenance processes of the ecological importance of boundary features of all types, and provide detailed advice to management contractors.

Trees

5.4.166 The 2015 and 2016 arboricultural surveys mapped the distribution of trees within and close to the scheme boundary and provided a detailed description of them. To the north of the A55(T), mature trees (predominantly broad-leaved) are located sporadically in hedges and the adjacent fields within the proposed scheme corridor. These include two mature trees (sessile oak and ash) within hedgerows along the northern edge of the A55(T), along with another seven within adjacent fields to the north. There are also three mature trees including two horse chestnuts and a sycamore within Wig Farm garden and several areas of woodland adjacent to the A55(T), including an area within the county wildlife site 'Railway Line Wood 2'. The edge of 'Railway Line Wood 2' closest to the highway includes a few mature trees including a beech, silver birch, alder and a number of beech trees forming part of an approximately 100 year old beech hedgerow.

5.4.167 To the south of the A55(T), there are also a few areas of mature broad-leaved trees, including oak, alder, hawthorn, sycamore and goat willow bordering watercourses culverted under the A55(T) within the scheme corridor (Stream 5: Afon Wig and Stream 7, see Figure 5.10.1, Volume 1a), and a number of trees within the garden at Tai'r Meibion, including small-leaved lime, sycamore and horse chestnut.

5.4.168 The majority of mature trees with potential to be impacted by the proposed scheme to the south of the A55(T) are located in the vicinity of the proposed PMA to Wig Farm land south of the A55(T) and improvement of the Roman Road (Henffordd) in this location. These include six mature oaks located within fields that the proposed route traverses, including one noted in the 2015 arboricultural report as “*the most impressive tree within the survey area*” (tree no. 119, sheet 11, Volume 1a). This tree would however remain unaffected by the Scheme. Mature alder, hawthorn and ash border the Afon Wig (Stream 5) where it would be crossed by the proposed PMA and there are six oaks and two ash trees located within the hedgerows bordering the Roman Road (Henffordd).

5.4.169 Although it is not considered acceptable to classify veteran trees solely based on their size, due to the different growth rates and size at maturity of different tree species, according to the Veteran Trees Initiative in a report produced for Natural England (*Veteran Trees: A Guide to Good Management, The Veteran Tree Initiative, 2000*), tree species such as oak with the following diameters at breast height (DBH) should be considered as potentially interesting or valuable in terms of conservation of veteran trees:

- DBH greater than 1m = Potentially interesting
- DBH greater than 1.5m = Valuable in terms of conservation
- DBH greater than 2m = Truly ancient

5.4.170 The arboricultural survey (2015 and 2016) identified 15 mature trees with a DBH greater than 1m within the survey corridor; three of these (all sessile oaks) would be lost to the Scheme; one is located at the junction with the county road to Wig Crossing Cottages (tree no. 55, see Figure 5.4.7, sheet 4, Volume 1a) and two along Roman Road (tree no's. 139 and 142, see Figure 5.4.7, sheet 10, Volume 1a). A further five are at risk of receiving root/canopy damage due to their close proximity to the works; three are located adjacent to the proposed agricultural PMA track to Wig farm (tree no's. 119, 120, 123, see Figure 5.4.7, sheet 11, Volume 1a) and two are along the Roman Road (tree no's. 136 and 140, see Figure 5.7.4, sheet 10, Volume 1a). There are none present with a DBH greater than 1.5m, or any smaller tree species (such as hawthorn) considered as having veteran potential.

Importance of the Trees and Hedgerows

5.4.171 The young to early mature trees within the corridor of the Scheme are of value on a **local** scale, providing habitat for a range of other species, and having the potential to develop into mature trees or woodland with time. The hedgerows provide habitat connectivity and also habitat for other species including birds, mammals, reptiles, amphibians, invertebrates, plants and fungi and as hedgerows are a Gwynedd LBAP habitat; it is therefore considered that they are of value at a **county** level. The older trees within the corridor of the Scheme (*e.g.* Oaks with DBH greater than 1m) are considered to be of importance on a **county** level for their potential to become veteran trees with time, another habitat listed on the Gwynedd LBAP. The TREBAP also includes native trees and shrubs. It is therefore considered that overall the trees and hedgerows within the vicinity of the Scheme are of importance on a **county** level.

Operation (Year 15)

5.4.172 With increased maturity, by 2035 the trees and hedgerows within the corridor of the Scheme are likely to have increased slightly in ecological value. Although some of them may have succumbed to pests and diseases, which are likely to increase due to climate change (The Terrestrial Biodiversity Climate Change Impacts Report Card 2012-13, Living with Environmental Change Partnership, 2013), this could initially increase their value for biodiversity before they eventually fall and decompose. However, it is considered that they would still be of importance at a **county** level.

Lowland Mixed Deciduous Woodland

Construction

- 5.4.173 Pockets of mature and semi-mature broadleaved and mixed woodland, dominated by ash, sycamore and sessile and pedunculate oak providing suitable habitat for badgers and a variety of breeding birds and bat species, are present throughout the survey area to both the north and south of the A55(T), generally with sparse understoreys and in some cases dominated by *Rhododendron ponticum* (a WCA Schedule 9 invasive plant species).
- 5.4.174 The main pockets that are likely to be directly affected by the Scheme are located to the north of the A55(T), including the County Wildlife Site 'Railway Line Wood 2' as discussed above in paragraph 5.4.150 and a wooded area within the highway verge immediately adjacent to this. Two more wooded areas likely to be directly affected are adjacent to stream 6 to the north of the A55(T) and Coed Bryn Meddyg (also a County Wildlife Site, as discussed above in paragraph 5.4.151), adjacent to the Bryn Meddyg properties to the south.
- 5.4.175 The strip of mixed woodland adjacent to stream 6 to the north of the A55(T) extends from the A55(T) to the railway line to the north and the small area that would be lost to the Scheme is composed of semi-mature oak, ash, Norway maple, wych elm and hawthorn.
- 5.4.176 Another small area of mixed woodland would be affected due to the installation of an artificial badger sett required as mitigation for badgers as part of the Scheme (see paragraph 5.4.422 in the Mitigation section of this chapter). The woodland identified for this purpose is composed of semi-mature trees, including wych elm, elder, sycamore, ash, hawthorn, blackthorn, holly, crab apple and Scots pine, although only a small proportion of this area would be affected.
- 5.4.177 Lowland mixed deciduous woodland is listed under Section 7 of the Environment (Wales) Act and woodland is also listed on the TREBAP, so it is considered to be of importance at a **county** level. The objectives of the TREBAP Action Plan for woodlands are as follows:
- Identify the presence of UKBAP woodland habitats within the network;
 - Avoid the further loss of woodland habitats along road verges;
 - Mitigate against the unavoidable loss of woodland habitat;
 - Maintain and enhance the existing woodland within the soft estate;
 - Maximise biodiversity within woodlands; and
 - Conserve existing roadside trees, shrubs and their associated habitat, where this does not conflict with road safety, or other ecological factors such as other biodiversity species requirements, or where there is a statutory requirement to maintain trees in a certain way.

Operation (Year 15)

- 5.4.178 It is unlikely that the woodland within the corridor of the Scheme would have changed significantly by 2035, other than to become slightly more mature and possibly to include a greater area of the invasive *Rhododendron ponticum* within Railway Line Wood 2, as there is no plan to manage this species at present. Overall, it is considered that the resource would remain important at a **county** level.

Rivers and Streams

Construction

- 5.4.179 Ten water features flow north through the area of the Scheme, which are all currently culverted underneath the A55(T) (see Figure 2.1, Volume 1a). These include the Afon Wig (Stream 5), a main river to the north of the A55(T), seven un-named ordinary watercourses and two field drainage features (between Stream 5 and Stream 6). Water quality samples collected in 2015 for Chapter 5.10 (Road Drainage and the Water Environment) indicated that the water quality of the streams within the Scheme area was of 'good' status. These were tested for pH, conductivity, chloride,

solids, turbidity, zinc, hydrocarbons and oil. The presence of hydrocarbons within the waters was below the toxicity threshold and therefore it has been assumed that the current level of pollution to the streams is not considered significant. Each watercourse has also been classified by NRW according to the Water Framework Directive, with a rating of its ecological composition. There are five possible ecological classes (high, good, moderate, poor or bad) and these have been included below in the descriptions of each watercourse. See also Chapter 5.10: Road Drainage and the Water Environment.

- 5.4.180 Stream 1, located at the western end of the Scheme (see Figures 5.10.1 and 7.2, Volume 1a), emerges from a long culvert (approximately 280m) extending north from south of Ty'n yr Hendre farm, under the A55(T) Tal-y-Bont interchange (Junction 12) before flowing north in a deeply eroded cut formed by flash floods. This watercourse forms the boundary between improved fields grazed by cattle and/or sheep and is fenced on both sides and bordered by scrub. Approximately 0.5m wide, very shallow and fast-flowing, with a gravel bed, this stream contains very little aquatic, emergent or marginal vegetation other than bramble making it extremely shaded. The banks ease as the stream enters the woodland adjacent to the railway embankment. This stream has been classed as 'moderate' ecologically under the Water Framework Directive. The length of the existing culvert for stream 1 underneath the A55(T) (approximately 280m) is considered to make it unsuitable for use by mammals or fish.
- 5.4.181 Stream 2 (see Figures 5.10.1 and 7.2, Volume 1a) runs north from the A55(T) along the side of a hedgerow before turning to the west to skirt a block of woodland before entering it to the north and crossing underneath the railway. The stream is narrow and shallow with little marginal vegetation, being overshadowed by bramble. This stream has been classed as 'moderate' ecologically under the Water Framework Directive. The existing culvert for stream 2 as it flows underneath the A55(T) is currently only 55m long and is considered to have some potential for fish to pass through at periods of higher flow and also mammals at periods of low flow but would be unsuitable for these species during other conditions.
- 5.4.182 Stream 3 (see Figures 5.10.1 and 7.3, Volume 1a) emerges on the northern side of the A55(T) from an unknown, covered source to the south (assumed to be via a long culvert, approximately 540m long, from near the Gilfach property) and flows through the block of woodland constituting the County Wildlife Site, Railway Line Wood 2. The stream runs through this woodland, overshadowed by Rhododendron for most of its length before entering a ditch parallel to the railway line. Approximately 0.25m wide, very shallow and slow-flowing with a silt and mud bed, this stream contains very little aquatic or emergent vegetation. This stream is unlikely to be used by wildlife south of its outfall north of the A55(T) due to the long culverted section between here and the Gilfach property; a distance of approximately 540m. A dry road drainage culvert and headwall is present on the south side of the road but no evidence of protected species has been recorded at this location and the distance from the stream 3 outfall on the northern side of the road to the headwall located on the south side is approximately 81m. It is therefore considered unlikely that animals use this culvert due its distance under the road. This stream has been classed as 'moderate' ecologically under the Water Framework Directive. The length of the existing culvert for stream 3 underneath the A55(T) (approximately 540m) is considered to make it unsuitable for use by mammals or fish.
- 5.4.183 Stream 4 (see Figures 5.10.1 and 7.3, Volume 1a) is completely culverted/piped throughout the study area and to the south as far as the Roman Road (Henffordd), only emerging briefly approximately 170m north of the A55(T) and flowing north before emerging again just before the railway line. Approximately 0.5m wide, fast flowing and with a rocky bed, this stream contains very little aquatic or emergent vegetation and is not considered likely to be used by wildlife to cross the A55(T) due to the extensive piped/culverted section. This stream has been classed as 'moderate' ecologically under the Water Framework Directive. Stream 4 is culverted/piped for approximately

650m, including the section beneath the A55(T) and it is therefore considered to be unsuitable for use by mammals or fish.

- 5.4.184 Stream 5, the Afon Wig, (see Figures 5.10.1 and 7.4, Volume 1a) flows from Crymlyn Farm to the south, bordered by mature trees dominated by alder, before running through the County Wildlife Site, Coed Wern-Porchell, where the stream banks are open and grassy with patches of bluebell. On leaving the woodland, the stream is again bordered by mature trees before being culverted underneath the A55(T). On emergence from the culvert to the north of the A55(T), the stream appears like Stream 1 to have been eroded by flash floods, leaving steep cut sides. To the north it flows through improved pasture bordered by scattered mature broad-leaved trees before being culverted underneath the railway. The stream contains very little aquatic, emergent or marginal vegetation. This stream has been classed as 'moderate' ecologically under the Water Framework Directive. There are steep steps descending into the existing culvert on the upstream side, making it unsuitable for use by fish and also by most mammals, except perhaps during periods of very low flow, although the grilles present at the mouth would prevent larger animals.
- 5.4.185 Stream 6 (see Figures 5.10.1 and 7.5, Volume 1a) is small, flowing north through improved pasture before being culverted underneath the A55(T) and entering a small strip of woodland at the site of Wig Bach to the north. Approximately 0.5m wide, shallow and fast-flowing with a silty and rocky bed, there is very little aquatic, emergent or marginal vegetation. This stream has been classed as 'good' ecologically under the Water Framework Directive. The culvert for this watercourse is similar to that for stream 5 with steep steps and grilles to the south, making it unsuitable for fish and most mammals.
- 5.4.186 Stream 7 (see Figures 5.10.1 and 7.5, Volume 1a) flows north to the A55(T) through the woodland within the Coed Bryn Meddyg County Wildlife Site, where it is fenced on both sides. The stream is conveyed underground north of the A55(T) for approximately 300m and is therefore not considered likely to be used by wildlife along this section. Approximately 0.5m wide, shallow and fast-flowing with a gravel, rock and silt bed, this stream contains very little aquatic, emergent or marginal vegetation and is culverted underneath and to the north of the A55(T). This stream has been classed as 'good' ecologically under the Water Framework Directive. Due to the length of this culvert, as well as the presence of steep steps and grilles to the south, it is considered unsuitable for use by fish and mammals.
- 5.4.187 Stream 8 (see Figures 5.10.1 and 7.6, Volume 1a) is a small field ditch assumed to originate from highway drainage that outfalls on the northern side of the A55(T), and is therefore not likely to be used by wildlife south of this point. It then runs north through improved cattle-grazed pasture to the railway line. Bordered by a hedgerow to the east, it is approximately 0.25m wide, very shallow and slow-flowing with a steeply cut channel approximately 1.75m deep with a mud and rock bed. There is very little aquatic, emergent or marginal vegetation. This stream has been classed as 'good' ecologically under the Water Framework Directive. As this is a small road drain that does not seem to extend to the south of the A55(T) at all, it is of no use for wildlife as a crossing point.
- 5.4.188 Rivers and streams are listed on the TREBAP and rivers are a Section 7 habitat of principal importance in Wales (Environment (Wales) Act) so they are considered to be of importance at a **county** level. The TREBAP objectives for rivers and streams are:
- To minimise the impacts of the road network on rivers and streams for road development (loss and disturbance through new schemes and through maintenance) and;
 - To ensure the quality of rivers and streams, and riparian bank-side habitat, is maintained both as habitat in its own right, and as wildlife corridors.

Operation (Year 15)

- 5.4.189 It is not considered likely that the rivers and streams within the corridor of the Scheme would have changed significantly by 2035 apart from further erosion causing a slight deterioration of habitat

quality, although this could be exacerbated by an increase in flash flooding due to climate change. It is also possible that there could be a lower volume of flow during the summer months due to an increased frequency and magnitude of droughts (The Climate Change Risk Assessment for Wales, Welsh Government and DEFRA, 2012). Therefore, the baseline conditions at operation are assumed to be the same as those at construction or possibly slightly reduced in their ecological value.

Species

5.4.190 Detailed results of species surveys undertaken for the Scheme can be found in Technical Appendix C, Volume 2.

Bats

Construction

5.4.191 No bat roosts were recorded during the 2002 surveys to identify tree roosts adjacent to the A55(T) within the proposed scheme corridor. There was also no activity recorded within the cattle underpasses at Tai'r Meibion and Wig Farm at this time.

5.4.192 The protected species surveys in 2005, 2006 and 2007 identified bat roosting potential within all of the properties and some of the mature trees to the south of the A55(T) where the proposed Wig Farm PMA would cut across fields to join the Roman Road (Henffordd), as well as identifying that the area has sufficient suitable foraging and commuting habitat to support small breeding populations of bats.

5.4.193 Bat transect surveys undertaken in 2008 and 2011 identified the following bat species foraging over habitat adjacent to the A55(T) within the proposed scheme corridor:

- Pipistrelle species
- Brown long-eared
- Myotis species
- Noctule
- Serotine.

5.4.194 The Local Biological Records Centre (Cofnod) provided historic records of the following bat species roosting within 2km of the proposed scheme:

- Pipistrelle species (Greenall Whitley Brewery - Abergwyngregyn)
- Whiskered (Bronant - Abergwyngregyn)
- Brown long-eared (maternity roost in St Bodfan's Church - Abergwyngregyn)
- Lesser horseshoe (Penrhyn Castle – Bangor; Pen y Bryn - Abergwyngregyn)
- Unknown species (Nant y Felin – Abergwyngregyn)

5.4.195 The bat activity transect surveys undertaken in 2015 recorded common and soprano pipistrelle, whiskered/Brandt's, noctule and, notably, serotine bats foraging along the proposed scheme corridor adjacent to the A55 carriageway (predominantly the north side), but only larger bat species such as noctule/serotine were observed crossing the carriageway, which they did at high levels avoiding any contact with traffic. This was consistent with previous survey data, although pipistrelles have also occasionally been recorded crossing the carriageway in the past. Both common and soprano pipistrelles and whiskered bats were recorded foraging along the Roman Road (Henffordd), above the road between the two hedges, and common pipistrelle activity was also recorded around Tai'r Meibion, including by the entrance to the cattle underpass. Where the proposed Wig Farm PMA leaves Roman Road (Henffordd) and crosses the fields between here and the A55 carriageway, pipistrelles were recorded foraging over the stream bed and a noctule flying overhead. It was noted that the large mature oaks in this area provide potential habitat for roosting bats. Results of these bat activity surveys are shown on Figure 5.4.6, Volume 1a.

5.4.196 Significant activity was recorded by static detectors at the underpasses at both Wig Farm and particularly at Tai'r Meibion in May – September 2015, with passes including common and soprano pipistrelle, noctule, a Myotis species and a lesser horseshoe recorded from the Wig underpass and common and soprano pipistrelle, a Myotis species and a serotine recorded from the Tai'r Meibion underpass (see Figure 5.4.6, Volume 1a). Most activity was recorded at Wig underpass during the September survey and the Tai'r Meibion underpass recorded the most activity during the July survey (mostly common pipistrelle). It is thought that the noctule and serotine records, as larger, higher flying species, are likely to have been distant passes by individuals flying outside of the underpass. As the lesser horseshoe bat pass was recorded during the September survey and this species had not been recorded previously during any surveys for the scheme, it was recommended that further monitoring of the underpasses was undertaken during the autumn months, to establish whether lesser horseshoe bats could be using the underpasses to commute between roosts in the autumn.

5.4.197 Following liaison with NRW, further static monitoring of the underpasses was therefore undertaken over a four-week period of constant monitoring between 12th October and 10th November 2015. Significant numbers of bats were recorded by the static detectors during this monitoring, as shown below (average passes per week):

Species	Tai'r Meibion	Wig
Lesser horseshoe	4	3
Myotis species	98	10
Common pipistrelle	90	0
Soprano pipistrelle	13	2
Brown long-eared	3	0
Noctule	8	10

All of the above species were recorded within the Tai'r Meibion underpass, which recorded the greater number of passes by far, while the Wig underpass detector recorded all of the species except common pipistrelle and brown long-eared. The data indicated that the bats were both foraging and commuting through the underpasses.

5.4.198 Table 5.4.7 below contains the results of the additional underpass surveys undertaken in May, July and September 2016, using both manual surveyors with heterodyne detectors and static recording detectors (summarised in Figure 5.4.6, Volume 1a).

Table 5.4.7: Number of bat passes and bats passing through the underpasses at Tai'r Meibion and Wig during the 2016 monitoring in May, July and September

Survey Date and Conditions	Bat Species	Tai'r Meibion Underpass		Wig Underpass	
		Manual data (no. of bats passing through)	Static data (no. of bat passes)	Manual data (no. of bats passing through)	Static data (no. of bat passes)
31.05.2016 Dusk (15mins before sunset until 1 – 1.5hrs after sunset) Max temp: 12.9°C Min temp: 11.2°C	Lesser horseshoe	0	0	0	0
	Myotis species	1	7	7	27
	Common pipistrelle	9	10	2	25
	Soprano pipistrelle	2	0	1	8
	Brown long-eared	1	1	0	0
	Noctule	0	0	0	2
05.07.2016 Dusk (15mins before sunset until 1 – 1.5hrs after sunset) Max temp: 12.2°C	Lesser horseshoe	0	0	0	0
	Myotis species	2	3	0	0
	Common pipistrelle	6	9	2	2
	Soprano pipistrelle	4	4	0	0
	Brown long-eared	1	0	0	0
	Noctule	0	0	0	0

Min temp: 6.5°C					
22.09.2016 Dawn (2hrs before sunrise until sunrise)	Lesser horseshoe	0	0	0	0
	Myotis species	2	9	0	0
	Common pipistrelle	9	11	0	0
	Soprano pipistrelle	3	1	0	0
Max temp: 13.7°C Min temp: 11.9°C	Brown long-eared	0	0	0	0
	Noctule	0	0	0	0
22.09.2016 Dusk (15mins before sunset until 1 – 1.5hrs after sunset)	Lesser horseshoe	0	0	0	0
	Myotis species	6	2	0	0
	Common pipistrelle	11	4	0	1
	Soprano pipistrelle	4	3	0	0
Max temp: 13.1°C Min temp: 12.9°C	Brown long-eared	0	0	0	0
	Noctule	0	1	0	0

5.4.199 Static monitoring of the underpasses was also undertaken between 7th and 14th October 2016 and this obtained the following results (bat passes per week):

Species	Tai'r Meibion	Wig
Lesser horseshoe	25	10
Myotis species	115	14
Common pipistrelle	173	1
Soprano pipistrelle	10	1
Brown long-eared	9	0
Noctule	5	7

5.4.200 The data obtained from the static detectors is an indication of bat presence and, to some extent, type of behaviour rather than bat numbers, whereas the manual surveys at dusk and dawn in 2016 provide more accurate numbers of bats passing through the underpasses. Therefore, the autumn 2015 and 2016 (static detector) results indicate more bat activity at the Tai'r Meibion underpass than the Wig underpass, mainly due to a fairly high level of activity by common pipistrelle and Myotis species bats at the Tai'r Meibion underpass. A fairly low level of lesser horseshoe, soprano pipistrelle and noctule activity was recorded at both underpasses in 2015 and occasional brown long-eared activity at Tai'r Meibion only. The October 2016 static data obtained records of the same species using the underpasses as in October-November 2015, although with significantly higher numbers of passes of lesser horseshoe in both underpasses and common pipistrelle and brown long-eared bats within the Tai'r Meibion underpass. This could be due to better weather conditions during the October 2016 recording period.

5.4.201 The 2016 manual surveys give a better indication of numbers of bats commuting through the underpasses, as shown by the bold figures in Table 5.4.7 above. No lesser horseshoes were recorded during these surveys but the results indicate that the underpasses are definitely used as a safe commuting route for bats to cross underneath the A55(T), with Myotis species, common pipistrelle and soprano pipistrelle observed commuting through both underpasses and brown long-eared seen passing through the Tai'r Meibion underpass on two occasions. These results seem to confirm the higher level of use of the Tai'r Meibion underpass than the Wig underpass over the whole season, particularly in September when no activity was observed manually during the surveys at Wig. They also confirm a high level of use by common pipistrelle, which is likely to be due in part to a common pipistrelle roost within the house at Tai'r Meibion, adjacent to this underpass (see below). As well as commuting straight through the underpasses, some bats were observed to be foraging within them, sometimes resulting in a high number of passes per bat as seen in the May results for Wig in Table 5.4.7 above, with Myotis and common and soprano pipistrelle bats.

- 5.4.202 The records of lesser horseshoe bats within the underpasses during the static monitoring in the autumn, but not during the manual dusk or dawn surveys in May, July or September, could be due to the tendency for lesser horseshoes to emerge from the roost later therefore missing the manual survey periods when light levels were high enough to observe bat activity. However, it could also be an indication that lesser horseshoe bats may be using the underpasses as a safe migratory route in the autumn between summer/autumn and winter roost sites.
- 5.4.203 During the emergence surveys undertaken in 2015, a small roost of approximately ten common pipistrelles was recorded at Tai'r Meibion in September 2015, which was considered to be a non-breeding roost. No bats were recorded emerging from Wig Farm or Wig Crossing Cottages.
- 5.4.204 All bats are European protected species under the Habitats Directive and are also protected under the Wildlife and Countryside Act 1981 (as amended). Lesser horseshoe, common pipistrelle and soprano pipistrelle bats are UKBAP, Gwynedd LBAP and Section 7 priority species, and noctule and brown long-eared bats are also Section 7 priority species.
- 5.4.205 The current Conservation Status of lesser horseshoe bats in the UK is considered to be Favourable⁹¹ in terms of range, habitat and future prospects although it has suffered widespread population declines in Europe as a whole, especially in the more northern parts of its range. The UK currently supports one of the largest populations of this species in western Europe and recent monitoring suggests that populations are increasing, particularly in Wales, with increased densities in wooded areas. The Conservation Status of pipistrelles, natterer's and brown long-eared bats in the UK is also considered to be Favourable⁵ in terms of range, population and future prospects, but the Conservation Status of serotine and noctule bats is Unknown⁵, as although their range and population are noted as being favourable, their future prospects are unknown due to the quality of population monitoring data for these species.
- 5.4.206 There is a Species Action Plan for bats in the TREBAP, which includes the following objectives in order to enhance the conservation of bats during scheme design, construction and maintenance operations:
- Undertake maintenance operations at the most appropriate time of year, after relevant surveys have been completed;
 - Avoid the loss of roosts, foraging areas and linear corridors during road construction and widening schemes;
 - Identify opportunities for enhancement of habitats for bats during design, construction and maintenance;
 - Avoid road mortality to bats.
- 5.4.207 Over the scheme as a whole, relatively low levels of bat foraging and commuting activity have been recorded, although activity has been most prevalent in the vicinity of Roman Road (Henffordd) and proposed Wig Farm PMA to the south of the A55(T) and at the two cattle underpasses at Wig and Tai'r Meibion, which a number of species, including lesser horseshoes, are using for commuting and/or foraging. A small non-breeding common pipistrelle roost has been identified very close to the proposed scheme at Tai'r Meibion to the south of the A55(T). The majority of bat species recorded have been of local importance only but during the 2011 and 2015 surveys, there were records of serotine and lesser horseshoe bats, which are less common species, and at the northern limit of their range in the UK. For these reasons and the potential for impacts arising from works affecting the underpasses in particular, it is considered that the bat population in the vicinity of the proposed scheme is of importance at a **regional** level.

⁹¹ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012. JNCC, produced on 11/10/2013

Operation (Year 15)

5.4.208 The TREBAP Action Plan for bats described in paragraph 5.4.206 above includes the following relevant actions:

- Include bats at the earliest stages of road design, construction and maintenance in order to ensure the early identification (and appropriate management) of sites valuable as roosts, foraging areas and linear corridors;
- Avoid the indirect impacts of water-based pollution on valuable feeding areas by using and maintaining appropriate road run-off control and treatment measures;
- Consider options for mitigation and enhancement in all road construction and maintenance operations (*e.g.* bat tunnels, habitat enhancements and hibernacula)
- Increase opportunities for roosting bats in areas of woodland within the highway boundary (which are otherwise suitable for use by foraging bats) by adding artificial roosts.

5.4.209 The latest data from the Bat Conservation Trust (BCT) indicate that lesser horseshoe, common and soprano pipistrelle and natterer's bats are increasing in population in Britain, with lesser horseshoe and natterer's also thought to be increasing in Wales (insufficient data to confirm this for pipistrelles). Brown long-eared and whiskered/Brandt's bats are stable in Britain and Wales, while noctule and serotine are stable in Britain but there is insufficient data available to confidently assess their population trends in Wales.

5.4.210 According to the Monarch Project⁹², climate conditions in Gwynedd, including the area of the Scheme, are likely to improve significantly for certain bat species including the lesser horseshoe. This species would no longer be at the northern extent of its range, which would likely lead to a further increase in numbers if all other conditions remained the same (as discussed in paragraph 5.4.122 above). This also applies to the greater horseshoe bat, which could move into the area of the Scheme by 2035 if other factors allow it to thrive, as at present it has entered a period of population decline since 2012 (BCT), although the population has increased significantly since 1990. Population trends relating to climate change are not known for the other bat species, but other factors are thought to pose threats to certain species. For example, recent outbreaks of arboricultural disease such as ash dieback may lead to a long-term reduction in suitable roosting habitat for obligate tree roosting species such as noctules, even if it could lead to a short-term increase in suitable habitat first, which may be the case by 2035.

5.4.211 Assuming that every effort is made to undertake the TREBAP actions described in paragraph 5.4.208 above and the trends identified above continue, it is possible that lesser horseshoe, common and soprano pipistrelle and natterer's bats may have increased in the area of the Scheme by 2035, while brown long-eared, whiskered/Brandt's, noctule and serotine bats may remain in similar numbers to those recorded in baseline surveys. It is even possible that low numbers of greater horseshoe bats would be present in the vicinity of the Scheme by 2035 due to changes in climate.

Otter (*Lutra lutra*)

Construction

5.4.212 No evidence of otters was recorded during any of the surveys undertaken for the Scheme between 2001 and 2008. However, otters were known to be using the fluvial catchments of the watercourses that cross beneath the A55(T) within the footprint of the Scheme, so it was assumed that they could be using the watercourses affected.

5.4.213 Targeted otter surveys undertaken in June 2015 confirmed the presence of otters and recorded recent otter activity on the Afon Wig and the other smaller unnamed watercourses to the north of

⁹² Monarch 3: Modelling Natural Resource Responses to Climate Change project (2007)

the A55(T) (see Figure 5.4.5, Volume 1a). Evidence of the activity of otters within the survey area was recorded in the form of fresh, recent and old otter spraints found on boulders and rocks within watercourses, throughout the northern half of the survey area. These were found on stream 5 (Afon Wig) approximately 240m north of the trunk road, on stream 6, where this watercourse runs parallel to the road 180m north of it and on stream 1 to the north and south of the railway crossing.

- 5.4.214 In addition, two potential otter resting sites were recorded during the course of the survey, also located within the northern half of the survey area to the north of the A55(T). However, no direct evidence such as spraints and/or foot prints was recorded at these locations to confirm this conclusion. One potential otter resting site was located within exposed roots beneath an undercut bank adjacent to the Afon Wig main river (Stream 5) to the north of the railway line with a potential otter run nearby. The survey undertaken in 2007 recorded the remains of a partially collapsed artificial otter holt at this location. However, no evidence of an artificial otter holt could be found at this location during the 2015 survey. The second potential otter resting place is located within dense scrub vegetation on Stream 6 to the north of the site of Wig Bach. No feeding remains or footprints of otter were recorded during the course of the survey. Otter survey data are shown on Figure 5.4.5, Volume 1a.
- 5.4.215 Due to the majority of otter evidence being recorded within the northern half of the survey area, north of the existing A55(T), and the lack of significant otter evidence to the south of the A55(T), the movement of otters within the study area is considered to be largely restricted north and south of the A55(T) by the generally impassable culverts that are present to allow the numerous small unnamed watercourses to flow under the A55(T) (see 'Rivers and Streams' above). Currently, if otters desire to travel south to the other side of the A55(T) at times of high rainfall and/or spate flows, it is considered likely that they would cross the A55(T) carriageway rather than using the small culverts that contain stock prevention grilles and sheer step falls, and which would quickly become impassable due to the volume of water passing through them during such events.
- 5.4.216 Historical records of otters, including road casualty data, were obtained for the study area from the local Environmental Records Centre (Cofnod). These showed an otter mortality on the A55(T) in 2000 close to the Tai'r Meibion property. Otter spraints were also recorded on rocks where Stream 5 meets the sea in 2012 and also 1.2km further east.
- 5.4.217 Historically, otters occurred over most of the UK. However, persecution, habitat loss and, more recently, the impact of toxic organochlorine insecticides caused a marked reduction in the range of the species. At present, the majority of the otter population in Great Britain occurs in Scotland, with a significant proportion of this number being found in the north and west of the country. Other strong populations survive in Wales and Ireland. The otter is still scarce over much of England, where the highest concentrations are in the south-west. However, recent surveys suggest that the otter population is recovering well and recolonising parts of its former range (JNCC).
- 5.4.218 Otters have been returning to many river catchments in Gwynedd in recent years. Increasing road mortalities indicate increasing numbers in areas such as the Llŷn Peninsula and the largest populations are found in the Glaslyn, Gwyrfai and Seiont mountain rivers and within the Dyfi and Dysynni catchments (Natur Gwynedd, 2004).
- 5.4.219 Otters are a European protected species under the Habitats Directive and are also protected under the Wildlife and Countryside Act 1981 (as amended). Otters are a UKBAP priority species, a Section 7 species, and feature within the Gwynedd LBAP and TREBAP. The current conservation status of

Otters in the UK is considered to be favourable⁹³ in terms of range, habitat and future prospects, with an estimated UK population of 10,395⁷.

5.4.220 The objectives of the Otter Species Action Plan from the Gwynedd LBAP are as follows:

- To establish the current status and distribution of otters in Gwynedd;
- To protect, maintain and enhance existing otter populations and related habitats;
- To reduce the accidental death of otters on roads and in rivers;
- To use the otter as a flagship species to raise awareness of the importance of appropriate management of its associated habitat.

5.4.221 The TREBAP also includes a Species Action Plan for Otter, with the following objectives:

- Avoid impacts of new road schemes or improvements on otters;
- Mitigate unavoidable impacts on otters and/or their habitats;
- Reduce the level of incidental otter mortality on existing roads;
- Safeguard and enhance known otter populations close to the road network;
- Raise the awareness of transport Directorate staff, Trunk Road Agents and consultants regarding the significance of otters on the network;
- Safeguard and enhance potentially suitable habitat features for otters within the soft estate; and
- Develop a greater knowledge of the distribution of otters across the trunk road network.

5.4.222 As the baseline data at the location of the Scheme indicates the presence of otters at a relatively low density, the local otter population has been considered important at a **regional** level, as a resident population of a species of European importance.

Operation (Year 15)

5.4.223 The TREBAP Action Plan for otters described in paragraph 5.4.219 above includes the following relevant actions:

- Where impacts of new schemes and road improvements on otter habitat are unavoidable consider the options for wide-span bridges, otter ledges, road underpasses, otter resting places, other habitat improvements and artificial holts, and prevent effects on feeding areas through appropriate pollution controls;
- Increase the amount of available otter habitat by removing barriers to dispersal (for example under bridges and through culverts) and by creating suitable habitat wherever possible;
- Undertake regular checks of artificial holts, otter underpasses and fences as part of maintenance activities to check that they are not blocked or in bad condition.

5.4.224 The distribution of otters in Wales has increased significantly over the past decades, with 90% of sites surveyed recording evidence of otters in 2009-10, compared to 72% in 2002, 53% in 1991, 38% in 1984-85 and only 20% in 1977-78 (Otter Survey of Wales, NRW, 2015). Although this cannot be directly translated into an increase in numbers, such a significant increase in distribution implies that the population is also currently increasing in size in Wales.

5.4.225 As otters are currently distributed throughout the UK, it is unlikely that changes in the distribution of climate space would significantly affect this species, although the likelihood of more variable river flow rates due to increases in floods and droughts could have an adverse effect on fish stocks and also on the ability of otters to hunt and catch prey (Biodiversity Impacts Climate Record Card Technical Paper: 2. The Implications of Climate Change for Terrestrial UK Mammals, Newman and

⁹³ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012. JNCC, produced on 11/10/2013

MacDonald, 2015). However, it is not considered likely that this would have a significant impact on the otter population of Wales by 2035.

5.4.226 Assuming that every effort is made to undertake the TREBAP actions described in paragraph 5.4.223 above and the increasing population trend continues, it is possible that the local otter population could have increased by 2035. However, it is considered likely that it would remain of importance at a regional level.

Badger (*Meles meles*)

Construction

5.4.227 Prior to the most recent survey in 2015, badger tracks were recorded adjacent to Stream 6 to the south of the proposed scheme in 2001 and evidence of badger activity was recorded in Coed Bryn Meddyg to the south of the Bryn Meddyg properties in 2005, including a dung pit, runs and badger hairs on a boundary breach. In February 2007, a large main sett was identified just outside the footprint of the Scheme to the north of the A55(T) and badger foraging activity was recorded along the entire length of the survey corridor to the north of the A55(T) although no activity was recorded to the south of the A55(T) at this time. The main sett was mapped in detail in August 2007 and an outlier sett was also recorded at this time. The evidence recorded suggested that the badgers were active along the railway embankment to the north and throughout the land between the railway line and the A55(T), with two further outlier setts present to the west of the survey area according to anecdotal information.

5.4.228 During the 2015 survey, evidence of badgers was recorded throughout the survey area with a concentration of activity being recorded to the north of the A55(T). However, no evidence of badgers crossing the A55(T) carriageway was recorded within the survey area.

5.4.229 The continued use of a main badger sett recorded during the 2007 survey was recorded during the 2015 survey and confirmed as still being active with approximately 10+ currently-used entrance holes (evidenced by discarded bedding and freshly disturbed earth), with a further 30+ inactive entrance holes; indicating the historic presence of this sett and its use over a long period of time. Further evidence of badgers was recorded in the form of an annex sett to the main sett located within the footprint of the Scheme comprising a total of 4 entrance holes; three active (evidenced by discarded bedding and freshly disturbed earth) and one inactive.

5.4.230 A small number of badger latrines was recorded to the north of the A55(T) and contained a low number of fresh scats; typically no more than 3 fresh scats at each location. Numerous badger boundary breaches including those passing through traditional slate fences were recorded throughout the survey area to both the north and south. In addition, a low number of badger foraging scrapes were also recorded throughout the survey area to both the north and south of the A55(T).

5.4.231 To the south of the A55(T) a limited amount of badger evidence was recorded with a single annex or subsidiary sett comprising two active and one inactive entrance hole.

5.4.232 Historical records obtained from the local Biological Records Centre (Cofnod) indicate that there have been two badger road mortalities approximately 115m and 185m southwest of Pentre Aber Farm at the eastern extent of the Scheme, and one approximately 15m to the northeast of the road bridge at Ty'n-yr-Hendre at the western extent of the Scheme (all recorded in 2009).

5.4.233 Badgers and their habitat are afforded protection on a domestic level through the Protection of Badgers Act 1992. They are also included on Schedule 6 of the Wildlife and Countryside Act 1981 (as amended), and Appendix III of the Bern Convention. The Eurasian badger is listed as Least

Concern on the IUCN (International Union for Conservation of Nature) Red List due to its wide distribution, large population, occurrence in many protected areas, high densities in anthropogenic habitats in large parts of its range, and because it is highly unlikely to be declining at nearly the rate required to qualify for listing even as Near Threatened. Although this species is not of particular importance for nature conservation, badger has been included as an Important Ecological Feature due to the legislation protecting badgers in the UK (which is mainly for welfare reasons) and the need for a licence to disturb, damage or destroy a sett.

5.4.234 The density of the local badger population within the survey area is concluded to be low to medium as, although the main sett to the north of the A55(T) is large, it includes a relatively low number of active sett entrances and a low number of fresh, recent and old scats in latrines were recorded during the course of the survey. However, the population of badgers using this sett is concluded to have been present for a considerable period of time due to the large number of disused and inactive setts and sett entrances. Due to the widespread abundance of badgers throughout Gwynedd, Wales, UK and Europe, a badger population of this size is considered to be of **local** importance.

Operation (Year 15)

5.4.235 In the UK there was an estimated 55% increase in the badger population between 1988 and 1997, when there were thought to be approximately 310,000 adult badgers. The population is now probably stable with road traffic accidents a major cause of death. There are many climatic factors that annually affect the recruitment and mortality rates of badgers, such as quantity of rainfall affecting availability of earthworms and winter temperatures affecting badger condition. However, according to the Biodiversity Report Card Paper 2 (The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015), badger numbers in the UK seem only about as likely as not to change as a result of climate change. It is therefore anticipated that the badger population in 2035 would be similar to the existing population.

Water Vole (*Arvicola terrestris*)

5.4.236 No evidence of water voles has been recorded during any of the surveys undertaken for the Scheme, including water vole surveys in 2008 and otter surveys in 2015. Habitat conditions are considered typically unsuitable for water voles throughout the survey area due to the fast-flowing, shallow nature of the watercourses with generally over-shaded rocky banks, which are unsuitable for burrowing, and a lack of suitable vegetation for feeding and cover. There are no historic records of water vole within the data provided by the local biological records centre (Cofnod). As the Scheme is therefore not likely to have any impact on water voles, they are not assigned a value or included further in the assessment.

Polecat (*Mustela putorius*)

Construction

5.4.237 There are seven historic records of polecat within 2km of the Scheme in the local biological records centre (Cofnod) data, including one road fatality on the A55(T) carriageway adjacent to the Bryn Meddyg properties within the corridor of the Scheme in 2010. The hedgerows, scrub, woodland and verge habitats provide suitable foraging and commuting habitat for this species.

5.4.238 In the past the polecat was widespread and common in Britain but the population underwent a severe decline and range contraction during the 19th century, which coincided with the rise in the sporting estate and game keeping profession. By 1915 the polecat had become extinct across much of Britain and confined to a stronghold in mid-Wales, with small populations in Herefordshire, Shropshire, Yorkshire, Cumberland and parts of northern Scotland. From the 1930s onwards the polecat population started to recover in Wales, attributed to a reduction in game keeping pressure during and following the First World War. During the 20th century polecats extended their range into the Welsh borders and parts of the English midlands (Vincent Wildlife Trust, 2016). A recent

survey by the Vincent Wildlife Trust suggests that polecats are still widespread in Wales, maintaining their range in their historical stronghold and that polecats are now more widespread in Britain than at any time in the last 100 years (The distribution and status of the polecat (*Mustela putorius*) in Britain 2014-2015, Croose, 2016). In contrast, in parts of Europe the polecat population is declining including in Germany, Spain, Portugal, Austria, Belarus, Croatia, Luxembourg, Belgium, Poland and Italy, with habitat fragmentation and degradation and drainage of wetlands suggested as the principal causes. Therefore in light of these reported declines over much of its range, the recovery of the polecat in Britain could be regarded as significant for the overall status of the global population.

5.4.239 Polecat is listed on Section 7 of the Environment (Wales) Act 2016 and is a Gwynedd LBAP species. The current UK Conservation Status of the polecat is Favourable⁹⁴, with all parameters assessed as Favourable (Range, Population, Habitat and Future Prospects).

5.4.240 The objectives of the Polecat Species Action Plan from the Gwynedd LBAP are as follows:

- To maintain and expand existing populations of the polecat in Gwynedd; and
- To improve awareness and tolerance of polecats.

5.4.241 Taking into account the status of the polecat population in Wales, the UK and Europe and the number of records of polecat within 2km of the Scheme, the local polecat population has been considered of importance at a **county** level.

Operation (Year 15)

5.4.242 The Species Action Plan for polecats in Gwynedd LBAP includes the following actions:

- Use planning conditions to ensure developments in sensitive locations are compatible with conservation of polecat;
- Provide advice on exclusion of polecats from game and poultry pens to gamekeepers, farmers and poultry keepers;
- Assist with the development of polecat survey techniques, where appropriate and feasible;
- Raise awareness among gamekeepers, farmers, poultry keepers and others who practice predator control of the legal protection afforded to this species, and of the benefits of sound practices of housing poultry and game over lethal polecat control. This to be achieved through publishing regular articles in relevant publications and giving talks to relevant groups (e.g. publications and local meetings of farming unions);
- Encourage the recording of polecat sightings by the general public, to be passed to Vincent Wildlife Trust for collation, through submission of regular press releases to local newspapers and the provision of detailed advice on request.

5.4.243 Estimates of the Welsh population of polecats in 1997 and 2006 have shown an increase of 4.3% to 18,448 in 2006, although it is considered that this could be an underestimate⁸. It is therefore assumed that the population is increasing, at least in the short-term. Although polecats, like most mustelids, have a thermally inefficient body-shape, making them vulnerable to any variations in their food supply due to climatic factors, it is considered that they are unlikely to respond significantly to climate change (Biodiversity Report Card Paper 2: The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015).

5.4.244 In summary, should actions be taken as described in the LBAP for this species (see paragraph 5.4.242 above), it is likely that the polecat population in Wales, and in Gwynedd, may have increased by 2035. However, it is considered that it would remain of importance at a county level.

⁹⁴ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December, JNCC, produced on 11/10/2013

Hedgehog (*Erinaceus europaeus*)

Construction

- 5.4.245 There are five records of hedgehog within 2km of the Scheme from the local biological records centre (Cofnod) data, including one road fatality on the A55(T) carriageway to the west of Stream 5 (Afon Wig) in 2012. The hedgerow, woodland and scrub within the corridor of the Scheme all provide suitable habitat for hedgehogs, with the heavily-grazed pasture also providing potential foraging habitat, although sub-optimal.
- 5.4.246 The UK hedgehog population is in sharp decline, with an estimated 50 million in the 1950s dropping to 1.5 million in 1995. This is thought to be continuing with a long-term rate of loss of 23% over ten years, with risks to hedgehogs predominantly relating to habitat loss, road traffic accidents, molluscicide poisoning and predation by badgers.
- 5.4.247 Accurate figures for the hedgehog population in Wales are not available, but a 1995 study (A Review of British Mammals: Population estimates and conservation status of British mammals other than cetaceans, Harris, Morris, Wray and Yalden) estimated a Welsh population of 145,000. They found that the UK hedgehog population seemed to be very variable in density across its range, with lower densities in areas with more badgers and large differences in areas with different habitat availability. For areas with semi-natural mixed woodlands and semi-improved and improved grassland, such as the habitat mosaic in the vicinity of the Scheme, they estimate a population density of 1 hedgehog per 20ha, compared with 1 in 10ha for built-up areas and 1 in 2-5ha for semi-natural broad-leaved, mixed and recently felled woodlands, parkland, scrub, lowland unimproved grassland and amenity grassland.
- 5.4.248 Hedgehog is listed on Section 7 of the Environment (Wales) Act 2016 and is a Gwynedd LBAP species. The current UK Conservation Status of the hedgehog is unknown due to insufficient data.
- 5.4.249 Taking into account the rapid decline in the UK hedgehog population in the past few decades, and the existing vulnerabilities of this species, it is considered that the local population of this species is likely to be of importance at a **county** level.

Operation (Year 15)

- 5.4.250 The Wales Biodiversity Action Plan for the hedgehog (2013) includes the following targets:
- Halt the decline and maintain the current range of hedgehogs in Wales;
 - Set up and run surveys to improve knowledge of hedgehog distribution. Ensure a national long-term monitoring system is in place with sufficient power to detect population changes at an agreed level;
 - Promote and support a prioritised research programme to study population genetics, population fragmentation and its causes and linking hedgehog densities to habitat types. Use the resulting data to focus conservation efforts;
 - Ensure agri-environment prescriptions are available that support and encourage the maintenance and development of habitat features helpful to hedgehogs;
 - Raise awareness of and urge people to consider the need for providing hibernacula in otherwise 'tidy' garden habitats and encourage better management of urban sites;
 - Investigate the effect on populations of incidental take by gamekeepers (several thousand per year in the UK);
 - Investigate the effects of slug pellets on hedgehogs that they ingest from eating slugs and snails.
- 5.4.251 The UK hedgehog population is thought to still be declining at a fairly rapid rate, although there is some evidence to suggest that this may be in rural areas only. The existing threats to the species from badger predation, habitat loss and fragmentation, road traffic accidents and molluscicide poisoning are likely to continue, although the targets described above in paragraph 5.4.250 may

help to curb some of these effects. Risks relating to climate change including disruption to torpor due to warmer winters, drier springs limiting earthworm prey and temporary flooding of foraging grounds, would also be detrimental to the population. The Biodiversity Report Card Paper 2: The Implications of Climate Change for Terrestrial Mammals (Newman and MacDonald, 2015) concludes that hedgehogs are likely to be vulnerable to population decline in the UK in response to climate-related pressures against a backdrop of more major population drivers. It is therefore considered likely that the local hedgehog population may have decreased fairly significantly by 2035 but would remain important at a county level.

Brown Hare (*Lepus europaeus*)

5.4.252 There are 27 records of brown hare within 2km of the Scheme from the local biological records centre (Cofnod) data, including one road fatality on the A55(T) carriageway to the east of Abergwyngregyn. Twelve records are located to the north of the A55(T) and 15 to the south, reflecting the habitat quality as the intensively grazed pasture bordering the A55(T) on both sides provides habitat with low suitability for brown hare, but the rougher grassland located further towards the mountains to the south is better, providing taller vegetation for the species to hide in. None of these records were located within fields or habitat immediately bordering the A55(T) or Roman Road (Henffordd) within the corridor of the Scheme and it is considered that these areas provide sub-optimal habitat for the species, being improved agricultural grassland. As there are also no records of road fatalities within the corridor of the Scheme (only one on the other side of Abergwyngregyn to the east), it is considered that the Scheme is unlikely to have a significant impact on this species and it has been scoped out of further assessment.

Breeding Birds

Construction

5.4.253 A breeding bird survey was undertaken in spring/summer 2016, including one transect on 29th and 30th April and another on 27th and 31st May. During the survey, a total of 41 bird species were recorded, including similar species to those recorded in the 2008 survey, with the addition of yellowhammer, collared dove, linnet, Canada goose, feral pigeon, mallard, common gull, red kite, lesser whitethroat and grey heron. Species listed on Gwynedd LBAP or the Section 7 list of species of principal importance in Wales (Environment (Wales) Act) that have been recorded either during the breeding bird surveys or are included in the data obtained from the Environmental Records Centre (Cofnod – data for a 2km radius) are shown in Table 5.4.8 below.

Table 5.4.8: Gwynedd LBAP or Section 7 (Environment (Wales) Act) species recorded during the breeding bird surveys and Cofnod data search (2km radius) for the Scheme

Species	Cofnod Data	2008 BBS	2016 BBS	Section 7	Gwynedd LBAP
Skylark (<i>Alauda arvensis</i>)	✓			✓	✓
Kingfisher (<i>Alcedo atthis</i>)	✓				✓
Pintail (<i>Anas acuta</i>)	✓				✓
Garganey (<i>Anas querquedula</i>)	✓				✓
Scaup (<i>Aythya marila</i>)	✓				✓
Dark-bellied brent goose (<i>Branta bernicla subsp. bernicla</i>)	✓			✓	
Common linnet (<i>Carduelis cannabina</i>)	✓		✓	✓	✓
Ringed plover (<i>Charadrius hiaticula</i>)	✓			✓	✓
Black-headed gull (<i>Chroicocephalus ridibundus</i>)	✓			✓	✓
Hen Harrier (<i>Circus cyaneus</i>)	✓			✓	✓
Stock dove (<i>Columba oenas</i>)	✓	✓			✓
Whooper swan (<i>Cygnus cygnus</i>)	✓				✓
Yellowhammer (<i>Emberiza citrinella</i>)	✓		✓	✓	✓

Reed bunting (<i>Emberiza schoeniclus</i>)	✓			✓	✓
Merlin (<i>Falco columbarius</i>)	✓				✓
Peregrine (<i>Falco peregrinus</i>)	✓				✓
Kestrel (<i>Falco tinnunculus</i>)	✓			✓	✓
Pied flycatcher (<i>Ficedula hypoleuca</i>)		✓		✓	
Red-throated diver (<i>Gavia stellata</i>)	✓				✓
Swallow (<i>Hirundo rustica</i>)	✓	✓	✓		✓
Herring gull (<i>Larus argentatus</i>)	✓	✓	✓	✓	✓
Bar-tailed godwit (<i>Limosa lapponica</i>)	✓				✓
Black-tailed godwit (<i>Limosa limosa</i>)	✓				✓
Twite (<i>Linaria flavirostris</i>)	✓			✓	✓
Grasshopper Warbler (<i>Locustella naevia</i>)	✓			✓	✓
Curlew (<i>Numenius arquata</i>)	✓			✓	✓
Whimbrel (<i>Numenius phaeopus</i>)	✓				✓
House sparrow (<i>Passer domesticus</i>)	✓	✓	✓	✓	✓
Tree sparrow (<i>Passer montanus</i>)	✓			✓	✓
Green woodpecker (<i>Picus viridis</i>)	✓				✓
Grey plover (<i>Pluvialis squatarola</i>)	✓				✓
Dunnock (<i>Prunella modularis</i>)	✓	✓	✓	✓	
Bullfinch (<i>Pyrrhula pyrrhula</i>)	✓			✓	✓
Firecrest (<i>Regulus ignicapilla</i>)	✓				✓
Common starling (<i>Sturnus vulgaris</i>)	✓	✓	✓	✓	✓
Shelduck (<i>Tadorna tadorna</i>)	✓	✓	✓		✓
Song thrush (<i>Turdus philomelos</i>)		✓	✓	✓	
Barn owl (<i>Tyto alba</i>) – dead on road	✓	✓			✓
Lapwing (<i>Vanellus vanellus</i>)	✓			✓	✓

5.4.254 As shown in Table 5.4.8 above, a number of birds listed on Section 7 (Environment (Wales) Act) and the Gwynedd LBAP have been recorded in the vicinity of the Scheme, although many of these would not be found breeding within habitat that would be directly affected by the works. Two species listed on Schedule 1 of the Wildlife and Countryside Act were recorded during the surveys, namely barn owl (2008) and red kite (2016), although barn owl was not recorded breeding within the vicinity of the Scheme. These are listed separately below.

5.4.255 During the 2016 survey, the greatest diversity of birds was recorded within the woodland blocks and connecting hedgerows, with grassland areas recording mainly foraging activity by gulls and carrion crows. The hedgerows bordering the A55(T) recorded little activity other than robin, blackbird and dunnock. It was noted that the level of traffic seemed to have increased along this section of the A55(T) since 2008, resulting in higher noise levels that could impact on bird song, territory and display. Due to the potential for Section 7 and Gwynedd LBAP species to be breeding within habitat directly affected by the Scheme, and records of red kite and barn owl (both Schedule 1) within the scheme corridor, it is considered that the birds present and likely to be breeding within the vicinity of the Scheme are important on a **county** level.

Operation (Year 15)

5.4.256 In the absence of the scheme, it is likely that the population of breeding birds within the corridor of the Scheme would remain in a similar condition by 2035, although the proportional composition may change very slightly due to the declining populations of some species such as starling, pied flycatcher, yellowhammer and common linnet. It is likely that climate change will eventually significantly change the composition of bird species present in North Wales due to shifts in suitable climate space changing the range and distribution of many species. Those that are likely to significantly change in the shortest timeframe include skylark, common linnet, tree sparrow and song thrush. None of these however are expected to increase or decline significantly within northern Gwynedd by 2035.

Red Kite (*Milvus milvus*)

Construction

- 5.4.257 Two red kites were recorded during the 2016 breeding bird survey that appeared to constitute a pair (consisting of one immature and one adult bird). This pair did not appear to be breeding during the 2016 season, but there was evidence to suggest that they could be setting up a breeding site for the following season. A dedicated red kite survey was undertaken in March-April 2017 to ascertain the presence of any red kite nest sites in the vicinity of the Scheme. This survey identified a red kite nest site, although all of the proposed works lie well outside the disturbance protection buffer of 300m recommended in A Review of Disturbance Distances in Selected Bird Species (Ruddock and Whitfield, 2007).
- 5.4.258 The red kite suffered from intensive human persecution through much of its world range, which is mainly in Europe, until the mid-1950s, but especially so between 1850 and 1900. This resulted in the species becoming extinct in several countries following a marked long-term decrease in range and numbers. Since the 16th century the red kite has been persecuted by gamekeepers and as it has become rarer it has also been targeted by egg collectors and taxidermists, all of which led to its extinction in England by 1871 and Scotland by 1879. By 1903 when protection for this species was introduced, only a handful of pairs were left in remote parts of central Wales leading to a genetic bottleneck where all remaining birds were descended from a single female. Only in the 1960s did the population start to increase and by the mid-1990s there were over 100 breeding pairs in Wales and 350-400 pairs by 2003. A reintroduction program in 1989 helped to establish red kites in several areas of England and Scotland and their range and numbers are now slowly expanding (RSPB).
- 5.4.259 Red kites are listed on Schedule 1 of the Wildlife and Countryside Act, which prohibits nesting sites from being disturbed, and are also a Gwynedd LBAP species. For these reasons and the status of the red kite population in Wales and the UK, it is considered that they are of **county** importance.

Operation (Year 15)

- 5.4.260 The population and range of red kites in Wales and the UK is currently increasing and they are given green status on the Birds of Conservation Concern 4 list published by BTO in 2015. Although the species still faces threats from illegal poisoning by bait left out for foxes and crows, secondary poisoning by rodenticides and collisions with power cables, these problems are currently being addressed to reduce their impacts on kites (RSPB). The impacts of climate change on the red kite are uncertain although there is some evidence to suggest that milder, wetter winters and hot summers may benefit the species due to an increase in food availability (Climate Change Potential Impacts on Wales, Phil Hurst, Friends of the Earth Cymru, 1997). Overall it is therefore possible that the red kite population in Gwynedd, Wales and the UK, may have increased by 2035, although it is still likely to be of importance at a county level.

Barn Owl (*Tyto alba*)

Construction

- 5.4.261 There are 16 historic records of barn owl included in the data from the local biological records centre (Cofnod) ranging from 1984 to 2014, for a 2km radius from the centre point of the Scheme. These are concentrated at the northeast and southwest ends of the Scheme and include five found dead on the A55(T), two of which were recorded within the footprint of the Scheme, at the location of stream 2 and between streams 2 and 3 at the western end. There are no known nest sites within the vicinity of the Scheme.
- 5.4.262 Widely distributed across the UK and the world, the barn owl has suffered declines through the 20th century and is thought to have been adversely affected by organochlorine pesticides such as DDT, in the 1950s and 60s. The population in the UK is estimated to be approximately 9000 breeding

pairs (Colin Shawyer, 2014), and although monitoring is poor due to their nocturnal lifestyle, it is considered that they may have increased since then (RSPB). The 2004 population estimate for Wales was around 200 pairs and data suggest that there were an average of 20 pairs nesting in Gwynedd each year during the last quarter of the 20th century.

5.4.263 Barn owls are listed on Schedule 1 of the Wildlife and Countryside Act, which prohibits nesting sites from being disturbed, and are also a Gwynedd LBAP and TREBAP species.

5.4.264 The objectives of the Gwynedd Species Action Plan for barn owl are as follows:

- To establish the current status and distribution of barn owls in Gwynedd;
- To protect and maintain existing barn owl breeding sites;
- To restore and enhance other potentially suitable barn owl breeding sites in order to increase barn owl population and distribution;
- To ensure that the barn owl population of Gwynedd does not diminish to less than 20 pairs, and;
- To use the barn owl as a flagship species to raise awareness of the importance of appropriate management of its associated habitats.

5.4.265 The main objectives of the TREBAP Species Action Plan for barn owl are to gather more information about the presence of barn owls on the trunk road network, and to reduce the level and incidence of mortality on roads whilst managing the soft estate for barn owls where it is safe to do so, and the risk of road-related casualties is low.

5.4.266 Taking into account the status of the barn owl population in Gwynedd, Wales and the UK, it is considered that they are of **county** importance.

Operation (Year 15)

5.4.267 The Gwynedd Species Action Plan for barn owl includes the following actions:

- Use planning conditions to ensure developments in sensitive locations are compatible with barn owl conservation;
- Promote and support grant schemes to increase potential feeding areas for barn owl, by extending areas of unimproved/semi-improved grassland and providing headlands to arable fields where small mammal populations may become re-established;
- Encourage the provision of suitable nesting sites, using grant schemes where applicable, in areas with suitable feeding habitat;
- Seek funding for land management by developing a biodiversity grant scheme, which would include grants for appropriate management, restoration and/or creation of barn owl feeding habitat and the provision of suitable nesting sites in areas with suitable feeding habitat;
- Ensure that the potential presence and management requirements of barn owls are considered within any relevant management plans or grant schemes by liaison between key organisations;
- Ensure that potential impacts on barn owl populations are considered within any road building/highways improvement programmes, and that appropriate measures are put in place to limit these;
- Provide advice and regular training on barn owl conservation issues, and how to recognise signs of barn owl occupation, to development control officers, highways engineers and other relevant parties;
- Provide advice on barn owls and habitat management to landowners and land managers;
- Establish annual monitoring of barn owl nesting attempts within all known and accessible nest sites, by suitably licensed field workers, to inform a local database;
- Investigate a survey of all known and potential barn owl nesting sites in Gwynedd;
- Ensure that road-kill data is forwarded to Highways department of Gwynedd Council so that any 'hot spots' can be identified and verge management issues addressed if necessary.

5.4.268 The TREBAP Action Plan for barn owls includes the following ongoing actions:

- Identify stretches of road where regularly high levels of mortality are recorded;
- Where new road developments are planned, ensure prior desk studies and surveys determine any likely impacts on the local barn owl population and options available for the mitigation of these impacts.

5.4.269 The UK barn owl population is thought to be increasing and they have recently been changed from amber to green status on the Birds of Conservation Concern 4 list published by BTO in 2015, although the breeding success in the last few years has been relatively poor according to the Barn Owl Trust. The main threats to barn owls include habitat loss (including loss of nesting habitat due to barn conversions and loss of veteran trees), traffic mortality and reduction in prey numbers due to agricultural intensification and pesticide use. The actions described in the Gwynedd and TREBAP Species Action Plans for barn owl (see paragraphs 5.4.267-268 above) should help to reduce some of these impacts, but this may be balanced by human population increase. The impacts of climate change on barn owls are not certain but there could be impacts due to different patterns of rainfall, as barn owls generally avoid hunting in wet weather due to their soft and silent, but not very water resistant, feathers. Conversely, warmer temperatures may increase prey abundance, which has been shown to be very closely linked to barn owl survival rates. Overall, it is uncertain whether the barn owl population of Gwynedd, Wales and the UK in 2035 will have increased or decreased significantly from its existing population.

Reptiles

Construction

5.4.270 There are local biological records centre (Cofnod) historic records of slow worm in Abergwyngregyn to the northeast of the Scheme and the Phase 1 Habitat survey undertaken in 2016 recorded habitat with medium suitability for reptiles within the verge of the A55(T) and adjacent boundary, scrub and woodland habitat, and medium to high suitability within the clawdd walls bordering Roman Road (Henffordd) to the south. However, due to access limitations and health and safety concerns regarding access to the A55(T) corridor where single lane closures would be required in order to complete a reptile survey, an assumption of the presence of the most common species of reptile at the site, namely common lizard and slow worm, was made for this assessment.

5.4.271 Although slow worms and common lizards are widespread and locally common, all reptile species have suffered a dramatic decline in Wales and Britain over the last century due to loss, degradation and fragmentation of habitat. Slow worms are found throughout mainland Britain but are most common in Wales and southwest England, while the common lizard is the UK's most common and widespread reptile.

5.4.272 The reptiles species likely to be present within the vicinity of the Scheme receive protection against killing, injury and sale under Schedule 5 of the Wildlife and Countryside Act 1981, and are listed on Section 7 of the Environment (Wales) Act and also on the TREBAP.

5.4.273 The objectives of the Action Plan for reptiles on the TREBAP are as follows:

- Identify areas of habitat that are suitable for reptiles within the soft estate;
- Adhere to new best practice advice as it is developed; and
- Identify opportunities for enhancement during road design and construction.

5.4.274 Taking into account the status of the reptile population in Wales and the UK, it is considered that the reptile population in the vicinity of the Scheme is of **county** importance.

Operation (Year 15)

5.4.275 The TREBAP Action Plan for reptiles includes the following ongoing actions:

- Undertake surveys of suitable habitat to build up a more complete picture of soft estate used by reptiles, and;
- Identify the likely presence of reptiles early, particularly for schemes where there is no alternative to effects on reptiles, and which would require translocation as a last resort.

5.4.276 Modelling of climatic suitability suggests that suitable climate space for the common lizard may decrease in the UK over the next few decades, as they move north (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). Slow worms on the other hand may benefit from warmer conditions. These effects would be balanced against the existing threats of habitat loss and fragmentation and the efficacy of the TREBAP actions mentioned above. Overall it is considered that the future status of reptile populations in Gwynedd and on a wider scale is uncertain.

Great Crested Newt (*Triturus cristatus*)

5.4.277 No great crested newts were recorded during the survey undertaken in 2008, although two ponds were recorded as having potential to support the species. There are no historic records of great crested newt within the data provided by the local biological records centre (Cofnod) and the nearest known records (excluding those on Anglesey on the other side of the Menai Strait natural barrier) are located approximately 10.9km to the northeast. It is therefore considered very unlikely that the Scheme would have any impacts on great crested newts. As the Scheme is not likely to have any impacts on great crested newts, they are not assigned a level of importance or included further in the assessment.

Other Amphibians

Construction

5.4.278 There are local biological records centre (Cofnod) historic records of common frog within 2km of the Scheme and smooth and palmate newts were recorded during the great crested newt survey in 2008. It is also very likely that common toad is present and most of the semi-natural habitat within the footprint of the Scheme provides habitat with some suitability for one or all of the species mentioned above.

5.4.279 All of these species are widespread throughout the UK with common frog the most abundant, with an estimated UK population of about 16,000,000 (DEFRA, 2003), and palmate newts the least abundant, having an estimated population of 1,800,000 in 2003 (DEFRA). Within Gwynedd however, palmate newts are more abundant than smooth newts, which are typically a lowland species. All of these species are thought to be declining, largely due to habitat loss and fragmentation and some, such as the common frog, also suffer from a number of diseases such as *Ranavirus* and *Batrachochytrium dendrobatidis*. The main reasons for the decline of the common toad are thought to be wetland drainage, agricultural activities, pollution and road mortality, with the highest road mortality rate of all the UK amphibians, due to the severance of migration routes.

5.4.280 The common toad is listed on Section 7 of the Environment (Wales) Act and all amphibians are listed on the TREBAP, the objectives of which include protecting and, where possible, enhancing amphibian habitat on the soft estate (including migration routes) as well as providing mitigation for existing amphibian road-kill black spots.

5.4.281 Taking into account the status of the amphibian population in Wales and the UK, it is considered that the amphibian population in the vicinity of the Scheme would be of **local** importance.

Operation (Year 15)

5.4.282 The TREBAP Action Plan for amphibians includes the following ongoing actions:

- Where new road schemes are proposed survey terrestrial and aquatic habitat in the area to assess local amphibian populations and predict potential migration routes;
- Where a road will unavoidably destroy or degrade amphibian habitat, consider the creation of new breeding waters, artificial hibernacula and suitable foraging habitat;
- Where existing amphibian road-kill black spots are known, consider building mitigation measures into the road: these may include tunnels, fencing and road signs;
- Take into account the possible impacts of alterations to drainage, or water levels on the surrounding amphibian populations during construction and maintenance operations;
- Consider the provision of habitats suitable for amphibians (both for foraging and hibernating) when managing the soft estate, to enhance the area for the local amphibian population; and
- Ensure measures are in place to prevent road run-off pollution events in line with best practice in new schemes.

5.4.283 Recent reductions in frog and toad populations are consistent with low summer rainfall and consequent lower soil moisture during the drier summers between 2003 and 2006, alongside loss of suitable habitats, habitat fragmentation and road mortality (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). These trends are likely to continue, particularly as climate change research indicates the likelihood of increasingly hotter, drier summers in the UK, although the actions described in the TREBAP Action Plan for amphibians above may reduce road mortality and habitat loss to some extent. Modelling suggests that the suitable climate space for the common toad could expand in the UK, allowing northward range expansion, although this will depend on their ability to move between habitat fragments. Smooth newts are projected to lose suitable climate space across England but may expand their range in Scotland. Overall it seems likely that amphibian populations will continue to decline in the UK and Wales and are likely to be less abundant by 2035, by which time they may remain of local importance or could become important on a county scale.

Migratory Fish

Construction

5.4.284 Eight minor watercourses and two small drainage features flow beneath the A55(T) within the footprint of the Scheme. It is considered possible that fish including salmon, brown/sea trout and European eels could be present within some of these watercourses within the footprint of the Scheme, although it is unlikely that they will be present to the south (upstream) of the A55(T) corridor in this location due to the restricted passage currently provided by the culverts, with sheer fall steps and other design features that would represent an obstacle to migratory fish (see 'Rivers and Streams' above). NRW also stated in their scoping consultation response that the Afon Wig (Stream 5) is likely to have salmonid and eel presence. There are no historic fish records within the data provided by the local biological records centre (Cofnod).

5.4.285 The UK Conservation Status of the Atlantic salmon (*Salmo salar*) is currently Stable⁹⁵ and the UK salmon population comprises a significant proportion of the total European stock. Brown/Sea trout (*Salmo trutta*) are widespread throughout England and Wales, occupying 67% of the total river length in 2002 (Gray and Mee, 2002) and are particularly prevalent in Wales, northern England and southwest England. Catches of migratory trout and salmon are declining in Gwynedd although brown trout still appears to be maintaining steady numbers. Reasons for this decline in salmonids are thought to be due to pollution, invasive non-native plant species (leading to severe erosion as they outcompete native marginal flora), habitat degradation due to river works, stocking with non-native trout, illegal poaching and by-catches, possible effects of global rise in sea temperatures and international fisheries catch during their marine phase. The European eel (*Anguilla anguilla*) stock is

⁹⁵ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December, JNCC, produced on 11/10/2013

facing an unprecedented level of decline and is on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2010)⁹⁶. It is also listed as 'Critically Endangered' on the IUCN red list. Reasons for this decline include barriers to migration including damage by hydropower turbines; poor body condition; climate change and/or changes in oceanic currents; disease and parasites (particularly *Anguillocola crassus*, a nematode worm); exploitation and trade of glass, yellow and silver eels; changing hydrology; habitat loss; pollutants; and predation (The IUCN Red List of Threatened Species, 2016).

5.4.286 The European Eel, Atlantic salmon and Brown/Sea trout are all included on Section 7 of the Environment (Wales) Act and are also included on the TREBAP (aquatic species including salmonids) and Gwynedd LBAP (salmonids). Provision for the European eel is also made under the Eels (England and Wales) Regulations 2009 (see paragraph 5.4.7 in Policy Framework above).

5.4.287 The objectives for Salmonids on the Gwynedd LBAP Species Action Plan are as follows:

- To protect, maintain and enhance existing populations of salmon and sea trout (including brown trout) and associated habitats, in particular spawning and nursery grounds;
- To ensure the genetic integrity of native stocks of brown and sea trout;
- To increase awareness among anglers and other recreational users of river corridors, estuaries and lakes, of conservation issues related to salmonids; and
- To use salmonids as a flagship species to raise awareness of the importance of appropriate management of their associated habitats.

5.4.288 The objectives of the TREBAP Aquatic Species Action Plan are to: avoid any detrimental impacts of new road construction, road improvements and road operation on aquatic systems and their species; and to identify opportunities throughout each phase of road construction for enhancement of existing habitats and the provision of effective mitigation.

5.4.289 Taking into account the status of salmonids and eels in Wales, the UK and Europe, the migratory fish likely to be present within the vicinity of the Scheme are considered to be of importance at a **county** level.

Operation (Year 15)

5.4.290 The Gwynedd Species Action Plan for salmonids includes the following relevant actions:

- Use planning conditions to ensure developments in sensitive locations are compatible with salmonid conservation;
- Where fish passes are present, ensure their maintenance and protection from possible upstream problems, including abstraction;
- Consider the provision of additional fish passes depending on the results of future surveys;
- Encourage and other recreational users of relevant habitats to report salmonid catches and sightings, through publishing articles in relevant publications and giving talks to relevant groups; and
- Raise awareness, amongst anglers and other recreational users of relevant habitats, of the conservation issues associated with salmonids, through publishing articles in relevant publications and giving talks to relevant groups.

5.4.291 The TREBAP Action Plan for Aquatic Species includes the following relevant actions:

- During the design phase of a road scheme, assess the impacts upon aquatic species, particularly at river crossing points, at both desk study and field survey phases;
- During construction, in consultation with NRW, ensure as little disruption as possible to aquatic species occurs. Maintain water quality, and the ability of species to move along rivers

⁹⁶ OSPAR is the mechanism by which 15 governments and the EU cooperate to protect the marine environment of the North-East Atlantic

and water bodies, throughout construction. Ensure footings do not significantly encroach on water courses;

- Ensure that, following construction, runoff from roads does not directly enter watercourses; and
- Create awareness within the Transport Directorate and the Trunk Road Agents of opportunities for enhancement for aquatic species.

5.4.292 The declining populations of salmonids and eel in Gwynedd are likely to continue due to continued pressure from further barriers to migration as there is increasing demand for sustainable energy sources including hydroelectricity; further increases in sea temperature; potential for changes in hydrology of watercourses due to altered rainfall patterns; expected increases in diseases and parasites due to warmer temperatures; likely increases in invasive non-native plant species due to increased temperatures; and increased pressure from fisheries due to an expanding human population. Conversely, the Eels (England and Wales) Regulations 2009 and legislation protecting salmonids such as the Salmon and Freshwater Fisheries Act 1975 and the Salmon Act 1986 should help to reduce these pressures, along with BAP actions such as those described above. There has been an apparent rise in European eel recruitment levels in 2011, 2012 and 2013 (IUCN) but this should be regarded with caution. Overall, it is considered likely that the populations of salmonids and eels in the vicinity of the Scheme will have declined by 2035. It is even possible that the scale of their importance may have increased to a regional scale.

Bluebell (*Hyacinthoides non-scripta*)

Construction

5.4.293 Bluebell was recorded during the Phase 1 Habitat Survey for the Scheme in 2016 within blocks of woodland, including Railway Line Wood 2 County Wildlife Site and the woodland north of the A55(T) adjacent to stream 6, within the ground flora of the hedgerows bordering Roman Road (Henffordd) and also scattered sparsely throughout the verges of the A55(T). There are also historic records of bluebell (Cofnod) from Railway Line Wood 2 and Coed Wern-Porchell to the south.

5.4.294 Bluebells are widely distributed and common throughout the UK, occurring widely except in Orkney and Shetland. Bluebells are of international importance within the UK as 25 – 49% of the world population is found here. They are also found scattered throughout western Europe, mainly in France, the Netherlands and Belgium, and have become naturalised in central Europe, although as an 'Atlantic' species, they are not native further east than western Germany and are absent from Scandinavia (Natur Gwynedd, 2004). Globally the bluebell is threatened, due to habitat loss, unsustainable collection, although it has been illegal to collect wild bluebells for sale since 1998 (Wildlife and Countryside Act), and competition and hybridisation with the Spanish bluebell, *Hyacinthoides hispanica*.

5.4.295 Bluebell is included in the Gwynedd LBAP and also in the TREBAP.

5.4.296 The Gwynedd Species Action Plan for Bluebell includes the following relevant objectives:

- To establish the current status and distribution of bluebell in Gwynedd;
- To protect, maintain and enhance existing bluebell populations and related habitats; and
- To restore and enhance other suitable sites in order to increase bluebell population and distribution.

5.4.297 The objective of the TREBAP Species Action Plan for bluebell is to conserve and enhance the existing population of bluebells along the soft estate through positive woodland and hedgerow management.

5.4.298 Taking into account the status of bluebells in the UK and globally, it is considered that the bluebells in the vicinity of the Scheme are of importance on a **county** level.

Operation (Year 15)

5.4.299 The Gwynedd Species Action Plan for Bluebell includes the following relevant actions:

- Use planning conditions to ensure developments in sensitive locations are compatible with bluebell conservation;
- Consider designating suitable sites of importance for bluebell (including Ancient Woodland sites) as wildlife sites;
- Promote and support grant schemes and/or management agreements where appropriate to secure favourable habitat management of sites with established bluebell populations, and adjacent areas which could provide linkages between isolated populations;
- Ensure that the potential presence and management requirements of bluebells are considered within any relevant management plans or grant schemes by liaison between key organisations;
- Continue to sympathetically manage all Gwynedd Council owned bluebell sites, and;
- Continue to raise awareness of the damage that livestock can do to woodlands and associated plants such as bluebells, and discourage people from picking or digging up these plants through attending local agricultural shows, creating local publicity and in producing education/advisory material.

5.4.300 The TREBAP Species Action Plan for Bluebell includes the following relevant actions:

- At the design stage for new road and improvement schemes, ensure that valuable woodlands and ancient hedgerows with bluebells are taken into consideration. Avoid the direct loss of this habitat wherever possible;
- Sympathetically manage woodland sites and ancient hedgerows, and other locations which contain bluebells that are within the soft estate;
- Consider the retention, storage and relocation of bulbs and topsoil, wherever road schemes affect areas of native bluebells;
- Raise awareness within the Transport Directorate and Trunk Road Agents of the protection and appropriate management of bluebells; and
- Increase public awareness of the value of bluebells in road verges.

5.4.301 The current threats to the native bluebell from habitat loss and competition from the Spanish bluebell are likely to continue, although the BAP actions described above would help to reduce the impact of habitat loss to some extent. It is also possible that climate change could benefit the Spanish bluebell in the UK, increasing its threat to the native species (Bluebells for Britain, 2004). It is therefore uncertain what the status of the UK bluebell population will be in 2035, although it is quite likely that it will have continued to decline. Within this timeframe however, it is likely that it would remain of county importance.

Non-Native Invasive Plant Species

Construction

5.4.302 *Rhododendron ponticum*, a non-native invasive plant species, was recorded during the 2016 Phase 1 Habitat Survey within Railway Line Wood 1, Railway Line Wood 2 and Coed Wern-Porchell, and there are historic records of the species within Coed Wern-Porchell (Cofnod). Japanese knotweed, another non-native invasive plant species was also recorded within the southwest end of Railway Line Wood 1. However, the Japanese knotweed would not be affected by the Scheme.

5.4.303 The introduction of exotic alien species has been identified as the largest threat to biodiversity globally, larger than habitat loss, deforestation and pollution. Exotic invasion is the third biggest threat to biodiversity in Welsh NNRs and to SAC sites. Through the deliberate or unwitting actions

of man, alien organisms are present in the Welsh countryside, some of which are aggressive colonizers and have the potential to displace native flora, fauna or ecosystems

5.4.304 *Rhododendron* has invaded large tracts of the Snowdonia National Park and is also widespread in many areas of Gwynedd, particularly in woodlands but also in heath and grassland areas. Japanese knotweed is also present throughout Gwynedd and is a particular problem on roadsides and riverbanks. Both Himalayan balsam and giant hogweed are also of particular concern on many ditch, river and stream banks in Gwynedd (Natur Gwynedd, 2004).

5.4.305 A number of factors act to cause the spread of these plants in Gwynedd, including escape from gardens; lack of natural enemies; dispersal by watercourses; movement of contaminated soil and/or material from affected sites; inappropriate and/or illegal disposal of cut material; and activities that disturb vegetation and the underlying soil (particularly for *rhododendron* and Japanese knotweed).

5.4.306 Both Japanese knotweed and *Rhododendron ponticum* are listed on Schedule 9 of the Wildlife and Countryside Act 1981, making it illegal to introduce them or allow them to spread in the wild. There is a Topic Action Plan for Invasive Plants in the Gwynedd LBAP, which has the following objectives:

- To reduce and control the spread of ecologically damaging non-native plants in Gwynedd;
- To raise awareness of the damaging effects of these species on natural habitats amongst the public, and improve knowledge of the options for control, and;
- To work strategically with others who share similar objectives.

5.4.307 As non-native invasive plant species are not a valued ecological feature, they are not assigned a level of importance in this assessment.

Operation (Year 15)

5.4.308 The Gwynedd Topic Action Plan for Invasive Plants includes the following relevant actions:

- Ensure the planning process assists in the control of invasive plants at development sites;
- Enforce existing legislation to prevent mechanical spread of invasive plants;
- Consider developing a joint working group with SNPA to co-ordinate effective control of problem plants over Gwynedd and Snowdonia;
- Continue eradication on Gwynedd Council land, including LNRs, Lon Las, and on roadside verges within the Council's jurisdiction;
- Continue eradication of invasive plants on SSSIs, SACs and NNRs through negotiated management agreements and / or active management by NRW wardens;
- Identify new introductions and carry out eradication if feasible;
- Provide best practice advice on the control of invasive plants to land owners, managers and developers;
- Survey sites pre- and post-development to monitor for the introduction and/or spread of invasive plants;
- Verify new cases of invasive plant introductions, and record on the database;
- Collate all existing records of known sites of alien invasive plants in Gwynedd and continue to update with new records, including those passed on by the general public;
- Encourage the general public to record sites where alien invasive plants are present by producing recording cards and submitting occasional press releases to local newspapers;
- Raise awareness of the effects of invasive plants by distribution of guidance on their control to developers, contractors and land managers, and;
- Raise awareness of problem invasive species and encourage the use of native plants in garden centres by distributing guidance and providing advice.

5.4.309 The non-native invasive plant species currently present within Gwynedd are likely to continue to spread, although the actions described in the Gwynedd Topic Action Plan above will help to reduce

this. It is also possible that factors relating to climate change, such as increased temperatures, increased carbon dioxide concentrations and stormier weather could provide conditions more favourable to non-native species, which could further assist their spread within the UK in the future.

Scoping Out Important Ecological Features

5.4.310 Following the compilation of baseline data for all important ecological features potentially affected by the Scheme, it is clear that some would not be impacted either directly or indirectly when considering the types of impacts likely to arise (see paragraph 5.4.90 above). Therefore some of these features have been scoped out of the impact assessment at this stage as summarised in Table 5.4.9 below.

Table 5.4.9: Important ecological features scoped out of the impact assessment

Important Ecological Feature	Scale of Importance	Rationale for scoping out of the impact assessment
Coedydd Aber SAC	International	No significant direct or indirect impact on qualifying habitats/species. There are no mobile species associated with this site which could be affected by the Scheme. The distance of the site from the Scheme makes any impacts unlikely. It is not hydrologically linked and no potential air quality impacts on this site are envisaged.
Eryri SAC	International	No significant direct or indirect impact on qualifying habitats/species. There are no mobile species associated with this site which could be affected by the Scheme. The distance of the site from the Scheme makes any impacts unlikely. It is not hydrologically linked and no potential air quality impacts on this site are envisaged.
Afon Gwyrfai a Llyn Cwellyn SAC	International	This site is located 15.7km to the southwest and as a European protected site within 25km with otter as a mobile qualifying feature, it has been considered in this assessment. However, although it is acknowledged that there could be impacts on the local otter population (without mitigation); the otter population in the vicinity of the proposed works is not considered likely to be part of the population of the SAC due to the distance and separate river catchments involved. Otters have been considered as a separate Important Ecological Feature in this assessment.
Coedydd Aber NNR	National	No significant direct or indirect impact on qualifying habitats/species. There are no mobile species associated with this site which could be affected by the Scheme. The distance of the site from the Scheme makes any impacts unlikely. It is not hydrologically linked and no potential air quality impacts on this site are envisaged.
Eryri SSSI	National	No significant direct or indirect impact on qualifying habitats/species. There are no mobile species associated with this site which could be affected by the Scheme. The distance of the site from the Scheme makes any impacts unlikely. It is not hydrologically linked and no potential air quality impacts on this site are envisaged.
Coedydd Aber SSSI	National	No significant direct or indirect impact on qualifying habitats/species. There are no mobile species associated with this site which could be affected by the Scheme. The distance of the site from the Scheme makes any impacts unlikely. It is not hydrologically linked and no potential air quality impacts on this site are envisaged.
County wildlife sites within 1km that are not within the	County	These sites include: Tan-y-Lon, Woodlands in Penrhyn Park 3, Tan-y-marian bach, Coed Ty'n-yr-hendre, Coed Wern-porchell and Afon Aber Copse. These sites are not located within or directly adjacent to the footprint of the Scheme. There are no mobile species associated with

Important Ecological Feature	Scale of Importance	Rationale for scoping out of the impact assessment
footprint or fluviially connected to the Scheme		these sites which could be affected by the Scheme, no fluvial pollution pathways and any potential impacts arising from air quality are considered insignificant due to the scale and nature of the works.
Ancient Semi-Natural Woodland Sites	Regional	None of these sites would be directly affected by the Scheme due to their distance and lack of fluvial pathways connecting them to the Scheme. The closest lies approximately 545m to the east. Any potential impacts from air quality are considered insignificant due to the scale and nature of the works.
Water vole	Not applicable as not present	No evidence of this species was recorded during surveys carried out in 2008 or during Otter surveys in 2015. Habitat conditions are considered typically unsuitable for water voles so it is very unlikely that they would be present within the footprint of the Scheme.
Brown hare	County	No significant direct or indirect impact likely on this species. There are no records of brown hare within the habitat immediately adjacent to the Scheme, which does not have high suitability for brown hare, and no mitigation is deemed to be required for this species.
Great crested newt	Not applicable as not present	No great crested newts were recorded within the survey corridor during the survey in 2008 and the nearest historical records are approximately 10.9km away so it is very unlikely that they would be present within the footprint of the Scheme.

Assessment of Environmental Effects without Mitigation

5.4.311 This section outlines the likely effects of the Scheme on the important ecological features identified for impact assessment, both during its construction and at Year 15 of operation. This initial assessment is undertaken under the assumption that no mitigation measures would be utilised.

5.4.312 A list of the types of impacts that could occur as a result of both the construction and operational phases of the Scheme are provided in paragraph 5.4.90 in Baseline Conditions above. The following paragraphs provide more detailed descriptions of potential impacts on each of the important ecological features, including reasons why an impact would not be significant where relevant. Potential impacts during construction and operation of the Scheme (without mitigation) are summarised in Tables 5.4.15 and 5.4.16 respectively.

Internationally Designated Sites

Traeth Lafan SPA

Construction

5.4.313 The site is located at its closest 410m north of the scheme boundary, and there is a low risk of contamination of habitats within the SPA via runoff from storage of earth piles, spillages of chemicals and concrete entering the watercourses during the construction phase. This is unlikely to happen and should any such pollution event occur, it is likely that, due to the distance, any pollutants would be greatly reduced and diluted on reaching the closest parts of the SPA, so that any damage to habitats or food sources used by the bird features would be minimal. It is possible that should an unmitigated pollution event occur, this could have a very slight detrimental impact on the second conservation objective for the oystercatcher feature of the site:

2. The abundance and distribution of cockles of 15mm or larger and other suitable food are maintained at levels sufficient to support the population with a 5 year mean peak of 4,000 individuals.

5.4.314 However, it is very unlikely that any pollution impact would reduce the Favourable Conservation Status of the oystercatcher feature of the SPA to less than 4000 individuals, when the population between 2010/11 and 2014/15 has recorded a 5 year mean peak of 7794. Any negative effects on the abundance and distribution of suitable food sources would be very slight and localised around the point where the pollution source (hydrological pathway) enters the site. This impact is likely to affect the other features of the SPA to a similar extent, namely curlew and great crested grebe for which conservation objectives were not available and is considered to be a **minor** impact of **local** significance.

5.4.315 The improved grassland fields between the SPA boundary and the carriageway, including those affected by the scheme, offer potential foraging habitat for oystercatcher and curlew. Approximately 5.7a of the adjacent fields (mainly a narrow, linear strip of improved grassland adjacent to the A55 carriageway) would be permanently lost and approximately 9.1ha would be temporarily lost during the construction phase. Since the fields adjacent to the scheme offer potential feeding opportunities for oystercatcher and curlew, these species could also be disturbed from using the fields as foraging habitat during the construction period, and potentially during the operational phase with the introduction of a new county road/PMA/NMU route along the northern edge of the carriageway.

5.4.316 The closest high tide roosts of Eurasian Oystercatcher to the proposals have previously been identified along the Menai Strait at Ogwen (2,630 individuals), Wig (5,938 individuals) and Aber (126 individuals)⁹⁷. None of these sites would be lost or disturbed by the proposals, which are approximately 410m south of the closest (Wig). The main carriageway works are approximately 625m south at their closest. In addition, large numbers of Eurasian Curlew are known to regularly roost on the foreshore of the Aber Local Nature Reserve, approximately 775m north of the proposals, which again would not be lost or disturbed by the proposals. The most recently available WeBS (Wetland Bird Survey) data for Eurasian Oystercatcher and Eurasian Curlew within Traeth Lafan SPA are presented in Tables 5.4.10 to 5.4.12 below.

Table 5.4.10: Five-year peak monthly counts of Eurasian Oystercatcher (2010 – 2015) (source: BTO)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5919	5652	4948	N/C	N/C	988	1325	4183	7091	6732	5154	7794

The value reported represents the highest count obtained over the five-year period during the month in question

Table 5.4.11: Five-year peak monthly counts of Eurasian Curlew (2010 – 2015) (source: BTO)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2310	2206	1384	N/C	N/C	295	1490	1404	1380	2178	1542	1845

The value reported represents the highest count obtained over the five-year period during the month in question

Table 5.4.12: WeBS Low Tide Count data for the winter 2010/11 (source: BTO)

	Nov	Dec	Jan	Feb
Eurasian Oystercatcher	5212	4462	4307	4520
Eurasian Curlew	522	583	761	952

5.4.317 These species are present at the site throughout the year, with a reduction in numbers during the summer months and a peak during winter. Since these species tend to roost close to their feeding grounds, these figures indicate that the majority of the Eurasian Oystercatcher and Eurasian Curlew population using the Traeth Lafan SPA rely on the intertidal and adjacent non-tidal habitats provided by the Menai Strait for feeding and roosting, which would not be disturbed by the Scheme. Furthermore, considering the abundance of suitable foraging and roosting habitat in the immediate surrounding area, including the Traeth Lafan SPA and the surrounding mud and sandflats at low tide as well as the agricultural fields between the SPA and the scheme that would not be affected by the proposals, existing disturbance due to present farming practices and the A55(T) carriageway and the presence of hedgerows that could provide shelter for predators along large sections of the land affected, the proposals are unlikely to have a significant impact on Eurasian Oystercatchers or Eurasian Curlews as a result of loss of foraging habitat or disturbance. This is therefore considered to be a **negligible** impact that would **not be significant**.

⁹⁷ BTO Research Report 393: Changes in Survival and Recruitment of Oystercatchers *Haemotopus ostralegus* at Traeth Lafan, North Wales, in Relation to Shellfish Exploitation. Atkinson *et al.*, British Trust for Ornithology, 2005.

Operation (Year 15)

5.4.318 Detailed calculations in accordance with HD45/09 (see Chapter 5.10: Road Drainage and the Water Environment) have shown that there would be no significant impact of routine runoff to surface waters during the operation of the Scheme, as the change to predicted levels of dissolved copper or total zinc in the receiving watercourses is below the relevant threshold. As a result, no additional pollution control measures are required for routine run-off. The combination of filter drains and detention pond proposed would decrease the amount of pollutants that currently discharge into the drainage system at present. The risk of a pollution incident from accidental spillages on the carriageway during the operation of the Scheme is <0.5% and is therefore below the acceptable risk threshold recommended by HD 45/09 for sensitive waters (100 years). As a result, there is no requirement for pollution mitigation measures to be incorporated into the Scheme design for accidental spillages as no negative impact is anticipated.

5.4.319 In relation to potential disturbance of foraging/roosting oystercatchers and curlews within the fields immediately adjacent to the Scheme to the north during operation, the level of use predicted for the County road/PMA/NMU route is low and a hedgerow is proposed that would screen these routes from the adjacent fields to some extent. Disturbance already occurs in the fields due to present farming practices and their close proximity to the existing carriageway. Also, the results of the WeBS data have indicated that the majority of these birds favour the habitat on and at the edge of the Menai Straits as discussed above, so it is considered likely that any effect would be **negligible** and **not significant**.

Y Fenai a Bae Conwy SAC

Construction

5.4.320 This site is also located approximately 410m to the north of the Scheme at its closest and as with Traeth Lafan SPA (described above) there would be a low risk of contamination of habitats within the SAC via runoff from storage of earth piles, spillages of chemicals and concrete entering the watercourses during the construction phase. It is possible that should an unmitigated pollution event occur, this could have a very slight and localised detrimental impact on the three Conservation Objectives for the 'intertidal mudflats and sandflats' and 'large shallow bay' features of the SAC, namely on their Range, Structure and Function and Typical Species (see paragraph 5.4.110 in Baseline Conditions for a fuller description of the Conservation Objectives of these two features).

5.4.321 Both of the features that could be affected are considered to be at Unfavourable Conservation Status at present, but the potential impact described above would not have any effect on the existing pressures on these features as identified in the Core Management Plan (CMP) for this SAC and outlined in paragraph 5.4.111 in Baseline Conditions above. Any impact is considered likely to be **minor** and of **local** significance.

Operation

5.4.322 As described in Chapter 5.10 of this ES, it is not considered that there would be an increased risk of pollution events during the operational phase of the Scheme and no other potential operational impacts on this SAC have been identified.

SACs with Lesser Horseshoe Bats as a Feature: Mwyngloddiau Fforest Gwydir SAC, Coedydd Derw a Safleoedd Ystlumod Meirion SAC and Glynllifon SAC

Construction

5.4.323 During baseline surveys, low numbers of lesser horseshoe bats were recorded passing through the cattle underpasses at Tai'r Meibion and Wig during the autumn in 2015. The data indicate that the bats were foraging within and commuting through the underpasses and there is a

small possibility that some of these bats could be linked to the three SACs with lesser horseshoe bats as a feature within 30km, located 15, 17 and 19km away respectively. During construction there is a chance that the underpasses could be obstructed to some extent during works to extend them, without mitigation in place. This would have a detrimental impact on these lesser horseshoe bats, potentially forcing them to fly up and over the A55(T) carriageway, with its increased risk of mortality, instead of passing through the underpasses for the period of works to these underpasses, likely to last for approximately 3 months. There would also be a temporary loss of some hedgerows that may play a role in connecting the underpasses with the wider countryside for bats. This could therefore add to the impact of reduced connectivity and obstruction during the construction period. The level of lesser horseshoe activity recorded within the underpasses amounted to approximately 4 passes/week through the Tai'r Meibion underpass and 3 passes/week through the Wig underpass during October – November 2015, with a pass also recorded in the Wig underpass in September 2015. Other potential impacts on bats such as loss of potential foraging habitat are not considered significant for the lesser horseshoe feature of these SACs because lesser horseshoes were not recorded in any other location within the scheme corridor during baseline surveys.

5.4.324 The Conservation Objectives that could potentially be affected by the impact described above are as follows:

- **Mwyngloddiau Fforest Gwydir SAC:** Conservation Objective 7 = Management of the surrounding habitats is of the appropriate type and sufficiently secure to ensure there is likely to be no reduction in population size or range, nor any decline in the extent or quality of breeding, foraging or hibernating habitat;
- **Coedydd Derw a Safleoedd Ystlumod Meirion SAC:** Conservation Objective 1 = The population of lesser horseshoe bats should be maintained at its current size and encouraged where possible to increase. As there has been an upward trend in lesser horseshoe bat numbers in Wales it is reasonable to expect the Gwynedd population to increase.
- **Glynllifon SAC:** Conservation Objective 4 = There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved and coniferous woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.

5.4.325 The impact on the lesser horseshoe feature of these SACs due to severance of flight paths and potential for increased mortality (as discussed above) is considered to be **minor** and of **local** significance.

Operation

5.4.326 Although the underpasses would remain unobstructed during the operation of the Scheme, the loss of hedgerows connecting the underpasses with the surrounding landscape would remain without mitigation. There could therefore be a slight adverse impact due to reduced connectivity to the underpasses that would continue into the operational period, particularly without any mitigation. At Year 15 of operation there may be a larger local population of lesser horseshoe bats that could be affected by this, based on population trends and climate change predictions but it is unlikely that the impact on the SACs would be greater than **minor**, as the SAC populations would be expected to increase proportionately. This would be of **local** significance at most.

5.4.327 Due to the construction of a larger culvert for the Afon Wig (Stream 5) as part of the Scheme, there is potential for lesser horseshoe bats to utilise this crossing point as well during operation, particularly as it is located between the two existing known crossing points for this species; the cattle underpasses at Tai'r Meibion and Wig. Although this impact is only likely to

be **minor beneficial** due to the low numbers recorded within the scheme corridor, the local lesser horseshoe bat population is expected to increase so there could be more use at Year 15 and beyond. However, it is not considered that this impact would be of significance to the bat SACs, due to their distance.

Nationally Designated Sites

Traeth Lafan SSSI

Construction

5.4.328 This site is located approximately 410m to the north of the Scheme and as with Traeth Lafan SPA (described above) there would be a low risk of contamination of habitats within the SSSI via runoff from storage of earth piles, spillages of chemicals and concrete entering the watercourses during the construction phase. It is possible that should an unmitigated pollution event occur, this could have a very slight and localised detrimental impact on the features of the SSSI, including saltmarsh, running water, redshank, red-breasted merganser and also habitats and species considered as part of the internationally designated sites above, namely eel grass, moderately exposed sand, rock pools, oystercatcher, curlew and great crested grebe. This is considered to be a **minor** impact of **local** significance.

5.4.329 It is possible that in addition to oystercatcher and curlew potentially foraging within fields close to the Scheme as discussed in paragraph 5.4.315 above, redshank might also utilise these areas to some extent. There are no historic records of redshank within the vicinity of the Scheme but the most recently available WeBS (Wetland Bird Survey) data for Redshank within Traeth Lafan SPA are presented in Tables 5.4.13 and 5.4.14 below.

Table 5.4.13: Five-year peak monthly counts of Redshank (2010 – 2015) (source: BTO)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1345	1564	1030	N/C	N/C	4	47	450	685	968	2165	1200

The value reported represents the highest count obtained over the five-year period during the month in question

Table 5.4.14: WeBS Low Tide Count data for the winter 2010/11 (source: BTO)

	Nov	Dec	Jan	Feb
Redshank	667	714	525	488

5.4.330 These data indicate that, as for the oystercatcher and curlew discussed above, redshank are present for most of the year and use the intertidal and adjacent non-tidal habitats provided by the Menai Strait for roosting and feeding, which would not be disturbed by the construction of the Scheme. Similarly, considering the abundance of suitable habitat in the immediate surrounding area, including the Traeth Lafan SSSI and the surrounding mud and sandflats at low tide as well as the agricultural fields between the SSSI and the scheme that would not be affected by the proposals, and existing disturbance due to present farming practices and the A55(T) carriageway, the proposals are unlikely to have a significant impact on redshank as a result of loss of foraging habitat or disturbance. This is therefore considered to be a **negligible** impact that would **not be significant**.

Operation

5.4.331 Due to the reasons discussed above and the low level of disturbance of adjacent fields during the operation of the Scheme as discussed in paragraph 5.4.319 above, it is considered that any disturbance would be **negligible** and **not significant** during operation.

Other Sites

Traeth Lafan LNR

5.4.332 The impacts on this site during construction and operation would be the same as those described for Traeth Lafan SSSI above.

Railway Line Wood 2 County Wildlife Site

Construction

5.4.333 During construction approximately 515m² (0.05ha) of mature, mixed semi-natural woodland habitat would be removed from this site, amounting to a 2% reduction in its total area. The area to be lost comprises mature beech, alder, silver birch and Corsican pine, with semi-mature sycamore and silver birch and a number of young trees including ash and sessile oak. This habitat is considered to be sub-optimal as it contains non-native species such as sycamore, Corsican pine and the invasive *Rhododendron ponticum* although it has the potential to become more natural and better quality, with appropriate management and control of non-native species. The impact of the loss of this habitat is therefore considered to be relatively **minor** and of **local** significance.

Operation

5.4.334 The area of woodland that would be lost from this site would be permanently removed for the construction of the new county road and agricultural access track and therefore the impact would remain into operation of the Scheme with no possibility of regeneration. As stated in the Baseline Conditions section above, it is likely that the condition of the site would be similar in Year 15 of operation without the scheme in place, although the trees would be more mature and there could be an increase in rhododendron as there is currently no management of this site. The impact is therefore considered to remain the same as the construction impact, as **minor** and of **local** significance.

Coed Bryn Meddyg County Wildlife Site

Construction

5.4.335 A very small area of semi-mature trees from this site could be compromised due to encroachment on the Root Protection Zones of an approximately 40m strip at the woodland edge during construction. Unmitigated, this has the potential to cause permanent damage to a number of semi-mature wych elm, sycamore and hawthorn trees. Damage to these trees is considered to represent a **negligible** impact of significance at a **local** level.

Operation

5.4.336 At Year 15 of operation the impact caused by lasting construction damage could be more apparent than in the earlier years of operation as damage, such as root damage, can cause problems that take some time to materialise and can result in the eventual death of a tree. However, it is still considered likely to constitute a **negligible** impact of significance at a **local** level.

Railway Line Wood 1, Railway Line Wood 2, Glan-y-Mor Isaf Copses, Wig Crossing and Traeth Lafan County Wildlife Sites

Construction

5.4.337 As with the Nationally and Internationally designated sites located downstream of the Scheme, there is some potential for an adverse impact on the County Wildlife Sites that are also located downstream. The impact arises from the increased risk of a pollution incident during the construction period that could enter the watercourses and degrade the habitats for which the sites were selected, namely broad-leaved woodland in all of the sites except Traeth Lafan, which was selected for its saltmarsh habitat. It is not anticipated that this impact would be more than **negligible** and of significance at a **local** level for these sites.

Operation

5.4.338 As discussed earlier for other sites, it is not considered that there would be a significant impact during operation of the proposed scheme relating to fluvial pollution. No other impacts are anticipated on these sites.

Habitats

Trees and Hedgerows

Construction

5.4.339 Approximately 4.8km of hedgerows would be removed for the construction of the Scheme, including 860m bordering Roman Road (Henffordd) that would be classified as 'important' ecologically and historically under the Hedgerow Regulations 1997. Approximately 17 mature trees would be removed, including three mature sessile oaks with a diameter at breast height (DBH) of more than 1m located within the hedgerow along the north side of Roman Road (Henffordd) (two) and adjacent to Afon Wig (Stream 5) to the north of the A55(T) (one). Although these three trees are not considered to be veteran, they are considered to have potential interest in terms of conservation of veteran trees according to Natural England guidelines (see paragraph 5.4.169 in Baseline Conditions). The 17 mature trees to be lost are either scattered individual trees or located within one of the six small areas of woodland or small groups of trees that would be lost to the Scheme. This loss would amount to approximately 0.36ha, including 0.23ha of woodland ranging from young to mature. Due to the scale of the impact, particularly on hedgerows, and the valuable habitat and landscape connectivity provided by these features in a largely agricultural landscape, this is considered to be a **moderate** impact without mitigation and of significance at a **local** level due to the relative abundance of the resource on a larger scale. The impact from loss of the three large mature oaks which have the potential to become veteran trees in the future is considered effectively irreversible due to the length of time that would be required to replace them at their current age.

Operation

5.4.340 Without mitigation the loss of trees and hedgerows would continue into the operational period although there may be some potential for regeneration in areas only temporarily lost for the construction works. Although the trees and hedgerow baseline would be slightly more mature at Year 15 of operation, it is considered that the impact and significance would not change significantly and would remain as a **moderate** impact of **local** significance.

Lowland Mixed Deciduous Woodland

Construction

5.4.341 During site clearance for the construction of the Scheme, there would be a loss of approximately 0.23ha of lowland mixed deciduous woodland of varying quality. This includes

the 0.05ha of mature mixed woodland to be lost from Railway Line Wood 2 County Wildlife Site (see paragraph 5.4.333 above), and a few small areas of semi-mature broad-leaved woodland scattered along the northern side of the A55(T), including a mixture of native and non-native species such as sycamore and Norway maple. Although this habitat is considered to be of importance on a county level, and provides valuable foraging and resting habitat for a large range of species such as badgers, bats, hedgehogs, polecats and breeding birds, this impact is considered to be **minor** and of significance at a **local** level due to the sub-optimal quality and relatively small scale of loss compared to remaining habitat in the vicinity.

Operation

5.4.342 Although the baseline woodland habitat that would be directly affected by the Scheme would have matured to some extent in the absence of the scheme, the impact of the continued reduction in habitat at Year 15 of operation is still considered to be **minor** and of significance at a **local** level.

Rivers and Streams

5.4.343 The impacts on the watercourses within the corridor of the Scheme have been assessed in detail in Chapter 5.10: Road Drainage and the Water Environment and summarised below.

Construction

5.4.344 During works to extend the culverts and replace the culverts at streams 5 and 8, there is the potential for an adverse impact on all of the eight watercourses from pollution due to increased suspended sediment, hydrocarbons or changes in chemical balance caused by works to extend or replace the culverts, disposal of surface water run-off from site compounds and construction dust. As part of the Scheme, Stream 8 would be lined for approximately 200m downstream of the A55(T), as far as the existing culvert under the main access track to the farm's fields. These activities would also cause disruption to the watercourses and a risk of pollution as described above. Without mitigation, this is considered to be a **minor** adverse impact of significance at a **local** level.

5.4.345 The works proposed to line Stream 8 with a geotextile lining for 200m downstream of the A55(T) would also have a detrimental impact on any aquatic plant communities present within this watercourse due to being overlaid by the geotextile. This is likely to kill and temporarily suppress the regrowth of these communities during the construction period. However stream 8 is a small field ditch assumed to originate from highway drainage and this would be a temporary impact only, as material removed from the stream bed would be placed on top of the geotextile, which would be perforated to allow regrowth of aquatic vegetation with time. For these reasons and the minimal aquatic, emergent or marginal vegetation recorded during baseline surveys, this impact is considered to be **negligible** and **not significant**.

5.4.346 There is also the potential for disturbance or disruption of aquatic animal species due to construction activities within or adjacent to the watercourses. However, this is assessed separately under the appropriate species headings.

Operation

5.4.347 The Scheme would result in a reduction in open channel watercourses of 70m in total due to the extensions to the culverts (see Chapter 5.10: Road Drainage and the Water Environment). This would include loss of aquatic vegetation and loss of the natural stream bed in these areas. Due to the relatively low ecological value of the areas to be lost, particularly immediately downstream of the A55(T), where many of the watercourses are deeply eroded and hence lacking in vegetation at present, it is considered that this impact would be **minor** and of significance at a **local** level.

5.4.348 The extension of all the culverts is likely to change the hydromorphology and hydrogeomorphology of the watercourses which could lead to increased erosion and a reduction in the ecological status of the streams according to the Water Framework Directive. However, the enlarged culverts that would be provided for streams 5 and 8 are likely to reduce the velocity of flow and therefore decrease the erosion of these watercourses during operation. Therefore this impact would only be negative for streams 1, 2, 3, 4, 6 and 7 and is considered to be **minor** and of **local** significance.

5.4.349 The reduction in erosion due to the geotextile lining proposed for the 200m section of stream 8 downstream of the A55(T) is likely to improve conditions for aquatic plant and animal communities during operation. By Year 15, aquatic vegetation should have become well-established through the perforated geotextile and this in turn would improve conditions for other aquatic species. This is considered to be a **minor beneficial** impact, significant at a **local** level.

Species

Bats

Construction

5.4.350 During works to extend the cattle underpasses at Tai'r Meibion and Wig, there is likely to be some obstruction for bats attempting to utilise these safe commuting routes underneath the A55(T) due to machinery, temporary supporting structures and artificial lighting. This could lead to bats flying up and over the A55(T) carriageway instead, increasing the risk of collision with traffic. The loss of hedgerows leading to the underpasses due to works to widen the carriageway in these locations could exacerbate this impact if they are currently being used for navigational purposes. According to the baseline surveys in these areas this is likely to affect common and soprano pipistrelle, Myotis, brown long-eared and lesser horseshoe bats. It could affect significant numbers of bats, with possibly 20 – 40 bats per night utilising the Tai'r Meibion underpass and 0 – 20 using the Wig underpass during the active season. The majority of these are likely to be common pipistrelle, Myotis species and soprano pipistrelle. Although these underpasses are currently the only two safe crossing points for bats underneath the A55(T) within the 3.5km corridor of the Scheme, the impact would be temporary in nature during the construction works in these areas, so it is considered that this impact would be **minor** and significant at a **local** level.

5.4.351 During construction works in the vicinity of Tai'r Meibion, it is possible that there could be some disturbance of the common pipistrelle roost within the farmhouse. This is a fairly small, non-breeding roost of approximately 10 bats and the existing noise and disturbance caused by farm machinery and the existing A55(T) carriageway suggest that any further disturbance from construction noise or lighting would be unlikely to have a large impact on the bats, particularly as it would be temporary during works in the vicinity. It is therefore considered that such an impact would be **minor** and of significance at a **local** level at most.

5.4.352 Potential bat foraging habitat comprising approximately 4.8km of hedgerows (including 860m of species-rich hedgerow), 0.23ha of mixed and broad-leaved woodland (mostly semi-mature), 0.13ha of scattered groups of trees (mostly semi-mature), 0.1ha of scrub and 70m of open watercourse would be lost to the Scheme. The hedgerows also constitute linear features likely to be used by bats for navigation. Due to the relatively small area of trees, scrub and woodland to be lost compared to that which would remain in the local area, the main impact is likely to be from the loss of hedgerows, providing sheltered foraging and commuting corridors and connectivity to the wider landscape. Taking into account the bat population likely to be using this habitat, it is considered that this impact would be **minor** and significant at a **local** level.

5.4.353 An additional impact arising from the loss of trees and woodland is the loss or disturbance of actual or potential roosting habitat in trees. Although potential roosting habitat can be found in younger trees, it is more likely that mature trees would have greater potential as the number and extent of features caused by damage, disease or malformation is likely to increase with age. There are 17 mature trees that would be lost to the Scheme, eight of which are likely to provide potential bat roosting habitat according to the findings of the baseline arboricultural survey. The disturbance of bats roosting within trees adjacent to the proposed works would be a temporary impact but removal of trees would be permanent, although not major in relation to potential roosting habitat remaining within the local area, such as within the four pockets of ancient semi-natural woodland within 1km of the Scheme including Coedydd Aber SAC to the east. It is therefore considered that this impact would be **minor** and significant at a **local** level.

Operation

5.4.354 Without mitigation, the loss of hedgerows providing connectivity to the cattle underpasses at Tai'r Meibion and Wig would remain, although there would no longer be any obstruction within the underpasses themselves. Although by 2035 there may be more lesser horseshoe, pipistrelle and natterer's bats present in the vicinity of the Scheme, this would be proportional to a larger population on a wider scale so the relative impact would not change. This impact is therefore likely to be less severe than the construction impact but would remain **minor** and significant at a **local** level.

5.4.355 Again, in the absence of mitigation, the loss of potential foraging habitat and linear features would remain into the operational period, although it is likely that some scrub regeneration would have occurred within the verges for example by 2035. It is therefore anticipated that this impact would not change significantly from the construction impact and would remain **minor** and significant at a **local** level.

5.4.356 The loss of potential roosting habitat would also remain into the operational period without mitigation so this impact would remain **minor** and significant at a **local** level.

5.4.357 As a positive impact of the Scheme, a larger culvert is proposed for the Afon Wig (Stream 5) as part of the scheme design so it is possible that this could be used by some bat species as a safe commuting route underneath the A55(T) during operation. This would be located in between the two cattle underpasses that represent the only two existing safe crossing points and at 1.6m high x 3m wide it would not be as large as these. However, due to its location on the Afon Wig, providing good foraging habitat as the largest watercourse within the scheme corridor, and immediately to the north of Coed Wern-Porchell County Wildlife Site where pipistrelle and Myotis bats have been recorded foraging, it is likely that it would receive some use. This positive impact is therefore considered to be **minor beneficial** and significant at a **local** level.

Otters

Construction

5.4.358 It is possible that otters using the watercourses passing through the scheme corridor could be disturbed by construction activities or artificial lighting provided for the construction of the Scheme. However, no holts or resting places were identified within 150m of the area of proposed works during baseline surveys and the level of use of these watercourses is assumed to be fairly low based on the evidence recorded. The presence of the existing A55(T) also incurs a certain level of disturbance at present in terms of noise and light pollution and the additional construction disturbance would be for a temporary period only. It is therefore considered that this impact would be **minor** and of **local** significance.

5.4.359 The potential pollution of the watercourses flowing through the scheme corridor during construction as described for a number of other receptors above, could lead to the degradation of otter foraging habitat as evidence of otter use has been recorded within three out of the eight watercourses (streams 1, 5 and 6). However, due to the extent of better quality habitat nearby but outside the scheme corridor, and the low level of otter evidence recorded, it is considered that this impact would be **minor** and of **local** significance.

5.4.360 The extension of the existing culverts due to the widening of the carriageway would result in the loss of approximately 70m of open channel watercourse that could potentially be used by otters for foraging. However, the majority of this habitat is currently sub-optimal for otter prey species such as fish and amphibians due to its small size, steeply eroded banks and lack of aquatic, emergent or bankside vegetation. Evidence of otters was not recorded in any of the areas to be lost during baseline surveys and it is considered that this loss would be **negligible** and **not significant** to the local otter population.

Operation

5.4.361 As part of the proposed works, a solid concrete safety barrier would be provided within the central reserve between the two carriageways for approximately 2.2km between Tai'r Meibion and the eastern extent of the Scheme. This could act as a barrier to any animals trying to cross the A55(T) during operation, trapping them on the carriageway and resulting in an increased risk of mortality. Without any mitigation in place, this is considered to be a **minor** impact of **local** significance due to the low numbers of otters that are likely to attempt to cross the carriageway given the size and quality of the majority of the watercourses within the scheme corridor and lack of evidence recorded immediately adjacent or to the south. The impact is also reduced due to the existing risk of crossing the carriageways without the scheme in place and the provision of a safe crossing point at the enlarged culvert for the Afon Wig (stream 5) that would be accessible by otters under most conditions.

5.4.362 The permanent extension of the existing culverts would result in a permanent loss of potential foraging habitat for otters that would remain into the operational period. However, as described above, this is considered to be **negligible** and **not significant**.

5.4.363 This loss of potential foraging habitat would be more than compensated by the provision of a detention pond at the site of Wig Bach on the north side of the A55(T) that would provide habitat for otter prey species such as amphibians and is considered to represent a **minor beneficial** impact of **local** significance.

5.4.364 As part of the proposed works, an enlarged culvert would be provided for the Afon Wig (stream 5), which currently passes through a 1.05m pipe with steep steps leading down into it on the south side. The new culvert would be 1.6m high x 3m wide, with a regraded channel for approximately 20m upstream to allow a more gradual descent into the mouth of the culvert. This would represent a significant improvement in accessibility for otters through this culvert, considered to be a **minor beneficial** impact of **local** significance.

Badgers

Construction

5.4.365 Due to construction of the Scheme, an active outlier badger sett and two inactive outlier setts would have to be destroyed. Unmitigated, this could lead to badger mortality and significant disturbance of any badgers utilising the active sett at the time, in addition to the disruption caused by the permanent loss of this sett leading to the need to find/dig a suitable replacement sett. These impacts are considered to be **moderate** but of significance at a **local** scale due to the conservation status of badgers that are a widespread and abundant species with a stable population.

5.4.366 There would also be some disturbance of badgers within the active main sett located approximately 15m from the Scheme at its closest point. This sett comprises ten active entrances and the level of activity indicated by scats, foraging scrapes and discarded bedding in the vicinity would suggest that this sett is currently supporting a population of approximately ten adult badgers. It is therefore considered that this would be a **minor** impact of **local** significance without mitigation.

5.4.367 During site clearance there would be a loss of badger foraging habitat including approximately 4.8km of hedgerows, 0.23ha of mixed and broad-leaved woodland, 0.13ha of scattered groups of trees and 0.1ha of scrub. This impact is considered to be **minor** and of **local** significance at most when compared with the abundance of foraging habitat that would remain in the local area.

Operation

5.4.368 As with otters, the solid concrete barrier proposed for the central reserve for 2.2km of the Scheme corridor, could act to trap badgers on the carriageway, increasing the chances of road traffic mortality. With no mitigation in place, this is considered to be a **minor** impact due to the existing level of risk without the concrete barrier, and of **local** significance.

5.4.369 The loss of foraging habitat would remain into the operational period with no mitigation in place, although there could be some regeneration of scrub within the verges by 2035. This impact is therefore considered to remain a **minor** impact of **local** significance.

5.4.370 As with otters, the enlarged culvert proposed for the Afon Wig (stream 5) would improve access for badgers to cross safely underneath the A55(T). This is considered to be a **minor positive** impact of **local** significance.

Polecat and Hedgehog

Construction

5.4.371 During construction, the local polecat and hedgehog population would lose a small area of potential foraging habitat, which is similar to that lost for badgers described above, including approximately 4.8km of hedgerows, 0.23ha of mixed and broad-leaved woodland, 0.13ha of scattered groups of trees and 0.1ha of scrub. This impact is considered to be **minor** and of **local** significance at most when compared with the abundance of foraging habitat that would remain in the local area.

Operation

5.4.372 The impacts during the operational phase of the Scheme (without mitigation) would also be similar to those for badgers described above, including a continued reduction in foraging habitat, a potential for increased mortality due to the concrete safety barrier trapping animals on the carriageway and improved access underneath the A55(T) via the enlarged culvert for the Afon Wig (stream 5), which would be located at the point where a hedgehog road fatality was recorded in 2012.

Breeding Birds

Construction

5.4.373 Without mitigation there is the potential for the destruction of active nests or disturbance of nesting birds should any of the clearance works be undertaken during the breeding bird season (March to August inclusive). This would be a result of clearance of potential bird nesting habitat, comprising approximately 4.8km of hedgerows, 0.36ha of woodland and scattered trees and 0.1ha of scrub. It is considered that, due to the extent of habitat affected

and the loss of active nests that could be incurred, the impact would be **moderate** and of **local** significance.

5.4.374 The clearance of habitat described above would cause an impact due to the permanent loss of potential nesting and also foraging habitat from the local area, whether it was removed during the breeding bird season or not. This is considered to be a **minor** impact of **local** significance due to the abundance of suitable nesting and foraging habitat that would remain in the surrounding area.

Operation

5.4.375 Without mitigation, the loss of habitat described above would remain into the operational period of the Scheme as a **minor** impact of **local** significance.

Red Kite

Construction

5.4.376 The pair of red kites recorded during the 2016 breeding bird survey were thought to be potentially looking for a suitable nest site within very mature trees to the south-east of Tai'r Meibion farm, approximately 450m to the south of Roman Road (Henffordd). The red kite survey in spring 2017 revealed a nest site further west that was also well outside the recommended nest site disturbance buffer of 300m for the species in relation to the proposed works. These areas would be beyond the risk of disturbance from the proposed works, but as it is possible that they could nest closer to the Scheme in future years, there is some potential for disturbance of the nest of a Schedule 1 bird species due to construction activities, which would constitute an offence under the Wildlife and Countryside Act. It is considered that this would be a **moderate** impact of **local** significance.

Operation

5.4.377 As there would not be any significant loss of red kite foraging or nesting habitat due to the Scheme, it is not considered that there would be any significant impact on red kites during the operational period.

Barn Owl

Construction

5.4.378 There is no evidence to suggest that barn owls would be nesting in close proximity to the Scheme during the construction period and there would be no significant loss of foraging habitat during site clearance. Therefore no impacts on barn owls are considered likely during the construction period.

Operation

5.4.379 Following construction of the 2.2km section of widened carriageway, it is predicted that traffic speeds along this stretch are likely to increase slightly due to improved visibility and driver perception of safety. This may lead to a slight increase in the incidence of barn owl road casualties in this location. The loss of trees, hedgerows or woodland along the edge of the carriageway could cause barn owls to fly lower over the carriageway, also resulting in a slightly increased rate of road traffic mortality even outside the widened section. Currently there is one record of a barn owl adjacent to the A55(T) to the south within the section to be widened and two road traffic mortalities within the corridor of the Scheme to the southwest of the section to be widened. It is considered that this impact would be **minor** and of **local** significance, due to the existing risk already associated with the A55(T) carriageway at this location.

Reptiles and amphibians

Construction

5.4.380 Without mitigation, reptiles and amphibians would both be likely to suffer injury and/or mortality during site clearance and construction activities within suitable habitat which comprises much of the semi-natural habitat present within the scheme corridor for reptiles and all of it for amphibians. Due to the moderate suitability of most of this habitat for these species, it is considered that this would constitute a **moderate** impact of **local** significance to both of these taxonomic groups, with impacts likely on slow worm, common lizard, common toad, common frog and smooth and palmate newt.

5.4.381 Site clearance would also lead to loss of potential foraging and hibernation habitat for both reptiles and amphibians, comprising approximately 0.36ha of woodland and scattered trees, 0.1ha of scrub, 4.8km of hedgerows and 4.4km of grassed verge habitat for both taxonomic groups, with the addition of 70m of open watercourse for amphibians. Degradation of amphibian habitat downstream of the Scheme could also occur due to the potential for pollution during construction. These impacts are considered to constitute a **minor** impact of **local** significance given the quantity of suitable habitat that would remain in the local area.

Operation

5.4.382 The loss of habitat discussed above would remain into the operational period of the Scheme without mitigation, other than the grassed verges that would be replaced and small area of scrub that would be likely to regenerate within a few years. This would continue to be a **minor** impact of **local** significance for both taxonomic groups.

5.4.383 As with other terrestrial animal receptors discussed above, there is likely to be a slightly increased risk of mortality associated with the proposed concrete safety barrier in the central reserve that could incidentally act to trap animals on the A55(T) carriageway if they attempt to cross. For reptiles and amphibians, this is considered likely to represent a **minor** impact of **local** significance.

Migratory Fish

Construction

5.4.384 Without mitigation, it is possible that fish could be directly injured or killed during construction activities within the watercourses, particularly within the more suitable Afon Wig (stream 5). This watercourse is likely to support a moderately sized population of fish that could include salmon, brown/sea trout and eels. This impact is likely to be worse if works are undertaken during the fish spawning season (generally 16th October to 16th May). It is considered that at worst this would be a **minor** impact of **local** significance due to the relatively small areas of suitable habitat that would be affected.

5.4.385 In-river construction activities could also lead to disturbance and disruption of fish and their habitats due to the potential for pollution including increased suspended sediment, hydrocarbons or changes in chemical balance caused by works to extend or replace the culverts, disposal of surface water run-off from site compounds and construction dust. Again this would be worse during the spawning season due to the potential for siltation of gravel beds used for spawning. It is considered that this would be a **minor** impact of **local** significance.

Operation

5.4.386 Following construction of the Scheme there would be an overall loss of approximately 70m of open watercourse due to the extensions of the culverts for the eight watercourses within the scheme corridor. However, only 44m of this constitutes habitat with potential suitability for

migratory fish, as the rest is to the south of the A55(T) and currently inaccessible due to the nature of the existing culverts. This is considered to represent a **minor** impact of **local** significance.

Bluebell

Construction

5.4.387 Bluebells present within Railway Line Wood 2, the woodland to the north of the A55(T) adjacent to stream 6, sparsely scattered throughout the verges of the A55(T) and within the ground flora of the Roman Road (Henffordd) hedgerows could be lost without mitigation due to site clearance and construction works within these areas. This is considered to be a **minor** impact of **local** significance.

Operation

5.4.388 This impact would remain into operation of the Scheme, although it is possible that temporary working areas could recolonize from adjacent habitat if bluebell is present. It is considered that this would remain a **minor** impact of **local** significance.

Rhododendron

Construction

5.4.389 There is the potential for the *Rhododendron ponticum* currently present within Railway Line Wood 2 and also the County Wildlife Site identified as a suitable location for the artificial badger sett to be spread throughout and even outside the corridor of the Scheme due to poor biosecurity procedures during site clearance and construction. This could lead to a decline in the biodiversity value of local woodland areas and is considered to be a **minor** impact of **local** significance.

Operation

5.4.390 During operation of the Scheme, the impact of increased presence of rhododendron would remain within and/or outside the corridor of the Scheme. This would remain a **minor** impact of **local** significance, although with time it is likely to get worse as the rhododendron further colonises adjacent areas and/or is inadvertently spread further by human actions.

Significant Effects Without Mitigation

5.4.391 Tables 5.4.15 and 5.4.16 characterise the potential impacts on the important ecological features identified during construction and operation respectively and describe their significance in the absence of mitigation measures.

Table 5.4.15: Summary of Potential Construction Impacts without Mitigation

***Explanation of Impact Characterisation**

Sign: Positive (beneficial) or Negative (adverse)

Extent: Area measures and percentage of total (e.g. area of habitat/territory lost)

Size: Description of level of severity of influence (e.g. complete loss, number of animals affected)

Reversibility: Reversible or Not Reversible (can the effect be reversed, whether or not this is planned?)

Duration: Permanent or Temporary in ecological terms. Where differing timescales are determined in relation to the life-cycle of the receptor, these should be defined.

Timing and frequency: Important seasonal and/or life-cycle constraints and any relationship with frequency considered.

N/A = Not Applicable

Important Ecological Feature	Scale of Importance	Description of Impact	Characterisation of Impact *	Scale of Significance (Without Mitigation)
Sites:				
Traeth Lafan SPA	International	Degradation of habitats associated with the SPA features arising from siltation and pollution incidents that are not properly managed.	<p><u>Sign:</u> Negative <u>Extent:</u> Limited to areas of habitat in the vicinity of hydrological pathways from the footprint of the Scheme. Due to the distance of this site from the Scheme, it is unlikely that any pollution would affect any significant area of habitat <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p> <p><u>SPA features potentially affected:</u> Oystercatcher; Curlew; Great crested grebe <u>SPA Conservation Objectives potentially affected:</u> Objective 2 for Oystercatcher = The abundance and distribution of cockles of 15mm or larger and other suitable food are maintained at levels sufficient to support the population with a 5 year mean peak of 4,000 individuals. (Conservation Objectives for other features not available).</p>	Local
		Disturbance and loss of potential foraging habitat for oystercatcher and curlew during construction of the Scheme.	<p><u>Sign:</u> Negative <u>Extent:</u> Fields adjacent to the Scheme. No oystercatchers or curlews have been recorded within these fields and WeBS data indicate that the majority of birds of these species favour habitat on and at the edge of the Menai Straits where more optimal foraging habitat is located. <u>Size:</u> Negligible, compared to retained, undisturbed habitat in the local area <u>Reversibility:</u> Reversible (disturbance), irreversible (habitat loss)</p>	Not Significant

			<p><u>Duration:</u> Temporary (disturbance), permanent (habitat loss) <u>Timing and Frequency:</u> During construction of the Scheme, with habitat loss continuing into Scheme operation.</p> <p><u>SPA features potentially affected:</u> Oystercatcher; Curlew <u>SPA Conservation Objectives potentially affected:</u> Objective 3 for Oystercatcher = Oystercatchers are not disturbed in ways that prevent them spending enough time feeding for survival. (Conservation Objectives for other features not available).</p>	
Y Fenai a Bae Conwy SAC	International	Degradation of habitats associated with the SAC features arising from siltation and pollution incidents that are not properly managed	<p><u>Sign:</u> Negative <u>Extent:</u> Limited to areas of habitat in the vicinity of hydrological pathways from the footprint of the Scheme. Due to the distance of this site from the Scheme, it is unlikely that any pollution would affect any significant area of habitat <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p> <p><u>SAC features potentially affected:</u> Intertidal mudflats and sandflats; Large shallow bay <u>SAC Conservation Objectives potentially affected:</u> Objectives 1. Range, 2. Structure and Function and 3. Typical Species for both SAC features in the vicinity of the hydrological pathways from the Scheme could all be affected by pollution incidents.</p>	Local
Bat SACs: Mwyngloddiau Fforest Gwydir SAC; Coedydd Derw a Safleoedd Ystumod Meirion SAC; Glynllifon SAC	International	Severance of lesser horseshoe bat flight paths through the cattle underpasses due to obstruction or loss of connecting habitat (hedgerows). This could potentially lead to bats flying over the carriageway and associated risk of mortality	<p><u>Sign:</u> Negative <u>Extent:</u> Potential for a slight loss of range size for a low number of lesser horseshoe bats due to severance <i>i.e.</i> area to north of A55(T) could be lost from range of one or two SAC bats, or if bats chose to fly over the A55(T) instead, potential for a slight increase in mortality rate <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary during works to extend underpasses only (3 months) <u>Timing and Frequency:</u> Not confirmed until detailed design stage</p> <p><u>SAC features potentially affected:</u> Lesser horseshoe bat <u>SAC Conservation Objectives potentially affected:</u> Mwyngloddiau Fforest Gwydir SAC: Conservation Objective 7 = Management of the surrounding habitats is of the appropriate type and sufficiently secure to ensure there is likely to be no reduction in population size or range, nor any decline in the extent or quality of breeding, foraging or hibernating habitat; Coedydd Derw a Safleoedd Ystumod Meirion SAC: Conservation Objective 1 = The population of lesser horseshoe bats should be maintained at its current size and encouraged where</p>	Local

			possible to increase. As there has been an upward trend in lesser horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase; Glynllifon SAC: Conservation Objective 4 = There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved and coniferous woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.	
Traeth Lafan SSSI	National	Degradation of habitats associated with the SSSI features arising from siltation and pollution incidents that are not properly managed	<u>Sign:</u> Negative <u>Extent:</u> Limited to areas of habitat in the vicinity of hydrological pathways from the footprint of the Scheme. Due to the distance of this site from the Scheme, it is unlikely that any pollution would affect any significant area of habitat <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses <u>SSSI features potentially affected:</u> Eelgrass; Moderately exposed sand; Rock pools; Oystercatcher; Curlew; Redshank; Red-breasted merganser; Great-crested grebe; Running water; Saltmarsh	Local
		Disturbance and loss of potential foraging habitat for oystercatcher, curlew, and redshank during construction of the Scheme	<u>Sign:</u> Negative <u>Extent:</u> Fields adjacent to the Scheme. No oystercatchers, curlews or redshank have been recorded within these fields and WeBS data indicate that the majority of oystercatcher, curlew and redshank favour habitat in and at the edge of the Menai Straits where more optimal foraging habitat is located. <u>Size:</u> Negligible, compared to retained, undisturbed habitat in the local area <u>Reversibility:</u> Reversible (disturbance), irreversible (habitat loss) <u>Duration:</u> Temporary (disturbance), permanent (habitat loss) <u>Timing and Frequency:</u> During construction of the Scheme, with habitat loss continuing into Scheme operation. <u>SSSI features potentially affected:</u> Oystercatcher; Curlew; Redshank	Not Significant
Traeth Lafan LNR	Regional	Degradation of habitats associated with the LNR features arising from siltation and pollution incidents that are not properly managed	<u>Sign:</u> Negative <u>Extent:</u> Limited to areas of habitat in the vicinity of hydrological pathways from the footprint of the Scheme. Due to the distance of this site from the Scheme, it is unlikely that any pollution would affect any significant area of habitat <u>Size:</u> Minor <u>Reversibility:</u> Reversible	Local

			<p><u>Duration:</u> Temporary <u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p> <p><u>LNR features potentially affected:</u> Eelgrass; Moderately exposed sand; Rock pools; Oystercatcher; Curlew; Redshank; Red-breasted merganser; Great crested grebe; Running water; Saltmarsh</p>	
		Disturbance and loss of potential foraging habitat for oystercatcher, curlew, and redshank during construction of the new county road, PMA and NMU route to the north of the A55(T)	<p><u>Sign:</u> Negative <u>Extent:</u> Fields adjacent to the Scheme. No oystercatchers, curlews or redshank have been recorded within these fields and WeBS data indicate that the majority of oystercatcher, curlew and redshank favour habitat in and at the edge of the Menai Straits where more optimal foraging habitat is located. <u>Size:</u> Negligible, compared to retained, undisturbed habitat in the local area <u>Reversibility:</u> Reversible (disturbance), irreversible (habitat loss) <u>Duration:</u> Temporary (disturbance), permanent (habitat loss) <u>Timing and Frequency:</u> During construction of the Scheme, with habitat loss continuing into Scheme operation.</p> <p><u>LNR features potentially affected:</u> Oystercatcher; Curlew; Redshank</p>	Not Significant
Railway Line Wood 2 County Wildlife Site	County	Loss of approximately 515m ² or 0.05ha of mature mixed woodland from railway Line Wood 2, constituting a 2% loss from a site of 2.8ha	<p><u>Sign:</u> Negative <u>Extent:</u> Loss of 515m² of mature mixed woodland constituting 2% loss of habitat from the site, although not optimal quality habitat comprising mature, semi-mature and young broad-leaved and coniferous trees and some <i>Rhododendron ponticum</i>. <u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent: construction period and continuing into operation <u>Timing and Frequency:</u> One-off loss.</p> <p><u>Feature potentially affected:</u> Broad-leaved semi-natural woodland</p>	Local
Coed Bryn Meddyg County Wildlife Site	County	Construction damage to a 40m strip of semi-mature trees along the edge of the site for which the Scheme runs through the root protection areas	<p><u>Sign:</u> Negative <u>Extent:</u> 40m strip of semi-mature broad-leaved woodland. Possible damage due to works within root protection area, which could cause lasting damage to a strip of trees that represent approximately 1.5% of the total habitat within the site <u>Size:</u> Negligible <u>Reversibility:</u> Potentially irreversible <u>Duration:</u> One off damage during construction could cause permanent damage <u>Timing and Frequency:</u> As above</p>	Local

			<u>Feature potentially affected:</u> Broad-leaved semi-natural woodland	
Railway Line Wood 1, Railway Line Wood 2, Glan-y-Mor Isaf Copses, Wig Crossing and Traeth Lafan County Wildlife Sites	County	Degradation of habitats associated with these sites arising from siltation and pollution incidents that are not properly managed	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Limited to areas of habitat in the vicinity of hydrological pathways from the footprint of the Scheme. Small areas of habitat in the vicinity of the watercourses could be temporarily affected by a pollution incident</p> <p><u>Size:</u> Negligible</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Temporary</p> <p><u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p> <p><u>Feature potentially affected:</u> Broad-leaved semi-natural woodland; Saltmarsh</p>	Local
Habitats:				
Trees and Hedgerows	County	Loss of trees and hedgerows during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> 4.8km of hedges to be removed, including 860m adjacent to Roman Road that would be classified as 'important' both historically and ecologically. 17mature trees (including 3 mature sessile oaks with a DBH >1m) and 6 small areas of woodland or small groups of trees (amounting to approximately 0.35ha) would be lost, including young, semi-mature and mature woodland (approximately 0.23ha).</p> <p><u>Size:</u> Moderate</p> <p><u>Reversibility:</u> Reversible (in long term) for hedgerows; effectively irreversible for mature trees, particularly the three large oaks</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss in autumn/winter if possible to minimise impacts on breeding birds</p>	Local
Lowland mixed deciduous woodland	County	Loss of 0.23ha mixed and broad-leaved woodland and potential construction damage to retained trees	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Loss of 0.23ha of mainly semi-mature woodland</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Relatively reversible for young trees, becoming less reversible with mature trees</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss in autumn/winter if possible to minimise impacts on breeding birds</p>	Local
Rivers and streams	County	Degradation of the watercourses within the corridor of the Scheme	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to affect any of the eight watercourses and two field drains flowing through the corridor of the Scheme, one of which, the Afon Wig, is a main river to the north of the</p>	Local

		arising from siltation and pollution incidents during construction that are not properly managed	A55(T) <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses	
		Damage to aquatic plant communities caused by lining a 200m section of Stream 8 with geotextile downstream of the A55(T)	<u>Sign:</u> Negative <u>Extent:</u> 200m section of Stream 8 downstream of the A55(T) between the carriageway and the farm access track to the north <u>Size:</u> Negligible <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary as plants will be able to grow through the perforated geotextile <u>Timing and Frequency:</u> During construction works to lay the geotextile and following this until vegetation regrows through the geotextile	Not significant
Species:				
Bats	Regional	Severance of bat flight paths through the cattle underpasses due to obstruction or loss of connecting habitat (hedgerows). This could potentially lead to bats flying over the carriageway and associated risk of mortality	<u>Sign:</u> Negative <u>Extent:</u> The only two safe crossing points for bats within the approximately 3.5km length of the proposed scheme corridor. A significant number of bats have been recorded using the underpasses, particularly the Tai'r Meibion underpass, including lesser horseshoe bats, Myotis species, common and soprano pipistrelles, brown long-eared bats and noctules. The bats seem to be using the underpasses for both foraging and commuting. <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> Possible obstruction at intervals during construction, and loss of navigational features leading to the underpasses following hedgerow removal	Local
		Disturbance of the common pipistrelle roost within Tai'r Meibion Farmhouse	<u>Sign:</u> Negative <u>Extent:</u> A non-breeding roost of approximately 10 bats could be disturbed <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> At intervals during construction: when works are in the vicinity	Local
		Loss of foraging habitat and linear features used for navigation (woodland and hedgerows)	<u>Sign:</u> Negative <u>Extent:</u> Approximately 4.8km of hedgerow to be lost throughout the scheme corridor, plus a few small areas of woodland (approximately 0.23ha), including young, semi-mature and mature woodland, and some small groups of trees (approximately 0.13ha), 0.1ha scrub and	Local

			<p>70m open watercourse <u>Size:</u> Minor <u>Reversibility:</u> Reversible (in the long term) <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One off loss</p>	
		Loss/disturbance of actual or potential roosting habitat within trees	<p><u>Sign:</u> Negative <u>Extent:</u> Approximately 17 mature trees, at least eight of which are likely to have bat roosting potential according to comments on condition recorded in the arboricultural report, are likely to be lost and there may also be bats roosting in trees immediately adjacent to the proposed works that could be disturbed during construction <u>Size:</u> Minor <u>Reversibility:</u> Not reversible (except in very long term) <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One off loss</p>	Local
Otters	Regional	Disturbance to otters passing along the watercourses	<p><u>Sign:</u> Negative <u>Extent:</u> Individual otters that could be using any of the eight small watercourses affected by the scheme (no holts or resting places likely to be disturbed and no evidence of these recorded within 150m of the proposed scheme) <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> At intervals during construction</p>	Local
		Degradation of foraging habitat due to pollution of watercourses during construction	<p><u>Sign:</u> Negative <u>Extent:</u> Potential to affect any of the eight watercourses flowing through the scheme corridor, three of which (streams 1, 5 and 6) have evidence of otter use downstream of the Scheme. Due to the existing quality of the foraging habitat and level of otter activity recorded, the potential impact is considered to be minor <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p>	Local
		Loss of approximately 70m of potential foraging habitat due to extension of the existing culverts	<p><u>Sign:</u> Negative <u>Extent:</u> 70m divided between the eight watercourses within the scheme footprint (up and downstream), three of which (streams 1, 5 and 6) have evidence of otter use downstream of the Scheme. Not significant as no otter evidence previously recorded within or immediately</p>	Not significant

			<p>adjacent to the footprint of the Scheme and very little recorded upstream to the south. Also the majority of this habitat on the downstream side is currently heavily eroded and sub-optimal foraging habitat, and the total area to be lost is very small compared to habitat remaining along the coast and in larger rivers nearby.</p> <p><u>Size:</u> Negligible <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One-off loss during construction and remaining into the operational period</p>	
Badgers	Local	Loss of badger setts during site clearance/earthworks	<p><u>Sign:</u> Negative <u>Extent:</u> An active (3 hole) subsidiary sett and inactive (1 hole) subsidiary/annex sett would be destroyed and a further inactive (3 hole) subsidiary sett would probably be destroyed. <u>Size:</u> Moderate <u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One off loss. Impact worse during breeding season (December – June inclusive)</p>	Local
		Mortality of badgers during construction	<p><u>Sign:</u> Negative <u>Extent:</u> Any animal remaining in their sett at the time of removal. A maximum of 3 individuals which may be present in the active subsidiary sett outside the breeding season or possibly 1 adult and up to 5 young during the breeding season (December – June inclusive) <u>Size:</u> Moderate <u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One off loss</p>	Local
		Disturbance to badgers in retained setts close to the scheme	<p><u>Sign:</u> Negative <u>Extent:</u> Disturbance is likely to occur to the main sett (approximately 30+ inactive and 10+ active holes) to the north of the A55(T), located approximately 15m from the Scheme at the closest point. The main sett is unlikely to support more than 10 badgers at the present time due to the low number of active sett entrances, discarded fresh bedding, foraging scrapes and scats in latrines <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Temporary <u>Timing and Frequency:</u> At intervals during construction</p>	Local

		Loss of foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Relatively small loss of foraging habitat, including woodland and scattered trees (approximately 0.36ha in total), scrub (0.1ha) and hedgerows (approximately 4.8km), compared to that which would remain in the vicinity</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible (in the long-term)</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss</p>	Local
Polecat and Hedgehog	County	Loss of foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Relatively small loss of foraging habitat, including woodland and scattered trees (approximately 0.36ha in total), scrub (0.1ha) and hedgerows (approximately 4.8km), compared to that which would remain in the vicinity</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible (in the long-term)</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss</p>	Local
Breeding Birds	County	Destruction of active nests and/or disturbance of nesting birds during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> During site clearance of 0.36ha of woodland and scattered trees, 4.8km of hedgerows and 0.1ha of scrub</p> <p><u>Size:</u> Moderate</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> Potential for impact during any clearance works undertaken during the breeding bird season (March to August inclusive)</p> <p><u>Timing and Frequency:</u> As above</p>	Local
		Loss of potential nesting and foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Following site clearance of 0.36ha of woodland and scattered trees, 4.8km of hedgerows and 0.1ha of scrub</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> One off loss causing permanent impact</p> <p><u>Timing and Frequency:</u> As above</p>	Local
Red kite	County	Potential disturbance of the nest site of a Schedule 1 bird due to construction activities	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> There is potential for a pair of red kites to nest in close proximity to the proposed works, particularly in the vicinity of Roman Road (Henffordd). Any disturbance of an active red kite nest would constitute an offence under the Wildlife and Countryside Act.</p> <p><u>Size:</u> Moderate (although unlikely)</p>	Local

			<p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> For the duration of any works in close proximity to a nest while it is in use (or being built). Incubation of eggs takes approximately 38 days and red kites rarely fledge before 48-50 days old and can take up to 60-70 days</p> <p><u>Timing and Frequency:</u> Eggs are usually laid in April</p>	
Reptiles	County	Injury/mortality during site clearance works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for reptiles to be directly affected during clearance/excavation within the verges, hedgerows, woodland and scrub, and particularly within the cloddiau and hedgerows to be removed adjacent to Roman Road (Henffordd)</p> <p><u>Size:</u> Moderate</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> During site clearance and construction within suitable habitat</p> <p><u>Timing and Frequency:</u> Larger impact during the winter hibernation period as animals will be torpid and therefore unable to escape</p>	Local
		Loss of habitat due to site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of 0.36ha of woodland and scattered trees, 0.1ha of scrub, 4.8km of hedgerows and 4.4km of grassed verge habitat without mitigation.</p> <p><u>Size:</u> Minor, compared to retained habitat in the local area</p> <p><u>Reversibility:</u> Reversible to some extent, although much would be permanently lost without mitigation</p> <p><u>Duration:</u> During site clearance and continuing into operation</p> <p><u>Timing and Frequency:</u> Continuous following removal</p>	Local
Amphibians	Local	Injury/mortality during site clearance works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for the more common amphibian species throughout all semi-natural habitat within the corridor of the Scheme</p> <p><u>Size:</u> Moderate</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> During site clearance and construction</p> <p><u>Timing and Frequency:</u> Larger impact during the winter hibernation period as animals will be torpid and therefore unable to escape</p>	Local
		Loss of habitat due to site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of 0.36ha of woodland and scattered trees, 0.1ha of scrub, 4.8km of hedgerows, 4.4km of grassed verge and 70m of open watercourse without mitigation.</p> <p><u>Size:</u> Minor, compared to retained habitat in the local area</p> <p><u>Reversibility:</u> Reversible to some extent although much (woodland and culverted sections of watercourses) would be permanently lost without mitigation</p>	Local

			<p><u>Duration:</u> During site clearance and continuing into operation</p> <p><u>Timing and Frequency:</u> Continuous following removal</p>	
Migratory Fish	County	Injury/mortality of fish during in-river works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> The culvert extensions would extend for approximately 44m of open watercourse habitat to the north of the A55(T) that could potentially be suitable for migratory fish, although the temporary works area is likely to be slightly larger (1.2m of this would be within the Afon Wig with moderate potential and the rest within habitat with low potential)</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> For the duration of all in-river works during construction, likely to be up to 3 months</p> <p><u>Timing and Frequency:</u> Impact greatest during fish spawning season (generally mid-October to mid-April)</p>	Local
		Disturbance/disruption to fish and their habitats, due to construction activities including pollution risk and mobilisation of suspended solids	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to affect area of works (44m of open watercourse suitable for migratory fish) and areas downstream of the works within all eight watercourses</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Mainly for the duration of all in-river works during construction, likely to be up to 3 months; but pollution potential also remains for works in the vicinity of the watercourses or from the site compound for example</p> <p><u>Timing and Frequency:</u> Impact greatest during fish spawning season (generally mid-October to mid-April)</p>	Local
Bluebell	Local	Loss of bluebells currently present within wooded areas and scattered within the verges due to construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Bluebells within affected woodland areas, sparsely scattered throughout the verges and within the ground flora of the Roman Road hedgerows could be lost due to construction works within these areas</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> One-off loss during construction and impact ongoing into operation</p> <p><u>Timing and Frequency:</u> As above</p>	Local
Rhododendron	N/A	Potential for construction activities to cause the spread of this Schedule 9 invasive plant species	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to cause the spread of rhododendron within and/or outside the footprint of the Scheme</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Potential for spread during construction but impact ongoing into the operational</p>	Local

			period <u>Timing and Frequency:</u> From site clearance activities within Railway Line Wood 2 and on into the operational period	
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Table 5.4.16: Summary of Potential Operational Impacts without Mitigation

***Explanation of Impact Characterisation**

Sign: Positive (beneficial) or Negative (adverse)

Extent: Area measures and percentage of total (e.g. area of habitat/territory lost)

Size: Description of level of severity of influence (e.g. complete loss, number of animals affected)

Reversibility: Reversible or Not Reversible (can the effect be reversed, whether or not this is planned?)

Duration: Permanent or Temporary in ecological terms. Where differing timescales are determined in relation to the life-cycle of the receptor, these should be defined.

Timing and frequency: Important seasonal and/or life-cycle constraints and any relationship with frequency considered.

N/A = Not Applicable

Important Ecological Feature	Scale of Importance	Description of Impact	Characterisation of Impact *	Scale of Significance (Without Mitigation)
Sites:				
Traeth Lafan SPA	International	Disturbance and continued loss of potential foraging habitat for oystercatcher and curlew during operation of the Scheme, particularly the new county road, PMA and NMU route to the north of the A55(T)	<p><u>Sign:</u> Negative <u>Extent:</u> Fields adjacent and especially to the north of the Scheme. No oystercatchers or curlews have been recorded within these fields and WeBS data indicate that the majority of birds of these species favour habitat in and at the edge of the Menai Straits where more optimal foraging habitat is located. The new county road/PMA/NMU route would be lower than the new carriageway and a hedge planted along its northern side. <u>Size:</u> Negligible, compared to retained, undisturbed habitat in the local area <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> During operation of the Scheme, especially the new county road, PMA and NMU route to the north of the A55(T).</p> <p><u>SPA features potentially affected:</u> Oystercatcher; Curlew <u>SPA Conservation Objectives potentially affected:</u> Objective 3 for Oystercatcher = Oystercatchers are not disturbed in ways that prevent them spending enough time feeding for survival. (Conservation Objectives for other features not available).</p>	Not Significant
Bat SACs: Mwyngloddiau Fforest Gwydir SAC; Coedydd Derw a Safleoedd Ystlumod Meirion	International	Continued severance of bat flight paths through the cattle underpasses due to loss of connecting habitat (hedgerows)	<p><u>Sign:</u> Negative <u>Extent:</u> Potential for a slight loss of range size for a low number of lesser horseshoe bats due to severance <i>i.e.</i> area to north of A55(T) could be lost from range of one or two SAC bats, or if bats choose to fly over the A55(T) instead, potential for a slight increase in mortality <u>Size:</u> Minor <u>Reversibility:</u> Reversible</p>	Local

<p>SAC; Glynllifon SAC</p>			<p><u>Duration:</u> Operational period, likely to decrease somewhat over time due to natural regeneration <u>Timing and Frequency:</u> Continuous, although less impact during winter due to reduced activity</p> <p><u>SAC features potentially affected:</u> Lesser horseshoe bat <u>SAC Conservation Objectives potentially affected:</u> Mwyngloddiau Fforest Gwydir SAC: Conservation Objective 7 = Management of the surrounding habitats is of the appropriate type and sufficiently secure to ensure there is likely to be no reduction in population size or range, nor any decline in the extent or quality of breeding, foraging or hibernating habitat; Coedydd Derw a Safleoedd Ystumod Meirion SAC: Conservation Objective 1 = The population of lesser horseshoe bats should be maintained at its current size and encouraged where possible to increase. As there has been an upward trend in lesser horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase; Glynllifon SAC: Conservation Objective 4 = There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved and coniferous woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.</p>	
		<p>Improved access underneath the A55(T) using the improved larger culvert proposed for the Afon Wig (stream 5), reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)</p>	<p><u>Sign:</u> Positive <u>Extent:</u> A new/improved commuting corridor would be available to lesser horseshoes between the two existing routes (cattle underpasses) used by low numbers of the species at present to access habitat/roosts to the north of the A55(T). No lesser horseshoe bats have previously been recorded in the vicinity of the Afon Wig within the corridor of the Scheme, but it is possible that a low number of individuals may use this corridor for commuting/foraging in the future, particularly if access is improved underneath the A55(T) and given the good foraging habitat provided by the Afon Wig. However, given the low numbers and distance from the SACs, any beneficial impact is likely to be very slight and not significant in relation to the Conservation Objectives of the sites <u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> From completion of the construction of this culvert and into operation</p> <p><u>SAC features potentially affected:</u> Lesser horseshoe bat <u>SAC Conservation Objectives potentially affected:</u> Mwyngloddiau Fforest Gwydir SAC: Conservation Objective 7 = Management of the surrounding habitats is of the appropriate type and sufficiently secure to ensure there is likely to be no reduction in population size or range, nor any decline in the extent or quality of breeding, foraging or hibernating habitat; Coedydd Derw a Safleoedd Ystumod Meirion SAC: Conservation Objective 1 = The population of lesser horseshoe bats should be maintained at its current size and encouraged where</p>	<p>Not significant</p>

			possible to increase. As there has been an upward trend in lesser horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase; Glynllifon SAC: Conservation Objective 4 = There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved and coniferous woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.	
Traeth Lafan SSSI	National	Disturbance and continued loss of potential foraging habitat for oystercatcher, curlew, and redshank during operation of the Scheme, particularly the new county road, PMA and NMU route to the north of the A55(T)	<u>Sign:</u> Negative <u>Extent:</u> Fields adjacent and especially to the north of the Scheme. No oystercatchers, curlews or redshank have been recorded within these fields and WeBS data indicate that the majority of oystercatcher, curlew and redshank favour habitat in and at the edge of the Menai Straits where more optimal foraging habitat is located. The new county road/PMA/NMU route would be lower than the new carriageway and a hedge planted along its northern side. <u>Size:</u> Negligible, compared to retained, undisturbed habitat in the local area <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> During operation of the Scheme, especially the new county road, PMA and NMU route to the north of the A55(T) <u>SSSI features potentially affected:</u> Oystercatcher; Curlew; Redshank	Not Significant
Traeth Lafan LNR	Regional	Disturbance and continued loss of foraging habitat for oystercatcher, curlew, and redshank during operation of the Scheme, particularly the new county road, PMA and NMU route to the north of the A55(T)	<u>Sign:</u> Negative <u>Extent:</u> Fields adjacent and especially to the north of the Scheme. No oystercatchers, curlews or redshank have been recorded within these fields and WeBS data indicate that the majority of oystercatcher, curlew and redshank favour habitat in and at the edge of the Menai Straits where more optimal foraging habitat is located. The new county road/PMA/NMU route would be lower than the new carriageway and a hedge planted along its northern side. <u>Size:</u> Negligible, compared to retained, undisturbed habitat in the local area <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> During operation of the Scheme especially the new county road, PMA and NMU route to the north of the A55(T) <u>LNR features potentially affected:</u> Oystercatcher; Curlew; Redshank	Not Significant
Railway Line Wood 2 County Wildlife Site	County	Loss of approximately 515m ² or 0.05ha of mature mixed woodland from Railway Line Wood 2, constituting a 2% loss	<u>Sign:</u> Negative <u>Extent:</u> Loss of 515m ² of mature mixed woodland constituting 2% loss of habitat from the site, although not optimal quality habitat comprising mature, semi-mature and young broad-leaved and coniferous trees and some <i>Rhododendron ponticum</i> . <u>Size:</u> Minor	Local

		from a site of 2.8ha	<p><u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent: construction period and continuing into operation <u>Timing and Frequency:</u> One off loss</p> <p><u>Feature potentially affected:</u> Broad-leaved semi-natural woodland</p>	
Coed Bryn Meddyg County Wildlife Site	County	Construction damage to a 40m strip of semi-mature trees along the edge of the site for which the Scheme runs through the root protection areas	<p><u>Sign:</u> Negative <u>Extent:</u> 40m strip of semi-mature broad-leaved woodland. Possible damage due to works within root protection area, which could cause lasting damage to a strip of trees that represent approximately 1.5% of the total habitat within the site <u>Size:</u> Negligible <u>Reversibility:</u> Potentially irreversible <u>Duration:</u> One off damage during construction could cause permanent damage <u>Timing and Frequency:</u> As above</p> <p><u>Feature potentially affected:</u> Broad-leaved semi-natural woodland</p>	Local
Habitats:				
Trees and hedgerows	County	Continued reduction in tree and hedgerow habitat	<p><u>Sign:</u> Negative <u>Extent:</u> 4.8km of hedges would be lost, including 860m adjacent to Roman Road that would be classified as 'important' both historically and ecologically. 17 mature trees (including 3 mature sessile oaks with a DBH >1m) and 6 small areas of woodland or small groups of trees (amounting to approximately 0.36ha) would be lost, including young, semi-mature and mature woodland (approximately 0.23ha). <u>Size:</u> Moderate <u>Reversibility:</u> Reversible (in long term) for hedgerows; effectively irreversible for mature trees, particularly the three large oaks <u>Duration:</u> Permanent <u>Timing and Frequency:</u> Permanent and continuous</p>	Local
Lowland mixed deciduous woodland	County	Continued reduction in woodland habitat	<p><u>Sign:</u> Negative <u>Extent:</u> Loss of 0.23ha of mostly semi-mature woodland <u>Size:</u> Minor <u>Reversibility:</u> Relatively reversible for young trees, becoming less reversible with mature trees <u>Duration:</u> Permanent <u>Timing and Frequency:</u> Permanent and continuous</p>	Local
Rivers and streams	County	Changes to hydromorphology of the watercourses due to	<p><u>Sign:</u> Negative <u>Extent:</u> Potential to affect any of the eight watercourses flowing through the corridor of the Scheme, one of which, the Afon Wig (Stream 5), is a main river to the north of the A55(T).</p>	Local

		extension or enlargement of the culverts	<p>However, the larger culverts proposed for streams 5 and 8 are likely to reduce flow velocity and therefore erosion in these locations</p> <p><u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> From completion of construction of these structures into operation</p>	
		Loss of approximately 70m of open watercourse in total due to extension of the culverts, including loss of the natural stream bed	<p><u>Sign:</u> Negative <u>Extent:</u> An average of approximately 9m of open channel lost per watercourse including habitat up and downstream of the A55(T). 6.5m would be lost from the Afon Wig, which is a main river to the north of the A55(T) (includes 1.2m from the main river) <u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> From completion of construction of these structures into operation</p>	Local
		Reduction in erosion in Stream 8 downstream of the Scheme due to geotextile lining likely to improve conditions for plant and animal species	<p><u>Sign:</u> Positive <u>Extent:</u> Reduced erosion for a 200m section of Stream 8 downstream of the A55(T). A slight improvement in the aquatic habitat in Stream 8 is likely due to decreased erosion improving conditions for aquatic plant and animal species <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Permanent although may need maintenance/replacement in the long-term <u>Timing and Frequency:</u> From completion of construction into operation</p>	Local
Species:				
Bats	Regional	Continued severance of bat flight paths through the cattle underpasses due to loss of connecting habitat (hedgerows)	<p><u>Sign:</u> Negative <u>Extent:</u> The only two safe crossing points for bats within the approximately 3.5km length of the proposed scheme corridor, although they may use the larger culvert proposed for the Afon Wig. A significant number of bats have been recorded using the underpasses, particularly the Tai'r Meibion underpass, including lesser horseshoe bats, Myotis species, common and soprano pipistrelles, brown long-eared bats and noctules. The bats seem to be using the underpasses for both foraging and commuting. <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> Throughout operational period without mitigation</p>	Local
		Continued reduction in foraging habitat and other	<p><u>Sign:</u> Negative <u>Extent:</u> Approximately 4.8km of hedgerow to be lost throughout the scheme corridor, plus a</p>	Local

		<p>navigational (linear) features</p>	<p>few small areas of woodland (approximately 0.23ha), including young, semi-mature and mature woodland, some small groups of trees (approximately 0.13ha) and 70m of open watercourse. The trees and hedgerows lost during construction would remain absent into the operational period without mitigation, so the impact from loss of habitat would remain, although some regeneration would occur over time</p> <p><u>Size:</u> Minor <u>Reversibility:</u> Reversible (in the long term) <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One off loss</p>	
		<p>Continued loss of bat roosting habitat due to tree removal</p>	<p><u>Sign:</u> Negative <u>Extent:</u> Approximately 17 mature trees, at least eight of which are likely to have bat roosting potential according to comments on condition recorded in the arboricultural report, are likely to be lost. <u>Size:</u> Minor <u>Reversibility:</u> Not reversible (except in very long term) <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One off loss</p>	Local
		<p>Improved access underneath the A55(T) using the improved larger culvert proposed for the Afon Wig (stream 5), reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)</p>	<p><u>Sign:</u> Positive <u>Extent:</u> Low numbers of the more common bat species have been recorded foraging and commuting in habitat on both sides of the A55(T). It is possible that the more agile smaller species such as lesser horseshoe bats would use a culvert of the dimensions proposed (1.6m high x 3m wide) to cross underneath the A55(T). The improved Afon Wig culvert may slightly increase crossing activity underneath the A55(T), although there would not be a large beneficial effect as the proposed large culvert would be located in close proximity to and directly in between the two existing cattle underpasses that are currently used by foraging/commuting bats to safely cross underneath the A55(T) and which provide a much larger area for flight. However, as the large culvert would be at the location of the Afon Wig, it is possible that the greater foraging potential of this watercourse would encourage bats to pass through <u>Size:</u> Minor <u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> At any time during operation</p>	Local
Otters	Regional	<p>Risk of increased mortality of otters crossing the carriageway due to new concrete central reserve</p>	<p><u>Sign:</u> Negative <u>Extent:</u> Individual otters that could be using the watercourses affected by the scheme (no known holts in the vicinity or evidence within 150m of the proposed scheme) <u>Size:</u> Likely to be a small number of otters using these watercourses and only very occasionally</p>	Local

	preventing any animals crossing both carriageways and potentially becoming trapped.	attempting to cross the carriageway, particularly with the larger culvert proposed for the Afon Wig, allowing access for otters under most conditions. Size of impact also reduced due to existing risk of crossing carriageway so it is considered to be a minor impact <u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> At any time during operation	
	Continued reduction in foraging habitat due to extension of the existing culverts	<u>Sign:</u> Negative <u>Extent:</u> 70m divided between the eight watercourses within the scheme footprint (up and downstream), three of which (streams 1, 5 and 6) have evidence of otter use downstream of the Scheme. Not significant as no otter evidence previously recorded within or immediately adjacent to the footprint of the Scheme and very little recorded upstream to the south. Also the majority of this habitat on the downstream side is currently heavily eroded and sub-optimal foraging habitat and the total area to be lost is relatively small compared to habitat remaining along the coast and in larger rivers nearby <u>Size:</u> Negligible <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> One-off loss during construction and remaining into the operational period	Not significant
	Increase in foraging habitat due to the provision of a detention pond	<u>Sign:</u> Positive <u>Extent:</u> A detention pond with associated planting would be provided at the site of Wig Bach and would provide habitat for otter prey species such as amphibians. A low number of otters may use this resource occasionally <u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> Following completion of the scheme	Local
	Improved access underneath the A55(T) using improved larger culvert for the Afon Wig (stream 5), reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)	<u>Sign:</u> Positive <u>Extent:</u> Individual otters foraging/commuting along the Afon Wig (no known holts in the vicinity or evidence within 150m of the proposed scheme) <u>Size:</u> Likely to be a small number of individual otters using this watercourse on an occasional basis, so minor impact <u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> At any time during operation	Local

Badgers	Local	Risk of increased mortality of badgers crossing the carriageway due to new concrete central reserve preventing any animals crossing both carriageways and potentially becoming trapped	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> There are likely to be in the region of 10-15 badgers that are using setts adjacent to the proposal to the north and south of the A55(T) that could potentially be impacted by the proposal. Although the existing A55(T) carriageway is likely to act as a barrier for badgers and no crossing points have been identified, three road fatalities have been recorded within the corridor of the Scheme so they do attempt to cross occasionally.</p> <p><u>Size:</u> This impact is considered to be minor due to the relatively low numbers of badgers that would be affected and existing risk of road mortality</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	Local
		Continued reduction in foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Relatively small loss of foraging habitat, including woodland and scattered trees (approximately 0.36ha) and hedgerows (approximately 4.8km), compared to that which would remain in the vicinity</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible (in the long-term)</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss</p>	Local
		Improved access underneath the A55(T) using improved larger culvert for the Afon Wig (stream 5), reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)	<p><u>Sign:</u> Positive</p> <p><u>Extent:</u> There are likely to be in the region of 10-15 badgers that are using setts adjacent to the proposal to the north and south of the A55(T) that could potentially be impacted by the proposal. The use of the Afon Wig culvert is unlikely to have a large beneficial impact on this population as passage underneath the A55(T) via Tai'r Meibion and Wig cattle underpasses already exists on either side of and in close proximity to this proposed culvert and badgers are likely to use these safe crossing points already. The underpasses are also located closer to the active setts recorded to the north and south than the proposed culvert would be, but the provision of this large culvert would provide additional opportunities for mammals (including badgers) to cross underneath the A55(T).</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	Local
Polecat and Hedgehog	County	Risk of increased mortality of polecats and hedgehogs crossing the carriageway due to new concrete	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Polecats and hedgehogs have been recorded within habitat adjacent to the proposal north and south of the A55(T), particularly at the eastern end where the concrete safety barrier is proposed. Although the existing A55(T) carriageway is likely to act as a barrier for</p>	Local

		central reserve	<p>them to some extent, a polecat road fatality has been recorded near the Bryn Meddyg properties and a hedgehog road fatality above the Afon Wig so they do attempt to cross occasionally and there are currently only two safe crossing points at the cattle underpasses</p> <p><u>Size:</u> This impact is considered to be minor due to the relatively low numbers of polecats and hedgehogs that would be affected and existing risk of road mortality</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	
		Continued reduction in foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Relatively small loss of foraging habitat, including woodland and scattered trees (approximately 0.36ha) and hedgerows (approximately 4.8km), compared to that which would remain in the vicinity</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible (in the long-term)</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss</p>	Local
		Improved access underneath the A55(T) using improved larger culvert for the Afon Wig (stream 5), reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)	<p><u>Sign:</u> Positive</p> <p><u>Extent:</u> The use of the Afon Wig culvert is unlikely to have a large beneficial impact on these populations as passage underneath the A55(T) via Tai'r Meibion and Wig cattle underpasses already exists on either side of and in close proximity to this proposed culvert and polecats and hedgehogs are likely to use these safe crossing points occasionally already. However, the provision of a culvert on stream 5 would provide additional opportunities for mammals to cross underneath the A55(T) at a location linking habitat likely to be used by these species at Coed Wern-Porchell and along the tree-lined Afon Wig. A hedgehog road fatality was recorded above the Afon Wig in 2012 indicating that this could be a crossing point for this species</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	Local
Breeding Birds	County	Continued reduction in nesting and foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Following site clearance of 0.36ha of woodland and scattered trees, 4.8km of hedgerows and 0.1ha of scrub</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> One off loss causing permanent impact</p> <p><u>Timing and Frequency:</u> As above</p>	Local

Barn Owl	County	Increased traffic speeds due to wider carriageway and loss of trees/woodland adjacent to the carriageway increasing the risk of road traffic mortality during operation	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> For the 2.2km section of the Scheme that includes widening of the A55(T) carriageway. There are currently no records of barn owl road fatalities within this section, but there are 2 records within the scheme corridor to the southwest and several on the other side of Abergwyngregyn to the northeast. There is also the possibility that removing trees/woodland close to the carriageway could mean that barn owls fly lower over the road which could also increase the risk of road traffic collision.</p> <p><u>Size:</u> The slight increase in traffic speeds predicted due to the wider carriageway and the loss of trees adjacent to the carriageway could lead to a minor impact on barn owl road traffic mortality</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> Continuous risk following construction</p>	Local
Reptiles	County	Continued reduction in foraging and hibernation habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of 0.36ha of woodland and scattered trees and 4.8km of hedgerows without mitigation. The verge habitat would be replaced and scrub would be likely to regenerate within a few years</p> <p><u>Size:</u> Minor, compared to retained habitat in the local area</p> <p><u>Reversibility:</u> Reversible to some extent although much would effectively be permanently lost without mitigation</p> <p><u>Duration:</u> During site clearance and continuing into operation</p> <p><u>Timing and Frequency:</u> Continuous following removal</p>	Local
		Increased risk of road mortality due to concrete safety barrier	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Although there are no records of reptile road fatalities within the area, probably due to their small size, it is considered likely that low numbers do sometimes attempt to cross the A55(T) and could therefore face a slightly increased risk of mortality due to the proposed concrete barrier in the central reserve.</p> <p><u>Size:</u> Minor</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> Continuous following construction</p> <p><u>Timing and Frequency:</u> As above, during the reptile active season (April to October inclusive)</p>	Local
Amphibians	Local	Continued reduction in foraging and hibernation habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of 0.36ha of woodland and scattered trees, 4.8km of hedgerows and 70m of open watercourse without mitigation. The verge habitat would be replaced and scrub would be likely to regenerate within a few years.</p> <p><u>Size:</u> Minor, compared to retained habitat in the local area</p> <p><u>Reversibility:</u> Reversible to some extent although much (woodland and culverted sections of</p>	Local

			watercourses) would be permanently lost without mitigation <u>Duration:</u> During site clearance and continuing into operation <u>Timing and Frequency:</u> Continuous following removal	
		Increased risk of road mortality due to concrete safety barrier	<u>Sign:</u> Negative <u>Extent:</u> Although there are no records of amphibian road fatalities within the area, probably due to their small size, amphibians are likely to attempt to cross the A55(T) and could therefore face a slightly increased risk of mortality due to the proposed concrete barrier in the central reservation <u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Continuous following construction <u>Timing and Frequency:</u> As above, during the active season (April to October inclusive)	Local
Migratory Fish	County	Loss of 44m of potential stream habitat due to culvert extensions	<u>Sign:</u> Negative <u>Extent:</u> 44m of open channel watercourse suitable for migratory fish would be permanently lost, which is a relatively small area compared to suitable habitat that would remain within the area <u>Size:</u> Minor <u>Reversibility:</u> Irreversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> Permanent loss following construction of culvert extensions	Local
Bluebell	Local	Continued reduction in bluebells due to loss during site clearance	<u>Sign:</u> Negative <u>Extent:</u> Bluebells within woodland areas and sparsely scattered throughout the verges could be lost due to construction works within these areas <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> One-off loss during construction and impact ongoing into operation <u>Timing and Frequency:</u> As above	Local
Rhododendron	Not Applicable	Potential for increased rhododendron within the vicinity of the Scheme, due to construction activities causing the spread of this Schedule 9 invasive plant species	<u>Sign:</u> Negative <u>Extent:</u> Potential for increased presence of rhododendron throughout and/or even outside the corridor of the Scheme <u>Size:</u> Minor <u>Reversibility:</u> Reversible <u>Duration:</u> Potential for spread during construction but impact ongoing into the operational period <u>Timing and Frequency:</u> From site clearance activities within Railway Line Wood and on into the operational period	Local

Mitigation, Enhancement and Residual Effects

5.4.392 The following section identifies the measures necessary to mitigate the potential impacts of the Scheme on each of the important ecological features for which the potential for a significant impact (without mitigation) has been identified. Mitigation measures for impacts arising from both the construction and operation of the proposed scheme are included and summarised in Table 5.4.18 below.

5.4.393 Any significant impacts that would remain with mitigation in place are also included in Table 5.4.18 and described in 'Residual Effects'. Proposed monitoring to assess the effectiveness of mitigation measures and the extent of any residual effects is also described.

5.4.394 Proposals for ecological enhancement measures that would improve the current situation for any ecological features or biodiversity in general, but which are not mitigation for significant adverse effects or inherently part of the scheme design, are also included in this section.

Construction Mitigation

Pollution Prevention

Receptors mitigated: Y Fenai a Bae Conwy SAC, Traeth Lafan SPA/SSSI/LNR, County Wildlife Sites downstream of the Scheme, Rivers and Streams, Otters, Amphibians and Migratory fish

5.4.395 The degradation of nearby protected habitats through pollution incidents, which could be transferred to protected sites through fluvial links, would be minimised through good environmental site management. In particular, during construction, best practice guidelines including PPG and CIRIA guidance would be followed when working in/near to watercourses. The mechanism for ensuring the delivery of this mitigation would be through the CEMP (see Chapter 7) and associated Method Statements for the works, to be agreed in advance with NRW. The CEMP would also include regular monitoring of watercourses during construction. Some examples of pollution prevention measures that would be included are ensuring the use of spill kits and refuelling in designated areas away from watercourses (see Chapter 5.10: Road Drainage and the Water Environment). In addition, a plan to deal with environmental (and other) emergencies would also be put in place. Dust generation during construction activities would also be controlled using best practice measures via the CEMP (see Chapter 5.1: Air Quality).

5.4.396 Statutory Consents would be required for works within all of the watercourses that pass underneath the A55(T) within the proposed scheme corridor. All mitigation described within these consents would be undertaken, including pollution prevention measures.

5.4.397 Construction personnel would also be made aware of the sensitive environment of the works through toolbox talks. These would be provided by a suitably qualified Environmental Manager or Environmental Clerk of Works, as appropriate.

Trees and Woodland

Receptors mitigated: Railway Line Wood 2 (County Wildlife Site), Coed Bryn Meddyg (County Wildlife Site), Trees, Lowland Mixed Deciduous Woodland, Bats, Badgers, Polecat, Hedgehog, Breeding birds, Barn owl, Reptiles, Amphibians, Bluebell, Rhododendron

5.4.398 All trees would be retained except for those within the footprint of the proposed works, including 17 mature trees, and all retained trees within the proposed scheme corridor would be protected by tree protection measures in accordance with BS:5837:2012. Of particular note are a line of mature trees adjacent to the Afon Wig (Stream 5) as it flows between Coed Wern-Porchell to the south and the A55(T). These are located along the eastern side of the watercourse, and would be retained to maintain a vegetated wildlife corridor leading into the

new improved culvert with wildlife ledges/shelves (see Environmental Master Plans, Figures 7.1 – 7.7, Volume 1a).

5.4.399 All habitat with potential to support nesting birds (trees, scrub, hedgerows, woodland) would be cleared outside the breeding bird season (March to August inclusive) or, should this not be possible, under ecological supervision to confirm the absence of nesting birds before any nesting habitat is removed (see mitigation for Breeding Birds below). If the presence of nesting birds was confirmed, works would cease and a suitable buffer zone (to be agreed with the ecologist) established until the young had fledged. All such habitat would also be removed under an ecological watching brief for reptiles and amphibians, including topsoil stripping within these areas (see mitigation for Reptiles and Amphibians below).

5.4.400 The loss of approximately 0.36ha of woodland and scattered trees (including 0.23ha of mixed and broad-leaved woodland) would be mitigated by woodland planting amounting to 0.26ha and approximately 0.26ha of scattered trees at the locations described below:

North of the A55(T)

- On the embankment slope between the A55(T) and the proposed county road to the south of the County Wildlife Site 'Railway Line Wood 2' (woodland);
- Around the proposed detention pond located at the site of Wig Bach (woodland and scattered trees);
- On the embankment slope between the A55(T) and the proposed NMU route (scattered trees).

South of the A55(T)

- To the west of the Bryn Meddyg properties, between the access road and the A55(T) (woodland);
- On the cutting slope between the proposed drainage bund and the A55(T) to the east of the Bryn Meddyg properties (woodland).

5.4.401 All tree and woodland planting would comprise native, broad-leaved species of local provenance only (see Chapter 5.3: Landscape for further details of landscape mitigation).

5.4.402 Occasional individual specimens of mature oak and ash exist within the hedgerows on both sides of the A55(T) and would be lost to the Scheme. It is not proposed to replace these directly, but to introduce small groups of trees within the hedgerow mix and maintain them to promote the establishment of these standard trees.

5.4.403 Due to the great diversity of species likely to be associated with the three large mature oaks with a DBH greater than 1m, including invertebrates, lower plants and fungi, that would be lost on removal of such trees, these felled trees would be retained in close proximity to nearby retained old mature/veteran trees, rather than be removed from site, in order to allow such species the chance to colonise retained habitat while the felled tree material dies. The dead wood would also provide habitat for a range of saprophytic organisms, increasing the biodiversity at the site.

5.4.404 Topsoil obtained from the wooded areas containing bluebell (Railway Line Wood 2 and the woodland to the north of the A55(T) adjacent to stream 6) would be re-used within proposed woodland planting areas. All topsoil from Railway Line Wood 2 would be used within the adjacent planting area (see Environmental Masterplan, Figure 7.2, Volume 1a), as this section of woodland also contains low levels of rhododendron that should not be moved to another area.

Hedgerows

Receptors Mitigated: Bat SACs, Hedgerows, Bats, Badgers, Polecat, Hedgehog, Breeding birds, Barn owl, Reptiles, Amphibians

- 5.4.405 A significant length of hedgerow would be removed as part of the Scheme (approximately 4.8km). The hedgerows that border the A55(T) are considered to be of low value in terms of their species composition, although they nevertheless act as wildlife corridors and foraging areas and are recognised as a priority habitat under Section 7 of the Environment (Wales) Act, an LBAP habitat and TREBAP habitat, as well as contributing to the surrounding landscape. New hedgerows would be planted using appropriate native broad-leaved species of local provenance where available (see Chapter 5.3: Landscape) to create a more diverse composition than currently exists. The hedgerow at the southwest end of the Scheme, along the northern boundary of the A55(T), would be retained.
- 5.4.406 The hedgerow along the northern boundary of the Roman Road within the corridor of the Scheme would be translocated; this is the only hedgerow affected to be classified as 'important' under the Hedgerow Regulations 1997 due to both its ecological diversity and historical importance. Additional hedgerows would be translocated between the Tai'r Meibion cattle underpass and Stream 6 (southern side of the A55(T)) and on either side of the Tai'r Meibion cattle underpass (northern side of the A55(T)). This would retain the mature state of these hedgerows, with associated benefits as a wildlife corridor and sheltered foraging route for bats and other species, along with the diversity of the hedgerow and any ground flora associated with them.
- 5.4.407 A new hedgerow would be planted along the northern side of the proposed county road, PMA and NMU route along the north side of the A55(T), creating a sheltered foraging corridor for bats and other wildlife, and where there are currently gaps within the hedgerows elsewhere within the scheme corridor, these would be infilled by planting new sections of hedgerow, in order to increase habitat connectivity.
- 5.4.408 The total length of hedgerow to be replanted/translocated/added due to the Scheme would be approximately 8.6km, compared to the 4.8km removed.
- 5.4.409 As described above, occasional individual specimens of mature oak and ash exist within the hedgerows on both sides of the A55(T) and would be lost to the Scheme. It is not proposed to replace these directly but to introduce small groups of trees within the hedgerow mix and maintain them to promote the establishment of these standard trees.

Overall Habitat Loss

- 5.4.410 Table 5.4.17 below provides a summary of the total areas of habitat lost and created due to the Scheme.

Table 5.4.17: Summary of habitat lost and created due to the Scheme

Habitat	Loss	Creation
Woodland	0.23ha (broad-leaved/mixed)	0.26ha (broad-leaved)
Scattered broad-leaved trees	0.13ha	0.26ha
Species-poor hedgerow	3.90km	1.62km
Species-rich hedgerow	0.86km	7.01km
Scrub	0.1ha	0.03ha
Open watercourse	70m	0
Pond	0	0.07ha
Species-rich grassland	0	5.87ha

Bats and Bat SACs

- 5.4.411 Access for bats would be retained through the cattle underpasses at Tai'r Meibion and Wig Farm, between sunset and sunrise during the construction period in order to avoid preventing bats (including lesser horseshoes) from using the underpasses and forcing them to fly over the A55(T) carriageway instead. It is acknowledged that it is likely to be necessary for a low level of obstruction to be present within the underpasses at some points, including shuttering for the underpass extensions. However, this would be kept to a minimum, with access retained overnight for bats at all times.
- 5.4.412 All boundary features removed during the construction period that lead into the cattle underpasses would be mitigated by the installation of suitable navigational features for bats, such as wooden hurdle fencing, that would be in place during night-time foraging throughout construction including the winter hibernation period as bats are still active then, especially during mild winter conditions. Temporary hurdle fencing would also be provided along the stock-proof fence between the Tai'r Meibion cattle underpass and Railway Line Wood 2.
- 5.4.413 NRW have confirmed that a European Protected Species licence for bats would not be required for the Scheme but that, to minimise disturbance of bats and impacts to commuting bat flight routes, there must be no artificial lighting or night time working during construction on the approaches to the underpasses or in the vicinity of the common pipistrelle roost at Tai'r Meibion. Site compounds, welfare units and generators would be positioned at least 150m away from these locations to minimise disturbance and any lighting of the carriageway would be directed away from these areas.
- 5.4.414 Construction monitoring of the underpasses would be undertaken to determine use of the cattle underpasses throughout the construction phase and monitor the success of construction mitigation. If the results suggest that further mitigation may be required, this would be agreed in consultation with NRW.
- 5.4.415 In order to minimise the loss of mature trees with bat roosting potential along the proposed route of the new PMA between Roman Road (Henffordd) and the A55(T), the route has been aligned to utilise the location of the existing fording point where it crosses the Afon Wig (Stream 5) and mature trees would be retained where possible throughout the corridor of the Scheme.
- 5.4.416 Prior to any trees being removed or managed, a full survey of all defects with potential to support roosting bats would be undertaken using an endoscope, and all retained trees would receive full tree protection measures according to BS5837:2012 in order to prevent damage or destruction of any tree roosts (see Environmental Masterplans, Figures 7.1 - 7.7, Volume 1a).
- 5.4.417 The loss of any trees that record a presence or potential for use by roosting bats would be fully mitigated by installing three suitably approved tree bat boxes for every tree lost, and the replanting of stock. There are likely to be approximately eight trees with bat roosting potential that would need to be removed due to the proposed works. Any actual roosts recorded would also require a bat licence to be obtained from NRW, and associated mitigation prior to removal. Trees with potential for use by roosting bats would be sectionally felled under an ecological watching brief by a licensed bat worker, following the erection of bat boxes.

Otter

- 5.4.418 As there is the potential for new otter resting sites to be established within or adjacent to the proposed scheme prior to construction, a pre-construction survey would be completed of the entire study area to determine the continued absence (or presence) of otter resting sites which may be located within close proximity to the scheme. Should any resting sites be

identified, the level of impact would be assessed and, if necessary, a European Protected Species licence obtained from NRW, along with associated mitigation.

5.4.419 Site compounds, welfare units, generators and construction lighting (where possible) would be positioned at least 30m away from the watercourses to minimise disturbance, with any construction lighting directed away from them where light spill is possible.

5.4.420 The pollution prevention measures described above would mitigate for the potential degradation of otter foraging habitat due to pollution of the watercourses during construction.

Badger

5.4.421 A licence from NRW would be obtained to destroy and/or disturb active badger setts which are in close proximity of the proposed works (within 30m of a sett entrance where heavy machinery is to be used).

5.4.422 The details of the licence would outline the specific mitigation measures required as part of working close to badger setts. However, at this stage it is considered likely that mitigation would include timing of the associated works to occur outside of the badger breeding season (December to June inclusive). An artificial sett would also be required to mitigate for the loss of an active sett and this would need to be constructed six months in advance of works to destroy this sett. Standard practice for sett exclusion would be followed, which would involve monitoring of all sett entrances for a minimum of three weeks until all animals appear to have left. The sett would subsequently be excavated, under the supervision of a suitably qualified ecologist, to confirm absence of any animals underground before the tunnel system is removed. Earthworks to remove topsoil and sub-soil in the area formerly occupied by the sett would be expected to take place immediately following excavation of the sett. A suitable area for the artificial sett has been identified and it is anticipated that the area required for this sett would be approximately 12m x 12m, due to the small size of the annexe sett to be lost. This area would subsequently be planted with native broad-leaved trees of local provenance to mitigate the impact from the clearance of this area of woodland. The new artificial badger sett will be developed within the scheme footprint and monitoring / aftercare will be undertaken on a minimum twice annual basis for one year post-construction, subject to agreement with NRW at the licence application stage; this requirement will be incorporated into the CEMP (Aftercare).

5.4.423 Construction phase lighting would be minimised in the vicinity of all remaining active badger setts, with screening where necessary to prevent light spill into these areas.

5.4.424 There is potential for new badger setts to be excavated by the local badger population prior to the commencement of construction works. A pre-construction survey would therefore be undertaken to ensure that any new setts are identified. This could lead to amendments to the licence and additional mitigation, which would be agreed with NRW.

5.4.425 Any excavations in the area would be covered overnight, where possible. Where this is not possible, open excavations would include ramps to ensure any mammals that enter them can escape.

5.4.426 Site compounds, welfare units and generators would be positioned at least 50m away from the locations of active badger setts to minimise disturbance.

5.4.427 The mitigation described for Trees and Woodland and Hedgerows above would mitigate for the loss of badger foraging habitat in the long term. The total area planted would be greater

than the area lost to help compensate for the loss of mature trees and time taken for the planting to establish.

Polecat and Hedgehog

5.4.428 The mitigation described for Trees and Woodland and Hedgerows above would mitigate for the loss of polecat and hedgehog foraging habitat in the long-term.

Breeding Birds including Red Kite

5.4.429 As described in mitigation for Trees and Woodland above, vegetation clearance would be undertaken outside of the main breeding bird season (between March and August inclusive) or, should this not be possible, under ecological supervision to confirm the absence of nesting birds immediately before any nesting habitat is removed. If the presence of nesting birds was confirmed, works would cease and a suitable buffer zone (to be agreed with the ecologist, but likely to be in the region of 300m for red kites) established until the young had fledged.

5.4.430 The loss of potential bird nesting and foraging habitat would be mitigated in the long term by the mitigation measures described in Trees and Woodland and Hedgerows above.

5.4.431 A red kite nest site survey would be undertaken in the spring prior to any scheduled works and each spring until the construction phase has been completed, to determine the location of any new nests that could potentially be disturbed by construction works. Should any such nest be identified works would be scheduled to avoid disturbance to the nest while it is active, with a suitable buffer zone (likely to be at least 300m) to be agreed with the ecologist.

Reptiles and amphibians

5.4.432 The translocation/removal of hedgerows, clearance of woodland and scrub and topsoil stripping in these areas would be done under a watching brief by a suitably qualified ecologist. Any reptiles or amphibians found to the north of the A55(T) would be relocated to an adjacent receptor site; the woodland adjacent to the site of Wig Bach. To the south of the A55(T), Coed Wern-Porchell is proposed as a receptor site for any reptiles found during site clearance to the south. Permission has also been obtained from Gwynedd Council to use Morfa Aber Nature Reserve (part of the Traeth Lafan County Wildlife Site) as an alternative reptile receptor site if required. Translocation would be carried out during temperatures greater than 5°C.

5.4.433 The loss of habitat due to potential degradation of the watercourses during construction and site clearance would be mitigated by the pollution prevention measures described in Pollution Prevention above.

Migratory Fish

5.4.434 Direct lighting of the watercourses that could support notable quantities of fish (*e.g.* Stream 5: Afon Wig) would be avoided where reasonably possible, particularly during periods when fish are likely to be spawning (generally 16th October to 16th May 2016). All lighting required for construction would be shielded and highly directional in the vicinity of all watercourses to ensure minimal light spill into these areas, with all site compounds, welfare units and generators positioned at least 30m away from any watercourse.

5.4.435 The Statutory Consents required for works within all of the watercourses within the corridor of the Scheme would provide details of mitigation required in each case, which could include a fish rescue for example. NRW have commented that this would be required within the Afon Wig (stream 5).

5.4.436 Disruption of habitat used by migratory fish due to construction pollution would be mitigated by the measures described in Pollution Prevention above.

Bluebell

5.4.437 As bluebell has been recorded within both Railway Line Wood 2 and the woodland adjacent to stream 6 to the north of the A55(T), all topsoil removed from these areas would be stored and reused within areas to be planted as woodland or hedgerows as discussed above. Topsoil from Railway Line Wood 2 would be used within the adjacent planting area (see Environmental Masterplan, Figure 7.2, Volume 1a), as this section of woodland also contains low levels of rhododendron that should not be moved to another area (see below).

5.4.438 Bluebell seed would also be included in the seed mix used for the creation of species-rich grassland within the verges in more shaded parts of the Scheme, such as areas to the north of hedgerows and woodland areas.

Rhododendron

5.4.439 All soil potentially contaminated with non-native invasive plant species, including the soil within Railway Line Wood 2, would be retained within the immediate vicinity of the area it was obtained from. Topsoil from Railway Line Wood 2 would be used in the proposed woodland planting area located on the opposite side of the new county road at this location (see Figure 7.3: Environmental Masterplan, Volume 1a). This would ensure that the spread of this Schedule 9 species is minimised.

5.4.440 Measures to treat, control and prevent the spread of *Rhododendron ponticum* (as shown on the Environmental Masterplan, Volume 1a) in Railway Line Wood 2 and the adjacent proposed planting area, would be included in the CEMP and HEMP (see Chapter 7: Environmental Management). These would include appropriate biosecurity measures to minimise the spread of this species.

Method of Delivery

5.4.441 The mechanism for ensuring delivery of construction mitigation would be through sensitive construction programming, the production of a Construction Environmental Management Plan (CEMP) and associated Method Statements, ongoing liaison with NRW and NMWTRA at the detailed design and construction stages, and through toolbox talks given to construction personnel by an ecologist/Environmental Clerk of Works (see Chapter 7: Environmental Management for further details). The Contractor's obligations relating to construction mitigation would be included in the Contract Documents and compliance would be managed through the development of the Contractor's Environmental Management System (EMS).

Operational Mitigation

Trees and Hedgerows

5.4.442 The construction phase mitigation for trees and hedgerows described above would mitigate the long-term loss of trees and hedgerows within the proposed scheme corridor eventually, although mitigation for the loss of very large/old mature trees such as the three large mature sessile oaks to be lost is not considered possible within a realistic timeframe. Therefore compensation measures have been proposed (see Compensation section below).

Rivers and Streams

5.4.443 Energy dissipation measures at the outfalls of all the culverts would reduce long-term erosion caused by changes to hydromorphology resulting from the extension and/or enlargement of the culverts.

5.4.444 No mitigation is possible for the loss of 70m of open watercourse due to the extension of the culverts. However, a number of other measures would help to compensate for this loss (see Compensation section below).

Bats and Bat SACs

5.4.445 The mitigation measures outlined in paragraphs 5.4.398 to 5.4.409 above for the construction phase, would also help to mitigate continued loss of bat foraging habitat, linear navigational features and roosting habitat during the operational phase of the Scheme, such as:

- Replanting, translocation or retention of affected hedgerows would ensure continued foraging/navigational habitat into the operational period, which would improve with time as replanted/translocated hedgerows mature/establish;
- Planting of woodland, scrub and scattered trees in various locations throughout the Scheme would help to mitigate loss of foraging habitat and eventually provide roosting habitat;

5.4.446 Post-construction monitoring would be undertaken to assess the level of use of the underpasses by bats during the operational period, with mitigation to be discussed with NRW if significant reductions occur.

5.4.447 The provision of three bat boxes for every tree lost with roosting bats or potential for roosting bats would mitigate the loss of roosting habitat from mature trees that require removal.

5.4.448 In addition to these measures the loss of mature trees, which would incur a long-term reduction in bat roosting and foraging habitat, would be compensated by the incorporation of replacement standard trees within the new hedgerows and 11 standard trees in an area to the north of the translocated Roman Road hedgerow in existing boundary features and field corners away from the road. (see Compensation section below).

Otter, Badger, Polecat, Hedgehog, Reptiles and Amphibians

5.4.449 Terrestrial mammals, reptiles and amphibians currently have few safe crossing points underneath the A55(T) within the proposed scheme corridor as the culverts are generally undersized with grilles and steep gradients and there are few underpasses, with the exception of the cattle underpasses at Tai'r Meibion and Wig. As part of the scheme design, a large culvert structure is proposed for the Afon Wig (Stream 5), which would enable many species to cross safely underneath the carriageway except at times of extreme flooding. However, this is balanced by the addition of a solid concrete safety barrier in the central reservation (in accordance with current highway standards) which could act to incidentally trap animals on the carriageway, increasing the risk of road mortality. As mitigation for this potential impact, the following is proposed:

- 200mm diameter holes would be provided at the base of the concrete barrier where the height difference between the two carriageways is not greater than 50mm. These would be located at least 50m apart and positioned to coincide with areas without mammal fencing and areas more likely to be used by badgers and otters where possible. 125mm diameter holes, that would be suitable for use by polecats, hedgehogs, reptiles and amphibians, would be provided at more frequent intervals where possible;
- A mammal ledge would be provided along each side of the large box culvert proposed for the Afon Wig (Stream 5). These would facilitate the passage of mammals, reptiles and amphibians under the A55(T) at this location, particularly at times of high rainfall and spate flows and would be positioned at or above 1 in 40 year flood event levels;
- Dry pipes (900mm diameter) would be incorporated in the vicinity of the culverts at Streams 2 and 6. These would facilitate the passage of all these species under the A55(T) at these locations, particularly as the pipes would be accessible and dry at times of high rainfall and spate flows above and beyond 1 in 100 year flood event levels;
- The existing stock-proof grilles over the culvert at stream 6 would be replaced with stock-proof grilles adapted to allow access by otters and badgers;

- Otter and badger resistant fencing would be provided throughout the length of the scheme in strategic locations such as likely crossing points (see Figures 7.1 – 7.7, Environmental Master Plans, Volume 1a).

5.4.450 Without mitigation badgers, polecats, hedgehogs, reptiles and amphibians would continue to suffer a reduction in foraging habitat well into the operational phase of the proposed scheme. The mitigation for loss of trees and hedgerows described in paragraphs 5.4.398-409, including translocation/replanting of hedgerows and new woodland, scrub and hedgerow planting, would help to mitigate this loss in the long-term.

Breeding Birds

5.4.451 The proposed planting described in paragraphs 5.4.400-402 above would mitigate loss of suitable breeding bird nesting habitat in the long term.

Barn Owl

5.4.452 The replanting or translocation of all hedgerows, including filling in any existing gaps and planting of woodland and scattered trees adjacent to the A55(T) carriageway, as described in paragraphs 5.4.398-409 above, would help to encourage barn owls to fly higher over the A55(T) carriageway, particularly in the longer term when the planting has become established. This would provide a greater length of wooded or tree-lined carriageway than exists at present.

Migratory Fish

5.4.453 Of the culverts underneath the A55(T) within the corridor of the Scheme, only the one at stream 2 is potentially suitable for fish passage at present, although it is unlikely to support a significant population of fish due to the small size of this watercourse. The loss of approximately 44m of potential habitat for migratory fish due to the extension of the culverts would be mitigated by energy dissipation measures downstream and regrading with baffles and weirs upstream to potentially allow fish passage through culverts 5 and 6. The regraded habitat would extend for approximately 15-20m upstream of the culverts in order to produce a more gradual descent into the culvert and a channel as hydrologically and morphologically similar to a natural stream channel as possible, with mechanisms to encourage the accumulation of natural bed material. These watercourses are more suitable for migratory fish and access to upstream habitat within them would therefore mitigate the overall loss of open watercourse downstream of each culvert. The energy dissipation measures downstream would also help to reduce erosion in the long-term, improving the habitat downstream for fish and other aquatic species.

5.4.454 Further enhancement may be possible/required in addition to that described above, under the Eels Regulations 2009. This would be agreed with NRW at the detailed design stage but could include measures such as:

- including combinations of low flow channels and baffles within culverts to facilitate movements of migratory fish during varying flow conditions;
- matching culvert gradient with the stream gradient where possible to minimise changes in stream hydraulics which may affect fish passage;
- the provision of outlet pools as a means of raising tailwater levels and avoiding extensive erosion protection works at the outlet. These pools provide resting places for migratory fish prior to negotiating the culvert. Inlet resting pools may also be required in certain situations;
- approach conditions should be within the cruising ability of the fish in the watercourse, and;
- installation of eel passage structures to encourage passage during periods of increased flows and turbidity.

Method of Delivery

5.4.455 The mechanism for ensuring delivery of operational mitigation would be through the CEMP and subsequent HEMP (Handover Environmental Management Plan), along with ongoing liaison with NRW and NMWTRA (see Chapter 7: Environmental Management for further details).

Table 5.4.18: Summary of Residual Effects on Important Ecological Features

Ecological Feature	Description of Impact	Nature (Positive/Negative) and Scale of Significance Without Mitigation	Mitigation Proposed	Nature of Impact (Positive/Negative) and Scale of Significance of Residual Effect	Compensation (if required)
Sites:					
Traeth Lafan SPA and Y Fenai a Bae Conwy SAC	Degradation of habitats associated with the features of these protected sites arising from siltation and pollution incidents during construction that are not properly managed	Negative: Local	<p>The following best practice mitigation measures would be applied prior to and during construction via the CEMP:</p> <ul style="list-style-type: none"> • PPG and CIRIA guidance would be followed when working in/near to watercourses. The mechanism for ensuring the delivery would be through the CEMP and associated Method Statements for the works, to be agreed in advance with NRW. The CEMP would include regular monitoring of surface water quality during construction. In addition, a plan to deal with environmental (and other) emergencies would also be put in place. • Dust generation during construction activities would be controlled using best practice measures (see Chapter 5.1: Air Quality). • Statutory Drainage Consents would be required for works associated with all of the watercourses within the proposed scheme corridor. All mitigation described within these consents would be undertaken, including pollution prevention measures. • Construction personnel would be made aware of the sensitive environment of the works through toolbox talks provided by a suitably qualified Environmental Manager or Environmental Clerk of Works, as appropriate. 	Negative: Not Significant	Not required
Bat SACs: Mwyngloddiau Fforest Gwydir SAC; Coedydd Derw a Safleoedd Ystlumod Meirion SAC; Glynllifon SAC	Severance of lesser horseshoe bat flight paths through the cattle underpasses due to obstruction or loss of connecting habitat (hedgerows/boundary features). This could potentially lead to bats	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> • Any obstructions in the vicinity of the cattle underpasses to be removed between sunset and sunrise during construction. • Site facilities to be located at least 150m away from cattle underpasses and any construction lighting directed away from them. • Any boundaries leading into the cattle underpasses that are lost, to be replaced by temporary navigational features (such as hurdle fencing) during construction until navigational 	Negative: Not Significant	Not required

	flying over the carriageway and associated risk of mortality		<p>features are restored. Hurdle fencing also to be provided between the Tai'r Meibion cattle underpass and Railway Line Wood 2.</p> <p><u>Operation:</u></p> <ul style="list-style-type: none"> • Translocating/re-planting hedgerows in the vicinity of the cattle underpasses • Post-construction monitoring to ensure continued level of use of underpasses by bats, with mitigation to be discussed with NRW if significant reductions occur 		
Traeth Lafan SSSI	Degradation of habitats associated with the features of this protected site arising from siltation and pollution incidents during construction that are not properly managed	Negative: Local	Same as for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above	Negative: Not Significant	Not required
Traeth Lafan LNR	Degradation of habitats associated with the features of this site arising from siltation and pollution incidents during construction that are not properly managed	Negative: Local	Same as for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above	Negative: Not Significant	Not required
Railway Line Wood 2 County Wildlife Site	Loss of approximately 515m ² or 0.05ha of mature mixed woodland from railway Line Wood 2, constituting a 2% loss from a site of 2.8ha	Negative: Local	<ul style="list-style-type: none"> • Tree protection measures in accordance with BS5837:2012 would be utilised to prevent damage to all retained trees during construction • Planting total area of 0.26ha of native broad-leaved woodland in a number of locations to the north and south of the A55(T) 	Negative to neutral (by Year 20 - 30): Not Significant	Not required
Coed Bryn Meddyg County	Construction damage to a 40m strip of semi-	Negative: Local	<ul style="list-style-type: none"> • Tree protection measures in accordance with BS5837:2012 would be utilised to prevent damage to all retained trees 	Negative: Not Significant	Not required

Wildlife Site	mature trees along the edge of the site, of which the Scheme runs through the root protection areas		during construction <ul style="list-style-type: none"> Planting total area of 0.26ha of native broad-leaved woodland in a number of locations to the north and south of the A55(T) 		
Railway Line Wood 1, Railway Line Wood 2, Glan-y-Mor Isaf Copses, Wig Crossing and Traeth Lafan County Wildlife Sites	Degradation of habitats associated with these sites arising from siltation and pollution incidents during construction that are not properly managed	Negative: Local	Same as for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above	Negative: Not Significant	Not required
Habitats:					
Trees and Hedgerows	Loss of trees and hedgerows (4.8km)	Negative: Local	<ul style="list-style-type: none"> Replanting (with species-rich native broad-leaved hedgerows), translocation or retention of all hedgerows Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) so that the total length of all hedgerows translocated/replanted/added would be 8.6km Planting of native broad-leaved woodland (0.26ha), scrub (0.03ha) and scattered trees (0.26ha) in a number of locations to the north and south of the A55(T) to provide a larger area of trees than the area lost Loss of semi-mature or mature standard trees within the hedgerows to be removed adjacent to the A55(T) to be replaced by small groups of young native trees to be managed as standards within new/translocated hedgerows The three large mature oaks that would be removed from within the Roman Road hedgerow (two) and adjacent to the Afon Wig to the north of the A55(T) (one) to be retained on site in close proximity to retained large mature/veteran trees in order to allow some of the associated species to recolonize existing habitat 	Negative: Local	Loss of 3 large mature oaks to be compensated by planting of trees within field corners and boundaries to the north of Roman Road, to be managed as standard trees (approximately 11 standard trees proposed after thinning)

Lowland Mixed Deciduous Woodland	Loss of 0.23ha mixed woodland and potential construction damage to retained trees	Negative: Local	<ul style="list-style-type: none"> Planting of 0.26ha of native broad-leaved woodland to replace the 0.22ha mixed/broad-leaved woodland lost Tree protection measures in accordance with BS5837:2012 would be utilised to prevent damage to all retained trees during construction 	Negative to neutral (by Year 20 - 30): Not Significant	Not required
Rivers and Streams	Degradation of the watercourses within the corridor of the Scheme arising from siltation and pollution incidents during construction that are not properly managed	Negative: Local	Same as for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above	Negative: Not Significant	Not required
	Changes to hydromorphology of the watercourses due to extension or enlargement of the culverts leading to increased erosion	Negative: Local	Energy dissipation measures at the outfalls of the culverts to prevent flooding downstream would reduce erosion rates	Negative: Not Significant	Not required
	Loss of approximately 70m of open watercourse in total due to extension of the culverts, including loss of the natural stream bed	Negative: Local	None possible	Negative: Local	The improvement of 200m of stream 8 due to the reduction in erosion caused by the geotextile lining and measures to improve access for migratory fish and other aquatic animal species to the south side of the A55(T) would compensate for this loss. The proposed

					detention pond would also provide additional aquatic habitat
	Reduction in erosion in Stream 8 downstream of the Scheme due to geotextile lining likely to improve conditions for plant and animal species	Positive: Local	Not applicable	Positive: Local	Not required
Species:					
Bats	Disturbance of the common pipistrelle roost at Tai'r Meibion during construction	Negative: Local	<ul style="list-style-type: none"> Location of any site facilities to the south of the A55(T) at least 150m away from the Tai'r Meibion roost No night-time working or lighting in the vicinity of the roost and any required for works on the carriageway to be directed away from the roost 	Negative: Not Significant	Not required
	Severance of bat flight paths through the cattle underpasses due to obstruction during construction or loss of connecting habitat. This could potentially lead to bats flying over the carriageway and associated risk of mortality	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> Cattle underpasses to be kept open and free of significant obstruction between sunset and sunrise throughout the construction period Site facilities to be located at least 150m away from cattle underpasses and any construction lighting directed away from them Any boundaries leading into the cattle underpasses that are lost, to be replaced by temporary navigational features (such as hurdle fencing) during construction until navigational features are restored. Hurdle fencing also to be provided between the Tai'r Meibion cattle underpass and Railway Line Wood 2 <p><u>Operation:</u></p> <ul style="list-style-type: none"> Translocating/re-planting hedgerows in the vicinity of the cattle underpasses Post-construction monitoring to ensure continued level of use of underpasses by bats, with mitigation to be discussed with NRW if significant reductions occur 	Negative: Not Significant	Not required

	Loss of foraging habitat and other navigational features	Negative: Local	<ul style="list-style-type: none"> • Replanting (with species-rich native broad-leaved hedgerows), translocation or retention of all hedgerows • Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) to create an additional sheltered foraging corridor • Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost 	Negative to positive (by Year 20 - 30): Not significant	Not required, but the proposed detention pond would help to compensate for loss of foraging habitat in addition to the improvement of 200m of stream 8
	Loss/disturbance of potential roosting habitat within trees	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> • Full endoscope survey of all mature trees to be removed prior to their removal and trees immediately adjacent to the proposed works. For each tree with bats or potential for bats recorded, three tree bat boxes to be erected within suitable habitat nearby and suitable replacement tree stock planted • Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker • If actual roosts recorded during endoscope survey, an EPS disturbance licence for bats to be obtained from NRW and associated mitigation undertaken <p><u>Operation:</u></p> <ul style="list-style-type: none"> • Planting of native broad-leaved woodland and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than that lost • Loss of mature standard trees within the hedgerows to be removed adjacent to the A55(T) to be replaced by small groups of young native trees to be managed as standards within new/translocated hedgerows 	Negative: Not significant	Not required, but see compensation for loss of mature trees in Trees and Hedgerows above
	Improved access underneath the carriageway due to enlarged culvert for the Afon Wig	Positive: Local	Not applicable	Positive: Local	Not required

Otters	Disturbance to otters passing along the watercourses during construction	Negative: Local	<ul style="list-style-type: none"> • Pre-construction survey to check for resting places and associated mitigation if any found in close proximity to proposed works • Location of site facilities at least 30m away from any watercourse • Minimal lighting in vicinity of watercourses and all construction lighting directed away from watercourses 	Negative: Not Significant	Not required
	Degradation of foraging habitat due to pollution of watercourses during construction	Negative: Local	Same as for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above	Negative: Not Significant	Not required
	Increased risk of mortality of otters crossing the carriageway during operation due to new concrete safety barrier in central reserve trapping animals on carriageway	Negative: Local	<ul style="list-style-type: none"> • Provision of 200mm diameter holes in the safety barrier at a minimum of 50m intervals where the height difference each side of the barrier is less than 50mm. <p>Improved access underneath the A55(T) due to:</p> <ul style="list-style-type: none"> • Mammal ledges/shelves within enlarged culvert at Stream 5 (Afon Wig) • Dry pipes at Streams 2 and 6 • Use of otter/badger accessible grilles over culvert mouths at Stream 6 to replace existing grilles • Mammal-proof fencing to guide animals towards safe crossing points and away from the A55(T) 	Positive: Local	Not required
	Improved access underneath the carriageway during operation due to enlarged culvert for the Afon Wig	Positive: Local	Not applicable	Positive: Local	Not required
	Increase in foraging habitat due to the provision of a detention pond	Positive: Local	Not applicable	Positive: Local	Not required

Badgers	Loss of badger setts during site clearance / earthworks	Negative: Local	Badger licence and associated mitigation, expected to include: <ul style="list-style-type: none"> • Provision of an artificial sett 6 months in advance of sett closure • Sett closure according to standard guidelines, including 3 weeks' monitoring prior to destruction under ecological supervision • Sett destruction and all licensed works within vicinity of active badger setts to be undertaken between July and November inclusive (outside badger breeding season) 	Negative: Not Significant	Not required
	Disturbance to badgers in setts to be destroyed and in retained setts close to the scheme	Negative: Local	As above and: <ul style="list-style-type: none"> • Construction lighting minimised in vicinity of remaining active setts • Site compounds, welfare units and generators to be positioned at least 50m away from the locations of active badger setts 	Negative: Not Significant	Not required
	Mortality of badgers due to construction activities and increased risk of mortality during operation due to concrete safety barrier in central reserve	Negative: Local	<u>Construction:</u> <ul style="list-style-type: none"> • Pre-construction survey to check for further active setts • Covering any excavations or providing an egress for trapped animals • Location of site facilities at least 50m away from remaining active setts <u>Operation:</u> <ul style="list-style-type: none"> • Provision of 200mm diameter holes in the safety barrier at a minimum of 50m intervals where the height difference each side of the barrier is less than 50mm Improved access underneath the A55(T) due to: <ul style="list-style-type: none"> • Mammal ledges/shelves within enlarged culvert at Stream 5 (Afon Wig) • Dry pipes at Streams 2 and 6 • Use of otter/badger accessible grilles over culvert mouths at Stream 6 to replace existing grilles • Mammal-proof fencing to guide animals towards safe crossing points and away from the A55(T) 	Positive: Local	Not required
	Loss of foraging habitat	Negative: Local	<ul style="list-style-type: none"> • Replanting (with species-rich, native broad-leaved hedgerows), translocation or retention of all hedgerows 	Negative to positive (by Year 20 - 30):	Not required

			<ul style="list-style-type: none"> Planting of an additional hedgerow along the northern side of proposed county road and NMU route to the north of the A55(T) Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost 	Not significant	
	Improved access underneath the carriageway due to enlarged culvert for the Afon Wig	Positive: Local	Not applicable	Positive: Local	Not required
Polecat and Hedgehog	Loss of foraging habitat	Negative: Local	<ul style="list-style-type: none"> Replanting (with species-rich, native broad-leaved hedgerows), translocation or retention of all hedgerows Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost 	Negative to positive (by Year 20 - 30): Not significant	Not required, but the proposed detention pond would provide additional foraging habitat in addition to the improved 200m section of stream 8
	Risk of increased mortality of polecats and hedgehogs crossing the carriageway due to new concrete central reserve safety barrier	Negative: Local	<ul style="list-style-type: none"> Provision of 200mm diameter holes in the safety barrier at a minimum of 50m intervals where the height difference each side of the barrier is less than 50mm Provision of 125mm diameter holes in the barrier wherever possible <p>Improved access underneath the A55(T) due to:</p> <ul style="list-style-type: none"> Mammal ledges/shelves within enlarged culvert at Stream 5 (Afon Wig) Dry pipes at Streams 2 and 6 	Positive: Local	Not required
	Improved access underneath the A55(T) using improved larger culvert for the Afon Wig (stream 5),	Positive: Local	Not applicable	Positive: Local	Not required

	reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)				
Breeding Birds	Destruction of active nests and/or disturbance of nesting birds during site clearance	Negative: Local	Vegetation removal outside breeding bird season (between March and August inclusive) or ecologist check for active nests immediately prior to removal	Neutral	Not required
	Loss of potential nesting and foraging habitat	Negative: Local	<ul style="list-style-type: none"> • Replanting (with species-rich, native broad-leaved hedgerows), translocation or retention of all hedgerows • Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) • Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost 	Negative to positive (by Year 20 - 30): Not significant	Not required
Red Kite	Potential disturbance of the nest site of a Schedule 1 bird due to construction activities	Negative: Local	<ul style="list-style-type: none"> • Pre-construction and construction checks for red kite nests in the vicinity of the proposed works particularly near Roman Road, in the spring prior to any scheduled works in this area. • If any active red kite nests are found that could be disturbed, construction activities to be programmed to avoid the area during the nesting period 	Neutral	Not required
Barn Owl	Increased traffic speeds due to wider carriageway and loss of trees/woodland adjacent to the carriageway increasing the risk of road traffic mortality during operation	Negative: Local	<ul style="list-style-type: none"> • Replanting, translocation or retention of all hedgerows • Planting of woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) which would provide a greater length of wooded or tree-lined carriageway than exists at present, helping to encourage owls to fly higher over the carriageway 	Negative to positive (by Year 20 - 30): Not significant	Not required

Reptiles and amphibians	Injury/mortality during site clearance works	Negative: Local	<ul style="list-style-type: none"> Ecological Watching Brief during the translocation/removal of hedgerows, clearance of woodland and scrub and topsoil stripping in these area Translocation of any reptiles/amphibians found to a suitable receptor site 	Negative: Not Significant	Not required
	Loss of habitat due to site clearance and/or degradation during construction due to pollution of watercourses during construction	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> Same as for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above <p><u>Operation:</u></p> <ul style="list-style-type: none"> Replanting (with species-rich native broad-leaved hedgerows), translocation or retention of all hedgerows Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost 	Negative: Not Significant	Not required, but the loss of 70m of open watercourses due to the extended culverts would be compensated by the provision of a detention pond to the north of the A55(T) adjacent to stream 6, and also the improvement of 200m of habitat within stream 8
	Increased risk of road mortality due to concrete safety barrier	Negative: Local	<ul style="list-style-type: none"> Provision of 200mm diameter holes in the safety barrier at a minimum of 50m intervals where the height difference each side of the barrier is less than 50mm Provision of 125mm diameter holes in the barrier wherever possible <p>Improved access underneath the A55(T) due to:</p> <ul style="list-style-type: none"> Mammal ledges/shelves within enlarged culvert at Stream 5 (Afon Wig) Dry pipes at Streams 2 and 6 	Negative: Not Significant	Not required
Migratory Fish	Injury/mortality of fish during in-river works	Negative: Local	Statutory Consents and associated mitigation for working in watercourses, expected to include fish rescues where required (e.g. Afon Wig)	Neutral	Not required
	Disturbance/disruption to fish and their habitats, due to	Negative: Local	<ul style="list-style-type: none"> Pollution prevention measures as described for Traeth Lafan SPA and Y Fenai a Bae Conwy SAC above Direct lighting of watercourses that could support migratory 	Negative: Not Significant	Not required

	construction activities including pollution risk and mobilisation of suspended solids		<p>fish (e.g. Afon Wig) to be avoided where possible, particularly during spawning season (generally 16th October to 16th April)</p> <ul style="list-style-type: none"> All construction lighting in vicinity of watercourses to be shielded and directed away from watercourses All site compounds, welfare units and generators to be located at least 30m away from watercourses 		
	Loss of 44m of potential stream habitat due to culvert extensions	Negative: Local	<ul style="list-style-type: none"> Energy dissipation measures would be installed at the discharge outfall of all the watercourses to reduce erosion, minimising habitat lost Improvements to fish passage through culverts at streams 5 and 6 due to energy dissipation measures downstream and a regraded channel upstream with baffles and weirs to create habitat suitable for fish passage – this would increase habitat available to fish through improved passage and also reduced erosion 	Positive: Local	Not required
Bluebell	Loss of bluebells currently present within wooded areas and scattered within the verges	Negative: Local	<ul style="list-style-type: none"> Topsoil from wooded areas containing bluebell bulbs to be re-used in areas of proposed planting Seed mix containing bluebell to be used in the more shaded areas of the Scheme Planting of native broad-leaved woodland in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost would provide additional habitat for the species 	Neutral	Not required
Rhododendron	Potential for <i>Rhododendron ponticum</i> to be spread more widely in the vicinity of the Scheme due to construction activities	Negative: Local	<ul style="list-style-type: none"> Topsoil from wooded areas potentially contaminated with Rhododendron seed (Railway Line Wood 2) to be re-used in adjacent areas of proposed planting and not moved to another location Measures to treat, control and prevent the spread of Rhododendron within the footprint of the Scheme to be included in the CEMP and HEMP 	Negative: Not significant	Not required

Residual Environmental Effects and Compensation

5.4.456 As described in the CIEEM (2016) guidance, the significance of any residual effects relate to the Scheme as a whole (*i.e.* construction and operation combined) as summarised in Table 5.4.18 above. They are described below, with measures to compensate for these effects explained where relevant.

Woodland, Trees and Hedgerows

5.4.457 Following completion of the Scheme, a residual adverse effect would remain on woodland, trees and hedgerows as new planting would not mature sufficiently to represent an effective reinstatement of these habitats for a number of years. This would lead to a continued loss of habitat for breeding birds, bats (foraging and roosting habitat), badgers, polecats, hedgehogs, reptiles and amphibians. It is considered that this residual adverse impact would change from a locally negative to a neutral impact within 20 – 30 years following planting. It is eventually likely to become a locally positive impact due to the larger area of woodland and scattered trees, improved diversity of the proposed hedgerows, infilling of existing gaps and additional hedgerows.

5.4.458 The loss of very mature trees such as the three sessile oaks with a diameter at breast height (DBH) greater than 1m, cannot be mitigated within a reasonable timeframe due to their age. Although the retention of the felled trees in close proximity to other retained trees of a similar age, would help to retain some of the biodiversity associated with them and reduce the impact slightly, it would not mitigate for their loss completely. Therefore a negative impact of local significance would remain.

Compensation

5.4.459 The loss of the three large mature trees would be compensated by the planting of six individual trees within nearby existing field boundary hedgerows to the north of Roman Road (Henffordd) and planting four field corners adjacent to Roman Road (Henffordd) with saplings to be thinned after ten years and managed to produce four or five further standard trees in these areas. These would all be maintained as standard trees. Planting of standard trees away from the road would help to ensure their retention and development into large mature standard trees that would not be affected by highway maintenance procedures such as flailing that could inhibit growth.

Rivers and Streams

5.4.460 There would be a residual loss of 70m of open channel due to the extension of the culverts. This is considered to be a negative impact of local significance.

5.4.461 The addition of a geotextile lining to stream 8 for 200m downstream of the A55(T) would constitute a positive impact of local significance as this would reduce the erosion of this watercourse and therefore improve conditions for aquatic species, particularly due to the nature of the geotextile, which would trap sediment and include perforations to allow vegetation to grow through the membrane.

Compensation

5.4.462 As part of the scheme drainage design, the proposed detention pond at the site of Wig Bach adjacent to stream 6 to the north of the A55(T), would provide additional aquatic habitat that would help to compensate for the loss of 70m of open channel watercourse elsewhere (see Chapter 5.10: Road Drainage and the Water Environment).

Bats

5.4.463 There is likely to be a residual negative impact on bats in the short-term due to loss of foraging and commuting habitat during construction, although this would be reduced by the mitigation measures proposed including translocation of selected hedgerows, retention of the hedgerow on

the north side of the A55(T) at the western end of the Scheme and provision of temporary navigational features where they are lost in the vicinity of the important crossing points identified at the two cattle underpasses. The proposed planting of woodland, trees, hedgerows and scrub would negate any impact on foraging habitat in the long term, with a positive impact eventually due to the greater area of woodland, trees and hedgerows that would remain.

5.4.464 There would be a residual positive impact during operation of the Scheme due to the enlarged culvert that would be provided for the Afon Wig (stream 5), likely to be used as a safe crossing point underneath the A55(T) by bats foraging/commuting along the Afon Wig.

Compensation

5.4.465 As part of the scheme drainage design, the proposed detention pond at the site of Wig Bach adjacent to stream 6 to the north of the A55(T), would provide additional foraging habitat that would help to compensate for the short-term residual loss of foraging habitat due to vegetation clearance (see paragraph 5.4.457 above).

Otters, Badgers, Polecats and Hedgehogs

5.4.466 It is considered that the adverse impact potentially caused by the proposed concrete central reserve safety barrier trapping animals such as badgers, otters, polecats and hedgehogs on the carriageway would be reduced by the provision of 200mm diameter holes at 50m intervals, and (for smaller animals) 125mm diameter holes at more frequent intervals, where the topography allows, and that any residual increase in risk would be more than balanced by the improved access underneath the A55(T) due to the larger culvert with ledges/shelves for stream 5 (Afon Wig), 900mm diameter dry pipes at streams 2 and 6, and replacement of inaccessible grilles at stream 6 with grilles suitable for otter and badger passage at times of low flow. In association with otter- and badger-resistant fencing to guide the animals towards these crossing points, it is considered that a beneficial impact is likely to remain for otters, badgers, polecats and hedgehogs, of local significance. These measures would also benefit reptiles and amphibians.

5.4.467 A detention pond would be constructed at the site of Wig Bach adjacent to stream 6, to the north of the A55(T), due to the drainage network having to accommodate a large catchment area of rural runoff from the fields to the south. This would provide a residual beneficial impact to a number of species in terms of a seasonally variable area of standing water providing habitat for amphibians and invertebrates and thereby creating additional foraging habitat for bats, otters, badgers, polecats and hedgehogs. Birds and reptiles could also benefit from this new area of habitat, particularly with sympathetic planting and sensitive management.

Migratory Fish

5.4.468 A positive residual impact would remain for migratory fish (including eels) due to improved passage along watercourses 5 and 6 as a secondary benefit of providing energy dissipation measures downstream to reduce the flow rate and subsequent erosion, in addition to regrading the channel of these watercourses for approximately 15-20m upstream with a series of baffles and weirs to create a more natural, gradual descent into these culverts. There could also be further improvements to the watercourses arising from further discussion with NRW at the detailed design stage, in association with the Eels Regulations 2009.

Cumulative Effects

5.4.469 Cumulative effects on ecological features in combination with other schemes and also incremental effects due to different aspects of the Scheme have been assessed in Chapter 6.0: Assessment of Cumulative Effects. Incremental effects from within the Scheme on the important ecological features, due to mitigation for other topics within this document, including Landscape and Road Drainage and the Water Environment, have been assessed within this chapter.

Ecological Enhancement

5.4.470 The ecological enhancement proposals detailed in this section do not mitigate impacts of the project, and are not included within the ecological impact assessment as mitigation or compensation measures. These proposals represent additional measures of benefit to nature conservation that have been included to add value to the biodiversity of the proposed scheme corridor, and may contribute to the fulfilment of the project proponent's 'biodiversity duty' in accordance with the Environment (Wales) Act and the use of best practice for biodiversity in the development of the trunk road network, in accordance with the objectives of the TREBAP.

Drainage

Amphibians

5.4.471 Where kerbs are proposed, amphibian-friendly gully pots would be used to reduce amphibian and reptile mortality, along with sympathetic kerb design to allow amphibians and reptiles to escape from the road to the surrounding area. The design of these features would be finalised at the detailed design stage, in consultation with NRW and NMWTRA.

Rivers and streams, Aquatic species, Traeth Lafan SPA, Y Fenai a Bae Conwy SAC, Traeth Lafan SSSI and Traeth Lafan LNR

5.4.472 As part of the Scheme, pollution control points for accidental spillages would be installed at the outfalls of each watercourse flowing underneath the A55(T) within the corridor of the Scheme. Subject to agreement with NRW at the detailed design stage, these are likely to include a chamber and isolation valve that would cut off flows from the highway, with the ability to be triggered remotely within a few seconds. They would be stand-alone units with solar and battery powered operation to prevent vulnerability to power outages. These devices would effectively protect downstream habitats, species and sites from accidental spillages occurring on the A55(T) during operation, such as fuel, chemicals or organic substances. This would provide an enhancement in terms of a reduced risk of future pollution for rivers and streams, aquatic species, Traeth Lafan SPA, Y Fenai a Bae Conwy SAC, Traeth Lafan SSSI and Traeth Lafan LNR within the Zone of Influence of the Scheme.

Verge seeding

Creation of Species-rich Grassland

5.4.473 Following discussions with the NMWTRA ecologist it is proposed that, where possible, the finished highway verges would not be top-soiled but would be left as sub-soil to reduce their fertility, and all verges and grassed areas not being returned to agriculture would be seeded with an appropriate species-rich seed mix of locally-occurring fine grasses and wildflower seed, including yellow rattle (*Rhinanthus minor*) to increase species diversity due to its parasitism on grasses. The seed mix would include spring-flowering species such as bluebell, primrose, cowslip and wood anemone, as well as summer-flowering species, to ensure a supply of pollen and nectar for pollinator species throughout the flowering season. Appropriate management would subsequently be followed to encourage wildflower growth.

5.4.474 During the detailed design stage, appropriate seed mixes would be established in consultation with the NMWTRA ecologist based on the conditions at each of the proposed locations (*e.g.* damp/dry/shaded). See also Chapter 5.3: Landscape. This would result in the creation of approximately 5.87ha of species-rich grassland.

5.4.475 This enhancement measure would also provide a benefit for ecosystem services, described as '*the benefits that people derive from the natural environment*' in the CIEEM (2016) guidelines, due to the benefits to pollinators, an essential component of agriculture in Wales. As described in the

Wales Action Plan for Pollinators (2013), honey bees and wild pollinators including bumblebees, solitary bees, parasitic wasps, hoverflies, butterflies, moths and some beetles are important pollinators in Wales for crops such as fruit and oilseed rape, clovers and other nitrogen-fixing plants that are important to improving the productivity of pasture systems for livestock grazing and wildflowers.

Provision of nesting habitat

Breeding birds

- 5.4.476 Riparian bird nest boxes would be attached to the headwalls of culverts where possible, such as on the Afon Wig culvert, to provide additional habitat for riparian bird species such as grey wagtail and dipper. Subject to landowner agreement, nest boxes suitable for use by a range of tree-nesting bird species would also be erected within woodland areas identified for other ecological mitigation.

Management of Railway Line Wood 2

Railway Line Wood 2 County Wildlife Site, Lowland mixed deciduous woodland, Bats, Breeding birds, Bluebell and Rhododendron

- 5.4.477 Subject to landowner agreement, it is proposed that a five year management plan would be implemented to improve the broad-leaved woodland habitat within Railway Line Wood 2 County Wildlife Site by controlling the rhododendron and infilling any gaps created by planting native broad-leaved species of local provenance, such as birch species (*Betula pendula* and/or *Betula pubescens*), sessile oak (*Quercus petraea*) and holly (*Ilex aquifolium*). This would also improve the woodland habitat for other species such as bats and birds, due to the greater number of invertebrate species associated with native broad-leaved trees and also for bluebells that need light during the winter months.

Monitoring

- 5.4.478 Ecological monitoring pre-, during and post-construction is proposed in order to confirm the effectiveness of the mitigation measures described above. For some receptors, the ecological monitoring would be combined with monitoring for landscape reasons (*i.e.* assessing the success of planting). Some monitoring would be required for any species derogation licences obtained for the construction of the scheme. Ecological monitoring associated with the Scheme should include:

Pre-construction:

- Bat surveys to monitor activity within the cattle underpasses between the advance and main works throughout the active season;
- Emergence survey of the common pipistrelle roost at Tai'r Meibion to update the baseline to assess further monitoring against in terms of the effectiveness of construction mitigation;
- Badger survey to confirm locations of active setts within the corridor of the Scheme;
- Otter survey to confirm the absence/presence of any holts or resting sites within the vicinity of the Scheme; and
- Red kite survey in spring to check for nest sites in the vicinity of the Scheme.

During construction:

- Monitoring of bat activity through the cattle underpasses (manual surveys during the active season and static monitoring throughout construction, including winter);
- Monitoring of the Common pipistrelle roost at Tai'r Meibion within the active season;
- Monitoring use of the artificial badger sett and other badger activity within the corridor of the Scheme;
- Monitoring of otter activity in the vicinity of the Scheme;

- Monitoring of any bat boxes erected as mitigation for loss of actual or potential roosting habitat in August-October;
- Red kite surveys in spring to check for nest sites in the vicinity of the Scheme; and;
- Monitoring of the surface water quality of the watercourses affected by the Scheme.

Post-construction:

- Monitoring of bat activity through the cattle underpasses for a period of 12 months;
- Monitoring of the common pipistrelle roost at Tai'r Meibion;
- Monitoring of the enlarged Afon Wig culvert for bats, otters, badgers, polecats, hedgehogs and any other wildlife;
- Monitoring of the dry pipes at streams 2 and 6 for otters, badgers, polecats, hedgehogs and any other wildlife;
- Monitoring use of the artificial badger sett and other badger activity within the corridor of the Scheme, and particularly in the vicinity of new crossing points provided as mitigation;
- Monitoring of otter activity in the vicinity of the Scheme and particularly in the vicinity of new crossing points provided as mitigation;
- Monitoring of bat boxes erected as mitigation for loss of actual or potential roosting habitat;
- Monitoring the mammal fencing and proposed crossing points beneath the A55(T) to ensure maintenance is undertaken where necessary;
- Monitoring the tree, shrub and hedgerow translocation and planting in parallel with landscaping obligations, to ensure that they continue to fulfil their ecological functions;
- Collation of records of road traffic mortality within the corridor of the Scheme for the duration of the aftercare period to give some indication of the success of the mitigation for the concrete safety barrier.

5.4.479 Details of the monitoring required would be established at the detailed design stage in consultation with NRW and NMWTRA and incorporated into the Construction Environmental Management Plan (CEMP), CEMP (Aftercare) and Handover Environmental Management Plan (HEMP). Post-construction monitoring would be undertaken for a minimum of 12 months, with the results to be included in a report and circulated to relevant statutory consultees for review and to establish the need for any further monitoring.

Summary and Conclusions

5.4.480 Table 5.4.18 above summarises the potential impacts of the Scheme, proposed mitigation measures and overall residual impacts expected with these in place.

5.4.481 In the short-term there would be a minor adverse residual impact of local significance due to the loss of mature trees, woodland and hedgerows leading to a loss of foraging/commuting habitat for bats, badgers, polecats, hedgehogs, birds, reptiles and amphibians, as well as potential roosting habitat for bats, nesting habitat for birds and hibernation habitat for reptiles and amphibians. This would change over time and due to the proposed planting of a greater number of standard trees, greater area of woodland and greater length of hedgerow than that lost, eventually the significance would become neutral and even positive in the future. Subject to landowner agreement, enhancement may also be provided by the management of Railway Line Wood 2 County Wildlife Site to control rhododendron and plant native broad-leaved tree species in its place, and native broad-leaved trees would be planted and managed as standard trees in areas away from the road to the north of Roman Road (Henffordd).

5.4.482 Adverse impacts relating to the concrete safety barrier proposed for the central reserve for 2.2km of the scheme corridor would be more than mitigated by the provision of numerous holes allowing passage by terrestrial mammals, reptiles and amphibians otherwise trapped on the carriageway, as

well as new safe crossing points underneath the A55(T), at streams 2, 5 and 6, accessible even at times of high flow. Overall, these changes are likely to result in a minor beneficial impact of local significance for species such as otters, badgers, polecats and hedgehogs. Improvements to streams 5 and 6 would also provide improved access for migratory fish. The enlarged culvert for the Afon Wig (stream 5) could also provide an additional safe crossing point for bats.

5.4.483 The detention pond proposed as part of the scheme drainage design would provide secondary benefits for a range of wildlife including additional foraging habitat for bats, otters, polecats, hedgehogs and amphibians.

5.4.484 A number of enhancement measures are proposed including pollution control points to reduce the potential for pollution of the watercourses, aquatic species and habitats and protected sites located downstream of the Scheme; creation of approximately 5.87ha of species-rich grassland in the verges; provision of riparian and woodland bird nest boxes and amphibian-friendly gully pots. The creation of species-rich grassland would also provide an additional benefit to ecosystem services, due to the benefits to pollinators as an essential component of agriculture in Wales.

5.4.485 Overall, it is therefore considered that the Scheme would have a beneficial impact on biodiversity and nature conservation in the long term.

Review against Policy Framework

5.4.486 Policies, plans and legislation relevant to nature conservation have been listed at the start of the chapter. It is considered that through the iterative design process and the identification of appropriate mitigation, compensation and enhancement measures, the Scheme would be compliant with all relevant legislation and policy.

5.4.487 Specifically, the Scheme avoids any significant impacts on sites designated for their nature conservation interest, and aims to minimise any impacts on wildlife in the vicinity of the Scheme, such as mortality, disturbance, severance or loss of habitat. Although some impacts on species and habitats are unavoidable, mitigation and compensation measures have been proposed for these impacts that would ensure that in the long-term there is a net gain for the important ecological features identified as well as for biodiversity as a whole. Where species or sites are protected by European or UK legislation, the appropriate licences would be obtained where necessary and all associated mitigation incorporated into Contract Documents, in order to comply with this legislation (specifically Conservation of Habitats and Species Regulations 2010, Protection of Badgers Act 1992 and the Eels Regulations 2009).

5.4.488 The Scheme has been subject to an Assessment of Implications on European Sites, to be determined by the Welsh Government (the 'Competent Authority'). See 'A55(T) Abergwyngregyn to Tai'r Meibion Improvement: Assessment of Likely Significant Effects Report (Screening Stage)' (YGC, 2016). This assessment concludes that no significant effects are likely on the Natura 2000 sites, with consideration of the measures outlined in the Mitigation section of this chapter.

5.4.489 Section 7 species and habitats have all been included in the full assessment process, any impacts mitigated and/or compensated where necessary and enhancement measures proposed that would benefit Section 7 species and habitats, including hedgerows, lowland mixed deciduous woodland, rivers, common and soprano pipistrelle, brown long-eared and lesser horseshoe bats, otter, polecat, hedgehog, slow worm, common lizard, common toad, Atlantic salmon, brown/sea trout and European eel. In this way, all reasonable steps have been taken to maintain and enhance living organisms and habitats listed on Section 7, as required under the Environment (Wales) Act 2016.

- 5.4.490 The mitigation, compensation and enhancement measures proposed, such as planting a greater area of woodland, trees and hedgerows than that lost, creation of species-rich grassland within the verges and increasing the permeability of the A55(T) within the scheme corridor, all help to maintain and enhance biodiversity and ensure ecosystem resilience by maintaining and enhancing habitat connectivity and accessibility throughout. This is important at a time of increasing pressure from climate change and habitat fragmentation, and complies with the requirements of Section 6 of the Environment (Wales) Act 2016.
- 5.4.491 There would also be impacts on species and habitats listed in the Gwynedd LBAP and/or the TREBAP, including hedgerows, lowland mixed deciduous woodland, rivers and streams, lesser horseshoe and pipistrelle bats, otter, polecat, hedgehog, red kite, barn owl, reptiles, amphibians, aquatic species, bluebell and invasive plants. These have all been included in the assessment, with mitigation and/or compensation proposed where potential impacts have been identified, and enhancement measures incorporated that would benefit many of these ecological features. In this way, many of the BAP actions described in the Baseline Conditions for these features have been met, and any that have been compromised have been mitigated and/or compensated.
- 5.4.492 The creation of 5.87ha of species-rich grassland within the verges of the Scheme would benefit local pollinator populations and thus contribute to the Wales Action Plan for Pollinators (2013), particularly as the seed mixes used would incorporate species with different flowering seasons spread throughout the spring and summer to ensure a continuous supply of pollen and nectar. The provision of a larger area of native woodland, tree and hedgerow habitat than the area lost would also benefit the pollinator population in the long-term. These benefits to pollinators also constitute a benefit to ecosystem services in terms of their essential role in agriculture in Wales, and therefore support the Resilient Wales' goal of the Well-being of Future Generations (Wales) Act 2015 by supporting social, economic and ecological resilience.
- 5.4.493 The mitigation, compensation and enhancement measures proposed would conform with Policy AMG4: Local Biodiversity Conservation, of the Anglesey and Gwynedd Joint Local Development Plan: 2011 – 2016, currently expected to be formally adopted in spring 2017, in terms of protecting and enhancing biodiversity that has been identified as being important to the local area, including that listed in the LBAP. They also support Policy B17 of the Gwynedd Unitary Development Plan, in terms of taking opportunities for nature conservation gain when direct harm is caused to a Local Wildlife Site; as well as B21 in relation to reinstating wildlife corridors and habitat linkages; and B35 in relation to avoiding the spread of invasive species.

5.5 GEOLOGY AND SOILS

Introduction

- 5.5.1 This chapter contains information on the geological and hydrogeological setting of the study area, past mining activity, nature of local soils and potentially contaminated land. This chapter should be read in conjunction with Chapters 5.6 (Materials), 5.9 (Community and Private Assets, including consideration of Agricultural Land Classifications affected) and 5.10 (Road Drainage and the Water Environment).

Method

- 5.5.2 The Scheme has been assessed for its impact on geology and soils in accordance with the DMRB, Volume 11, Section 3, Part 11: Geology and Soils (Highways Agency, 1993). HA205/08 and IAN 125/09(W) have also been taken into consideration in drafting this chapter. Cross references are provided within this chapter to other relevant topics within the ES where there is potential for incremental effects between them and Geology and Soils receptors. Cumulative effects associated with soils have been identified and reported in Chapter 6.
- 5.5.3 As well as a desk study which produced a Preliminary Sources Study Report (in accordance with HD22/08), several phases of ground investigation have been carried out in connection with the scheme and ground investigation information from adjacent schemes, including the A55 Abergwyngregyn Improvement to the east and the A55 Bangor Bypass to the west, is also available. Table 5.5.1 summarises the information that has been used to inform this assessment.
- 5.5.4 As sources of information were readily found the only consultation undertaken has been with Natural Resources Wales regarding groundwater abstraction.

Assessment Methodology

- 5.5.5 The assessment has used the criteria in Tables 5.5.1 and 5.5.2 to define the value/sensitivity of receptors and predict the magnitude of impact. These are based on the generic scales noted in DMRB, Volume 11, Section 2, Part 5 (Tables 2.1 and 2.2) with further modification to directly relate to geology, groundwater and contaminated land. Table 2.4 from the same document, reproduced in this document as Table 5.5.3, has been used to derive the Degree of Significance.

Table 5.5.1: Criteria for assessing Value (Sensitivity) in connection with geology, soils, hydrogeology and contamination

Value (Sensitivity)	Criteria
Very High	<ul style="list-style-type: none"> Geological feature is of international importance Major aquifer with high quality and abstraction volume.
High	<ul style="list-style-type: none"> Geological feature is of national importance <i>e.g.</i> SSSI Major aquifer locally important A pollution linkage with an incident likely to occur
Medium	<ul style="list-style-type: none"> Geological feature is of regional importance <i>e.g.</i> RIGS Aquifer providing water for agricultural or industrial use important locally
Low	<ul style="list-style-type: none"> Sites of local geological importance

	<ul style="list-style-type: none"> • Minor aquifer • A pollution linkage but a low likelihood of occurrence
Negligible	<ul style="list-style-type: none"> • Geological feature is of little or no geological interest. • Non-aquifer • No pollution linkage

Table 5.5.2: Criteria for assessing Magnitude of Impact in connection with geology, soils, hydrogeology and contamination

Impact	Criteria
Major	<ul style="list-style-type: none"> • Geological feature or soils at high risk of being destroyed or adversely affected <i>e.g.</i> obscured • Damage to human health, watercourse, or ecological system in short term <i>e.g.</i> risk pollution to an aquifer • High concentrations of known contaminants
Moderate	<ul style="list-style-type: none"> • Partial loss of geological feature/soils (adverse) • Greatly increased access to geological feature <i>e.g.</i> new cutting in important formation (beneficial) • High risk to human health, watercourse or ecological system • Concentrations of contaminants at or exceeding guideline values
Minor	<ul style="list-style-type: none"> • Potential partial loss of geological feature/soils (adverse) • Low risk to watercourse or ecological system • Low concentrations of known contaminants
Negligible	<ul style="list-style-type: none"> • No significant effect on geological feature or aquifer • Concentrations of contaminants requiring interventions during construction <i>e.g.</i> PPE
No Change	<ul style="list-style-type: none"> • No effect on geological feature, aquifer, no contamination risk • No change in status quo

Table 5.5.3: Assessment Matrix for Degree of Significance in connection with geology, soils, hydrogeology and contamination

		IMPACT				
		<i>Major</i>	<i>Moderate</i>	<i>Minor</i>	<i>Negligible</i>	<i>No Change</i>
SENSITIVITY	<i>Very High</i>	Very Large	Large	Moderate/Large	Slight	Neutral
	<i>High</i>	Large	Moderate/Large	Slight/Moderate	Slight	Neutral
	<i>Medium</i>	Moderate/Large	Moderate	Slight	Neutral/Slight	Neutral
	<i>Low</i>	Slight/Moderate	Slight	Neutral/Slight	Neutral/Slight	Neutral
	<i>Negligible</i>	Slight	Neutral/Slight	Neutral/Slight	Neutral	Neutral

Study Area

5.5.6 Due to the linear nature of the scheme and the relatively minor works at the extreme ends of the scheme the study has been restricted to a 1km wide corridor centred on the existing road and covering the full length of the scheme. The study area is bounded by the following approximate NGRs:

- 261880 371591
- 262467 370784
- 264902 373102
- 265390 372228

References and Sources of Information

5.5.7 The following information has been used to inform the Geology and Soils assessment.

Table 5.5.4: Information used for the Geology and Soils assessment

Source	Date viewed/published	Details
Anglesey and Gwynedd Councils	2015	Anglesey and Gwynedd Joint Local Development Plan – Deposit Plan (2015) available at https://www.gwynedd.gov.uk/en/Council/Documents---Council/Strategies-and-policies/Environment-and-planning/Planning-policy/Deposit-Plan/Deposit-Plan-2015.pdf
British Geological Survey (BGS)	Viewed July 2015	http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=borholes Online archive of submitted exploratory hole logs
BGS	Viewed July 2015	http://mapapps.bgs.ac.uk/geologyofbritain/home.html Geology of Britain Viewer
BGS	1985	1:50,000 sheet number 106 Snowdon Solid Geology
BGS	1986	1:25,000 map Classical Areas – Bethesda and Foel Fras Solid and Drift.
Coflein	Viewed July 2015	http://www.coflein.gov.uk/en/quick_search Online database of historic buildings in Wales
Cranfield University	Viewed August 2015	http://www.landis.org.uk/soilscapes/ Soilscapes Viewer
Foundation and Exploration Services Ltd.	1990	A55 North Wales Coast Road Aber Improvement – Volume 1 - Factual Report
Map Gwynedd	Viewed July 2015	Online GIS resource containing OS mapping, aerial photography and information from the EA, CCW, CADW & Gwynedd Council.
Mott MacDonald	1993	Initial Report on Encountered Ground Conditions - February to August 1993
Environment Agency	Viewed July 2015	http://maps.environmentagency.gov.uk
Old Maps	Viewed July 2015	http://www.old-maps.co.uk/maps.html Online database of historic Ordnance Survey mapping Used to identify potentially contaminative land uses within and adjacent to the study area as well as groundwater features such as springs, issue and sinks. (locations where groundwater emerges from or sinks into the ground)
Ordnance Survey	Viewed July 2015	Maps at various scales consulted to identify ground and surface water features, topographical and land use features
Strata Surveys	2007	A55 Aber – Tai'r Meibion Improvement: Supplementary Factual Report

Strata Surveys	2007	PMA, Wig Farm: Factual Report
UK Radon	Viewed August 2015	http://www.ukradon.org/information/ukmaps/englandwales

Limitations and Assumptions

- 5.5.8 No difficulties or limitations were encountered in the collation and assembly of information for the preparation of the Geology and Soils assessment for this ES.

Baseline Conditions

Regulatory Framework

- 5.5.9 In writing this chapter consideration has been given to the relevant sections of the following legislation and policy documents:

- Environment Act (1995);
- Environmental Protection Act (Part IIa) (1990);
- Contaminated Land (Wales) Regulations (2006 + 2012 amendment);
- Groundwater Regulations (1998);
- Water Environment Regulations (2003);
- Water Act (2003);
- Water Resources Act (1991), and;
- Planning Policy Wales (Ed. 9).

- 5.5.10 Within the Gwynedd Unitary Development Plan (2001 – 2016) Policy B17: Protecting Regionally Important Geological/Geomorphological Sites states: *“Proposals that are likely to cause significant harm to a Regionally Important Geological/Geomorphological Site (RIGS) will be refused unless the need for the development is more important than the site's value to Earth Science or the landscape”*.

- 5.5.11 In addition the emerging Anglesey and Gwynedd Joint Local Development Plan – Deposit Plan (2015) includes Policy AMG5: Protecting Regionally Important Geological/Geomorphological (RIGS) Sites. This states: *“Proposals that are likely to cause direct or indirect significant harm to ... regionally important geological / geomorphologic sites (RIGS) will be refused, unless it can be proven that there is an overriding social, environmental and/or economic need for the development, and that there is no other suitable site that would avoid having a detrimental impact on sites of nature conservation value and local geological importance. When development is granted, assurance will be required that there are appropriate mitigation measures in place. It will be possible to use planning conditions and/or obligations in order to safeguard the site's biodiversity and geological importance”*.

Solid Geology

- 5.5.12 The Scheme passes over underlying bedrock of Ordovician Age comprising rocks of one formation only, the Nant Ffrancon Subgroup, which is described by the British Geological Survey (BGS) as Nant Ffrancon Subgroup - Siltstone. These are noteworthy, geologically and economically, in that they also contain mudstones that have been locally metamorphosed to slates which have been exploited since at least medieval times.

- 5.5.13 The BGS geological map of the area⁹⁸ shows that the underlying solid geology is generally consistent throughout the area. The geological map also shows that the solid geology is completely masked by the drift geology.
- 5.5.14 The Scheme lies to the north-west of the Maes y Gaer anticline. The nearest noted major fault line is the Aber - Dinlle fault, which crosses the Scheme at the location of the site of Wig Bach (Grid reference: SH 640 721) and trends north-east/south-west.
- 5.5.15 There are no notable metalliferous deposits or igneous intrusive rocks that might contain or give rise to such deposits along or adjacent to the Scheme.

Drift Geology

- 5.5.16 The BGS Geology of Britain Viewer shows that the drift geology may be split into two basic groups. The first and larger group comprises brown and grey-brown largely impermeable Glacial Till that can be locally sandy. These beds provide a regional cover of several metres (up to 39m in a borehole northeast of Wig Farm) over the majority of the Scheme and the surrounding area. There are no tidal deposits present.
- 5.5.17 The second group comprises varicoloured clays, sands, gravels and boulders, Alluvial Fan Deposits, that form an alluvial cone or outwash fans trending north-west towards the sea from the mountains to the south. These types of deposits generally represent river and outwash deposition occurring during or just after glacial periods.
- 5.5.18 The Alluvial Fan Deposits, if granular in nature, could potentially act as a local aquifer, providing base flow for rivers and water to local ponds and wells. Where the glacial till is present relatively minor perched water tables may form.
- 5.5.19 The area of Alluvial Fan Deposits appears from the BGS mapping to lie towards the centre of the study area (between the site of Wig Bach and Tai'r Meibion) and the presence of these soils appears to be inferred from a correspondingly slightly raised area of land in this section of the route, where the Alluvial Fan Deposits appear to overlie the Glacial Till. However, based on the ground investigation results this is not certain, with surface soils in the areas of supposed Alluvial Fan Deposits containing uncharacteristic amounts of clay.
- 5.5.20 There are currently no Regionally Important Geological Sites (RIGS) or geological Sites of Special Scientific Interest (SSSI) lying within, adjacent to or affected by the Scheme, and therefore there would be no impact upon such sites.

Geomorphology

- 5.5.21 The local geomorphology is reflected in the topography of the route corridor. The topography consists of land which slopes gently from the base of an upland area to the south of the study area towards the Menai Strait and the sea located approximately 650 metres to the north of the existing A55(T). The majority of the route corridor lies between approximately 25mAOD and 35mAOD. See also Chapter 5.3: Landscape.

⁹⁸ Classical Areas of British Geology, Bethesda and Foel-fras, Parts of Sheets SH66 and SH67, Solid and Drift Edition, 1:25,000 Scale, British Geological Survey, 1978

- 5.5.22 The landforms are typical of both the glacial and alluvial processes forming the two main drift soil types. The Glacial Till is generally an ablation or lodgement till formed by deposition with no distinctive landforms on its surface, but a generally planar land surface.
- 5.5.23 The gentle south to north sloping land surface has in large part dictated the surface water regime with a number of south to north flowing streams dissecting the surface of the slope in generally straight lines following the fall line of the slope. See also Chapter 5.10: Road Drainage and the Water Environment.
- 5.5.24 In summary there are no unusual or significant geomorphological features within the study area.

Soils

- 5.5.25 The predominant natural soil type covering the majority of the route corridor is classed as Soilscape 17 under the Soilscape soil classification system viewed at <http://www.landis.org.uk/soilscapes/>. Soilscape 17 soils are described as slowly permeable, seasonally wet acidic, loamy and clayey soils with low fertility where the main risks are associated with overland flow from compacted or poached fields. See Chapter 5.9 (Community and Private Assets) for a discussion of ALC grades and the potential effect of the Scheme on these.

Made Ground

- 5.5.26 Made Ground present within the site is predominantly associated with the existing A55(T), minor road junctions and other minor accesses off the existing road. This consists of minor amounts of earthworks materials, most of which are likely to have been locally won, together with unbound granular aggregates (capping and sub-base) and bituminous bound pavement layers.
- 5.5.27 As the Scheme is effectively on-line the existing Made Ground forming the Trunk Road will predominantly be left in situ with minor amounts re-used within the proposed carriageway construction (see Chapter 5.6: Materials).

Mining and Tunnelling Activities

- 5.5.28 Evidence for local underground or surface mining activities in the area adjacent to the Scheme is confined to two features of interest. A quarry is shown as present at the Bryn Meddyg properties (Grid reference: SH 264600, 372400) on Ordnance Survey maps between at least 1919 and possibly as late as 1975 (see feature 37, Figure 5.2.1, Volume 1a and Chapter 5.2 for further information on this). It is not known what was exploited at this site, though it is most likely to have been either gravel and/or hard rock (slate). A gravel pit to the south-east of this location (Grid reference: SH 264880, 372190) is also noted as working over a similar period.
- 5.5.29 The general nature of mineral exploitation in this region and the historical and geological map information make it unlikely that any underground mining has occurred close to the Scheme. It is also considered unlikely that the Scheme would bury any economically important deposits that may exist below the site as there are no recorded sites within or adjacent to the site.

Radon

- 5.5.30 Radon maps suggest that the majority of the study area lies in an area of elevated radon potential with a maximum radon potential of 10-30%. As it is likely that all parts of the works will be well ventilated during both the construction and operational phases radon is highly unlikely to present a problem to the works.

Unexploded Ordnance (UXO)

- 5.5.31 Given the rural location, lack of industry and major infrastructure and distance from centres of industry and population and flight paths towards such centres during the 1939 – 1945 period, the risk of UXO being present in the study area is extremely low.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.32 The area of influence around the Scheme contains rocks of Ordovician Age consisting of mudstones and siltstones, which are generally impermeable below the uppermost weathered layers. Water flow through fractures and fissures within this rock may be unimpeded and interconnected but this is difficult to assess. The rock may be locally important in providing water sources, springs and local river base flow.
- 5.5.33 The drift geology comprising Glacial Till and Alluvial Fan deposits has been found to be very variable in permeability such that any potential aquifers are likely to be very small and non-persistent.
- 5.5.34 Due to the nature of the solid and drift geology no discrete aquifers have been identified and any aquifers present are likely to be very small in vertical and lateral extent and to be classed as minor aquifers, if at all.
- 5.5.35 The relevant Policy and Practice for the Protection of Groundwater map of this area is the Groundwater Vulnerability Map Sheet 15, North Wales Coast, 1:100,000 scale, Environment Agency, 1998. This map indicates that the Scheme would pass over two Intermediate Class One Vulnerability areas that overlay minor aquifers with variable permeability associated with the Alluvial Fan Deposits identified in geological mapping. Such areas are defined as having soils of Intermediate Leaching Potential, that is: *“Soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer.”*
- 5.5.36 In addition Classification One denotes *“Soils which can possibly transmit a wide range of pollutants”*. The remainder of the route passes over areas considered to be non-aquifers. See Chapter 5.10 (Road Drainage and the Water Environment) for an assessment on the potential effects on groundwater resources.

Local Groundwater Exploitation (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.37 The Ordnance Survey maps indicate where ground water emerges out of/sinks into the ground surface (known as springs, issues and sinks). Any sub-surface ground water would be directed under the A55(T) by new or improved existing culverts to maintain flows.
- 5.5.38 No evidence of local groundwater abstraction on the geological and hydrogeological maps of the region or the NRW database was found. Therefore, it is considered highly unlikely that any abstraction of local groundwater is presently occurring in the area affected by the

Scheme (see Chapter 5.10: Road Drainage and the Water Environment for further information). As such, the Scheme is unlikely to impact upon groundwater abstraction.

Hydrology (see also Chapter 5.10: Road Drainage and the Water Environment)

5.5.39 In general the topography dictates both the surface and sub-surface drainage direction which is from the south/south-east to the north/north-west. As the soils are generally low in permeability the surface water streams which cross the route corridor from south to north form the main pathways for transport of any contaminants that may arise e.g. arising from construction works.

Environmentally Sensitive Land Use Areas

5.5.40 Table 5.5.5 identifies the environmentally sensitive land use areas within the vicinity of the Scheme (see Chapter 5.4 for further information on the SAC, SPA and SSSI).

Table 5.5.5: Environmentally Sensitive Land Use Areas

Site Number	Site Name	NGR	Distance & Direction from Scheme	Designation
1	Snowdonia National Park	SH269545 365818	25m S	National Park
2	Menai Strait and Conwy Bay	SH262947 372807	410m NW	SAC/SSSI
3	Traeth Lafan	SH261877 338375	410m NW	SPA

Land Uses Indicative of Potential Contamination

5.5.41 The information provided by the study of old Ordnance Survey maps indicates that the area affected by the Scheme does not contain any significant industry and has not done so for a considerable period of time. The area is mostly rural, with any industry seemingly on a very small scale and centred upon agriculture.

5.5.42 The only potential risk arising from contaminated land is considered to depend upon the condition of the quarry immediately north-east of the Bryn Meddyg properties (Grid reference: SH 264600, 372400) that was not present in 1899, but was present between 1919 and to possibly as late as 1975. It is not known what was exploited at this site (possibly either gravel and/or hard rock) and with what this was filled. The construction works will not directly affect the quarry.

5.5.43 It should be noted that the landfill regulations and registration initially came in to force in the United Kingdom in 1974. It could, therefore, be significant that the quarry is thought to have closed around this period. However, the nature and magnitude of any risks arising from the in-filled quarry would depend on the nature of the material and how any contaminants present are making or could make contact with potential receptors. Such receptors would include humans, the water environment, flora and fauna and the built environment, including building materials used in the development of land.

5.5.44 No recorded evidence that the quarry is adversely affecting the quality of the local environment has been found. There are no indications of groundwater close to the quarry and the surface and drift geology is relatively impermeable (slate and/or glacial till). In

addition, there are no particularly sensitive receptors or other designated ecosystems, water abstractions or major aquifers in the vicinity that are likely to be affected by the quarry.

- 5.5.45 In conclusion, it appears unlikely that significant quantities of hazardous materials are present in the quarry or, if such materials are present, that they are not resulting in significant adverse effects on the local environment. As no contaminants have been positively identified no monitoring for contaminants is considered necessary.

Current Land Uses Potentially Indicative of Contamination

- 5.5.46 The main current land use is farming, which is known to produce potential contaminants such as slurry, sheep dip etc. However, it is unlikely that these contaminants have passed into the soils in any significant quantities and they are very unlikely to constitute a source of contamination.

- 5.5.47 The existing road appears to have been constructed in the late 1960s and may contain tar within the bituminous layers forming the road pavement. A number of cores have been taken through the road pavement layers and have been tested for tar content; the results of these have been negative for the A55(T), but positive for one core taken from Roman Road (Henffordd). If disposed of off-site this material may be classed as a hazardous waste.

Value/Sensitivity of Resource

- 5.5.48 The Value (Sensitivity) of Resource has been assessed in accordance with the guidance provided in the DMRB, Volume 11, Section 2, Part 5 HA: 205/08; Determining Significance of Environmental Effects (see Table 5.5.1 earlier in this chapter).

Geology

- 5.5.49 From the description of the baseline conditions it is concluded that, as there are no geological SSSI's, RIG's, GCR's or other sites of geological interest located within or directly adjacent to the Scheme, the geology is assessed as of **Negligible** value and of local interest only.

Soils

- 5.5.50 The Agricultural Land Classification system produced by MAFF classifies the agricultural quality of the land in the immediate vicinity of the Scheme as Grade 3a and Grade 3b (see Chapter 5.9: Community and Private Assets). The Soilscales classification also suggests the soils present are low in fertility. It is therefore concluded for this assessment that the baseline conditions in terms of soil quality are **Low** in value/sensitivity and on a local scale.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.51 As only areas designated as either minor aquifers or no aquifers are present within the study area the sensitivity of the hydrogeology is assessed as **Low** value.

Contamination

- 5.5.52 As no identified source of contamination exists and therefore there are no pollution linkages the sensitivity is assessed as **Negligible** value.

Magnitude of Impacts and Significance of Effects (Before Mitigation)

The following assessment has been completed in consideration of the guidance provided in HA205/08 (see Tables 5.5.1 - 5.5.3 earlier in this chapter).

The Do Minimum Scenario

- 5.5.53 The Do Minimum Scenario is based on the current situation remaining the same and the Scheme not being implemented (see Chapter 3). If the Do Minimum Scenario is followed the current situation with regard to Geology and Soils, Hydrogeology and Contamination would remain unchanged and there would be no impact upon them.

Construction Period

Geology

- 5.5.54 No geological SSSI's, RIG's or GCR's would be affected by the Scheme. The Magnitude of Impact on geology during the construction period is considered to be **Negligible**. As the sensitivity is low and there is no appreciable effect on any geological features the degree of Significance is assessed as **Neutral**. Therefore, no mitigation is proposed.

Soils (see also Chapter 5.9: Community and Private Assets)

- 5.5.55 The soil within all areas of land required temporarily during the construction period, including the site compound, would receive a **Moderate** but temporary **adverse** impact through compaction and disturbance. As the effect will be short term and reversible and the sensitivity is Low the degree of Significance during the construction period will be **Slight**.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.56 As only minor aquifers are present and no abstraction of groundwater is taking place within the study area the impact during the construction phase will be **Negligible**. There is no predicted change in quality of any type of aquifer and/or its use as a resource and as the sensitivity/impact is Low/Negligible the degree of Significance is assessed as **Neutral**.

Contamination

- 5.5.57 Adverse effects on human health, controlled waters and sensitive protected sites associated with contaminated land that may lie within or adjacent to the Scheme may potentially occur during construction. However, this is considered unlikely as the only potentially contaminated source identified (possible landfill in old quarry east of Bryn Meddyg) is not expected to be disturbed or affected by the Scheme. See Chapters 5.1, 5.4 and 5.10 for further discussion on potential construction-related impacts on human health, controlled waters and sensitive sites.
- 5.5.58 In carrying out this assessment it has been assumed that the following contingency measures would be applied as standard good practice throughout the construction period:
- 1) In order to avoid contamination of the ground by spills or leakages of harmful substances, all precautions will be taken by the Contractor to ensure that this risk is minimised. The Contractor will also be required to have an effective emergency spill response procedure in place. See Chapter 5.10 (Road Drainage and the Water Environment) for further details.
 - 2) During the earthworks, vigilance would be maintained with regard to the possible presence of contaminated material. If any suspicious substances were encountered, work would cease and specialist advice would be sought. The potential for the

generation of contaminated dust would be minimised by the adoption of appropriate working practices including, if necessary, damping down through mist spraying if the earthworks take place during dry weather (see Chapter 5.1: Air Quality).

- 3) The potential impacts on the health of construction workers (such as possible contact with contaminated soils) would be addressed by the adoption of appropriate health and safety and hygiene practices including the use of PPE (Personal Protective Equipment) as necessary.
- 4) Further investigation would be undertaken at the start of construction to determine the potential sources of contamination within the boundary of the Scheme in order to:
 - confirm the exact nature of any contamination present;
 - accurately assess any resulting risk posed, and;
 - allow for design/implementation of appropriate design measures.

5.5.59 As there is only one potential source of contamination identified and this will be unaffected by the construction works the impact will be **No change**. As there will be no appreciable effects on health, groundwater or surface water the sensitivity/impact is Negligible/No change and the Degree of Significance is assessed to be **Neutral**.

Operational Period

Geology

5.5.60 The close proximity of any alluvial fan deposits to their origin renders it unlikely that they would form an economically important deposit of gravel or sand. Therefore, the Scheme would not significantly impact any future exploitation of this potential resource.

5.5.61 No geological features of interest within the study area have been identified. No SSSI's, RIG's or GCR's would be affected by the Scheme. The Magnitude of Impact on the geology is therefore considered to be Negligible. Combining this impact with a sensitivity assessed as **Negligible**, the Degree of Significance is assessed as **Neutral**.

Soils

5.5.62 Soil loss associated with land take for the scheme is considered in Chapter 5.9: Community and Private Assets. The total scheme footprint is approximately 27 hectares (of which approximately 5.7ha involves the permanent loss of agricultural land and associated soils). In addition, low nutrient soils would be required on the new verges to facilitate the establishment of wildflower seed mixes (see Chapters 5.3: Landscape and 5.4: Nature Conservation), which could necessitate the removal of topsoil from site. Considering that there would be an overall permanent loss of soils for the Scheme the magnitude of impact would be **Moderate adverse**. However, as the environmental value is considered to be Low the Degree of Significance is assessed as being **Slight**.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

5.5.63 As only minor aquifers are present and no abstraction of groundwater is taking place within the study area the impact during the operational phase will be **Negligible**. Since there is no predicted change in quality of any type of aquifer and/or its use as a resource and the sensitivity/impact is Low/Negligible the Degree of Significance is assessed as **Neutral**.

Contamination

- 5.5.64 As there are only one potential source of contamination identified and this will be unaffected by the construction works the impact during the operational period will be **No change**. As there will be no appreciable effects on health, groundwater or surface water and the sensitivity/impact is Negligible/No change the Degree of Significance in the operational period is assessed to be **Neutral**.

Design, Mitigation and Enhancement Measures

Construction Period

- 5.5.65 The following mitigation measures would form part of the Contractor's Construction Environmental Management Plan (see Chapters 2.5 and 7).

Geology

- 5.5.66 Due to the Degree of Significance being assessed as **Neutral** no mitigation is proposed in connection with geology.

Soils

- 5.5.67 It will be necessary to clearly define all areas where no site traffic is permitted during the construction period in order to reduce the level of compaction of the existing soils.
- 5.5.68 During the construction period, areas of topsoil to be stripped will be stored and (where required) reinstated accordingly on completion of the work. The following mitigation measures will apply for all soil disturbed, and would form part of the Contractor's Construction Environmental Management Plan (see Chapters 2.5 and 7):
- Topsoil and subsoil layers will be identified and clearly defined before being stripped and stored separately under favourable weather conditions so that a proper soil profile can be re-established, with consideration that low nutrient soils are required for the new verges (see Chapters 5.3: Landscape and 5.4: Nature Conservation).
 - Soils for reinstatement shall be derived from the site. Storage mounds will be located locally in small batches and re-used in as close to the original location as possible; they shall not exceed 2m in height (see Chapter 5.6: Materials).
 - Soil handling will be avoided during wet conditions and shall not be compacted by heavy machinery once spread. Soil shall be kept free of injurious and non-native invasive weeds such as Japanese Knotweed.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.69 Standard pollution control measures based on best working practices will be implemented during construction. These pollution control measures are based on the best practice guidance detailed in the Environment Agency's Pollution Prevention Guidelines (PPG's) and Guidance for Pollution Prevention 5⁹⁹. Those of relevance in relation to protection of soils and waters are:
- PPG 1: General guide to pollution prevention
 - PPG 2: Above ground storage tanks
 - PPG 4: Disposal of sewage where no mains drainage is available

⁹⁹ Guidance for Pollution Prevention, Works and maintenance in or near water: GPP 5, NIEA/SEPA/NRW, January 2017.

- GPP 5: Works in, near or liable to affect watercourse
- PPG 6: Working at construction and demolition sites
- PPG 21: Pollution incident response planning
- PPG 22: Dealing with spills.

Contamination

5.5.70 Due to the Degree of Significance being assessed as **Neutral** no mitigation measures are proposed. The contingency measures identified in paragraph 5.5.58 (*i.e.* contingent on unidentified sources of contamination being encountered) would be implemented via the Construction Environmental Management Plan (see Chapter 7). If sources of contamination are found during the construction works efforts to remove any source, pathway or receptor linkages will be implemented.

Operational Period

Geology and Soils

5.5.71 No mitigation measures are proposed for geology or soils during the operational period because no significant impacts are expected to occur to geological features or beyond the initial loss of soils.

Hydrogeology

5.5.72 As the drainage design for the scheme considers any likelihood of pollution generated during the operational phase entering the surface water and groundwater systems no further mitigation measures are proposed for the operational phase (see Chapter 5.10: Road Drainage and the Water Environment).

Contamination

5.5.73 As any sources of contamination found would be dealt with during the construction phase no mitigation measures for the operational phase are proposed. Although the scheme falls below applicable thresholds for providing pollution control during the operational phase, pollution control points are proposed for each watercourse outfall through the scheme (see Chapter 5.10: Road Drainage and the Water Environment for further details on these and highway pollution risks during operation).

Magnitude of Impacts and Significance of Effects (After Mitigation)

Construction Period

Geology

5.5.74 No geological SSSI's, RIG's or GCR's would be affected by the Scheme and no mitigation is proposed. The Magnitude of Impact on the geology is therefore considered to be Negligible. Combining this impact with a sensitivity assessed as **Negligible** the Degree of Significance is assessed as **Neutral**.

Soils (see also Chapter 5.9: Community and Private Assets)

5.5.75 Provided that the proposed good practice mitigation measures are followed, the overall effect of the construction period on soils will be minimised and is assessed as **Minor adverse**. As the environmental value is considered to be Low the Degree of Significance is assessed as being **Slight**.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.76 As only minor aquifers are present and no abstraction of groundwater is taking place within the study area the impact during the construction phase with mitigation will be **Negligible**. There is no predicted change in quality of any type of aquifer and/or its use as a resource and the sensitivity/impact is Low/Negligible the Degree of Significance is assessed as **Neutral**.

Contamination

- 5.5.77 As there are only one potential source of contamination identified and this will be unaffected by the construction works the impact will be **No change**. As there will be no predicted effects on health, groundwater or surface water the sensitivity/impact is Negligible/No change and the Degree of Significance is assessed to be **Neutral**.

Operational Phase

Geology

- 5.5.78 No geological SSSI's, RIG's or GCR's would be affected by the Scheme and no mitigation is proposed. The significance of effect on geology during the operational phase is assessed to be **Neutral**.

Soils (see also Chapter 5.9: Community and Private Assets)

- 5.5.79 Considering that there would be an overall permanent loss of soils for the Scheme the magnitude of impact would remain as **Moderate adverse**. However, as the environmental value is considered to be Low the Degree of Significance is assessed as being **Slight**.

Hydrogeology (see also Chapter 5.10: Road Drainage and the Water Environment)

- 5.5.80 As there is to be no predicted change in quality of any type of aquifer and/or its use as a resource the Degree of Significance is assessed as **Neutral**.

Contamination

- 5.5.81 As no identified source of contamination exists the significance of effect of contamination during the operational phase is assessed to be **Neutral**.

Summary

- 5.5.82 This chapter contains information on the geological and hydrogeological setting of the study area, past mining activity, nature of local soils and potentially contaminated land, and should be read in conjunction with Chapters 5.6 (Materials), 5.9 (Community and Private Assets) and 5.10 (Road Drainage and the Water Environment). The Scheme has been assessed for its impact on geology and soils in accordance with the DMRB, Volume 11, Section 3, Part 11: Geology and Soils (Highways Agency, 1993) and consideration of HA205/08 and IAN 125/09(W).

- 5.5.83 There are no local or regional scientific or geological sites of interest within the corridor of the Scheme. The Scheme is considered unlikely to affect hydrogeological water movement, water abstraction, contamination or potential future economic geological exploitation to any significant degree.

- 5.5.84 Compaction and disturbance is expected to affect soils in the land temporarily required during the construction period. However, this would be temporary in nature and it is

expected that the land would return to baseline conditions during the years following completion of the Scheme. Some soil will be lost due to the increased width of carriageway construction and new access provisions; however the environmental value of the soil lost is low.

5.5.85 No potential sources of contamination that will be affected by the works have been identified. A potential source of waste that could be classed as hazardous has been identified due to tar within the road pavement materials (see Chapter 5.6: Materials).

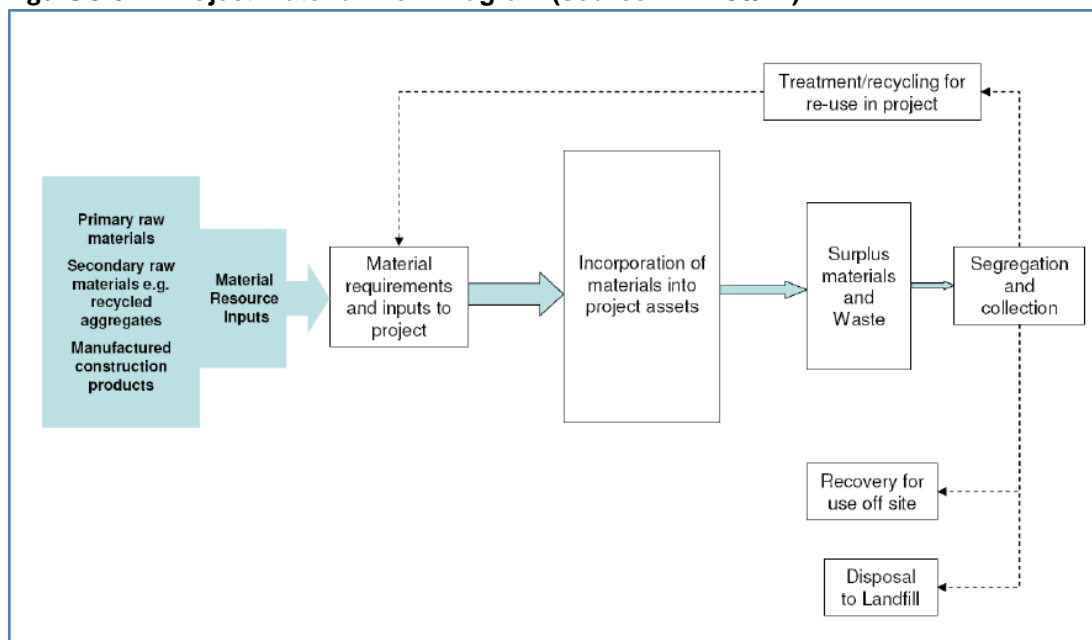
5.5.86 Monitoring of the residual impacts on Geology and Soils receptors is not considered to be required due to the minimal impact on them.

5.6 MATERIALS

Introduction

- 5.6.1 This chapter provides an assessment of the potential impacts from the use of material resources and generation of waste associated with the Scheme, and has been prepared in accordance with Interim Advice Note (IAN) 125/09, 'Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment' (Highways Agency, 2009).
- 5.6.2 IAN 153/11 'Guidance on the Environmental Assessment of Materials Resources' was produced by the Highways Agency in October 2011. The methodology for this chapter has been based upon the guidance provided within this document.
- 5.6.3 For the purpose of this assessment the term 'material resources' encompasses the materials and products required for the construction of the Scheme. Material resources include primary raw materials such as aggregates and minerals, and manufactured construction products. Many material resources will originate off site, purchased as construction products, and some will arise on site such as excavated soils or recycled road planings.
- 5.6.4 Construction waste associated with the Scheme will be generated from surplus materials which are likely to arise from two sources:
- Existing site materials e.g. concrete from demolition of existing structures, excavation of material from earthworks, and;
 - Materials brought on to site but not used for the original purpose e.g. damages, offcuts
- 5.6.5 Figure 5.6.1 illustrates how materials and waste are used in the construction process.

Figure 5.6.1: Project Material Flow Diagram (source: IAN153/11)



Method

- 5.6.6 A detailed assessment has been undertaken in accordance with IAN 153/11. The assessment is a quantitative exercise which aims to identify and quantify the effects associated with material use and waste during the construction of the Scheme. The guidance in IAN 153/11 is not prescriptive or exhaustive in order to provide a flexible approach, enabling those undertaking the assessment to tailor their approach to the specific characteristics of each scheme.
- 5.6.7 The assessment of the effects of constructing the Scheme on materials considers the extent, method and programme of the proposed earthworks and construction activities required to complete the construction phase. The impacts have been assessed before and after mitigation measures are applied.
- 5.6.8 This assessment has considered the following parameters:
- **Materials Requirements**
 - materials balance;
 - type of materials;
 - source of materials, and;
 - origin of supply of material
 - **Waste Forecasts**
 - volume and types of waste, and;
 - suitability for re-use, reclamation or recycling
 - **Construction impacts**
 - movements of materials;
 - storage of materials, and;
 - processing of materials
- 5.6.9 These parameters are based on the subjects included within IAN 153/11 for detailed assessments and subsequently the reporting mechanisms are based upon the matrices provided within Annex 2 and 3 of that guidance document.
- 5.6.10 The use of materials, including the management of waste, may also give rise to other impacts, which might include, for example, detrimental impacts on air quality and increased noise. Such impacts may be referenced in this chapter, however more detailed assessment can be found in other chapters of the ES (see Chapter 5.1: Air Quality and Chapter 5.7: Noise).

Assessment Criteria

- 5.6.11 Detailed guidance on aspects of assessment, including assigning significance of effects, is not available from IAN 153/11. However, this guidance does suggest that identifying the quantities of materials to be used and waste forecast to be produced provides the basis for assessment of magnitude of change, while permanent impacts are likely to be more significant in terms of their effects.

Study Area

- 5.6.12 The study area for the assessment corresponds primarily with the site boundary for the works, although if materials are imported or exported to and from site reference is made to the likely origin and destination sites based on current knowledge as described above.

Regulatory/Policy Framework

The EU Waste Framework Directive

- 5.6.13 The *EU Waste Framework Directive 2008/98/EC* provides the overarching legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste.
- 5.6.14 The overall purpose of the Waste Framework Directive is to lay down measures to protect the environment and human health by preventing or reducing the adverse effects of the generation and management of waste and by improving the efficiency and reducing the overall impacts of resource use. The Waste Framework Directive requires all Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health or causing harm to the environment.
- 5.6.15 The Waste Framework Directive sets out 5 steps for dealing with waste, ranked according to environmental impact - the 'waste hierarchy', see Table 5.6.1. Prevention, which offers the best outcomes for the environment, is at the top of the priority order, followed by preparing for re-use, recycling, other recovery and disposal, in descending order of environmental preference.

Table 5.6.1: The waste hierarchy

Prevention	Using less material in design and manufacture, keeping products for longer, re-use, using less hazardous materials
Preparing for re-use	Checking, cleaning, repairing, refurbishing, whole items or spare parts
Recycling	Turning waste into a new substance or product, includes composting if it meets quality protocols
Other recovery	Includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste, some backfilling
Disposal	Landfill and incineration without energy recovery

National Policy

- 5.6.16 *Towards Zero Waste*, published in 2012, is the Welsh Government's overarching waste strategy document and identifies high level outcomes, policies and targets. It forms part of a suite of documents that comprise the national waste management plan for Wales as required under various EU Directives and the National Waste Strategy for Wales as required under UK legislation. Detailed delivery actions are provided in 'sector plans'.
- 5.6.17 The following milestones and outcomes have been set in *Towards Zero Waste*:

By 2025, there will be a significant reduction in waste, and we will manage any waste that is produced in a way that makes the most of our valuable resources. This means maximising recycling and minimising the amount of residual waste produced, and achieving as close to zero landfill as possible. This is an intermediate step on the way to our 2025 target of achieving zero waste and 'living within our environmental limits'. This is needed because reducing the impact of waste in Wales to 'One Wales: One Planet' levels will require big changes in the way that products and services are designed, and the actions that consumers and businesses take.

By 2050, we will have reduced the impact of waste in Wales to within our environmental limits. Residual waste will have been eliminated and any waste that is produced will all be recycled. This means that the ecological footprint of waste in Wales will be at 'One Wales: One Planet' levels.

5.6.18 In addition to these key milestones, *Towards Zero Waste* sets out 4 sector specific milestones / targets for the construction and demolition sector:

2015 - The amount of C&D waste disposed of to landfill will be reduced by 50%.

2020 - The amount of C&D waste being prepared for re-use and recycled will have increased to a minimum of 90% by weight for all non-hazardous construction and demolition waste, excluding naturally occurring material defined in category 170504 in the List of Wastes.

2025 - There will be a significant reduction in the generation of C&D waste (23%), thereby reducing the impact of the ecological footprint of C&D waste.

2050 - We will have further reduced the ecological footprint of waste due to a further reduction in the amount of C&D waste generated (61%).

5.6.19 The Welsh Government *Construction and Demolition (C&D) Sector Plan* (November 2012) addresses waste materials which are directly generated by a C&D business conducting construction or demolition activities in Wales, no matter what the source of the waste. It includes all types of construction development and each phase within these developments (demolition, site clearance, sub-structure, super-structure, and fittings). The sector plan also covers wastes generated through the activities of renovation and maintenance of existing building structures.

5.6.20 This sector plan is aimed at all stakeholders who can influence the life cycle of a construction project and is therefore of relevance to anyone who commissions construction projects (whether private or public sector), architects and designers, planning and building control professionals, manufacturers, retailers and suppliers of building materials, construction companies, demolition companies, civil engineering organisations, general building operators of all sizes from sole-trader to large scale companies operating and working across Wales, and the waste management industry who take in C&D waste.

5.6.21 Key areas for action addressed with the sector plan mirror the 'waste hierarchy' discussed above and involve waste prevention, preparing for re-use, recycling, other recovery and disposal.

5.6.22 The sector plan focuses on a number of 'priority materials' – materials within the waste stream of the C&D sector specifically referred to by the *Waste Framework Directive* and/or which have the highest ecological footprint associated with them, and for which appropriate management is of paramount importance. Over 75% of the ecological footprint of C&D waste is attributable to five material groups:

- Wood (26.6%)
- Plastic (17.5%)
- Insulation and gypsum products (12.5%)
- Hazardous waste (10%)
- Metals (9.5%)

5.6.23 *Planning Policy Wales (PPW)* (edition 9, 2016) sets out the land use planning policies of the Welsh Government, translating the government's commitment to sustainable development into the planning system so that it can play an appropriate role in moving towards sustainability. PPW should be taken into account in the preparation of development plans and may be material to decisions on individual planning applications.

5.6.24 Chapter 4 of *PPW* (Planning for Sustainability) lists objectives which reflect the sustainable development outcomes and should be taken into account in the preparation of development plans and in taking decisions on individual planning applications in Wales. One of these objectives included in section 4.4 is to:

Maximise the use of renewable resources, including sustainable materials (recycled and renewable materials and those with a lower embodied energy). Where it is judged necessary to use non-renewable resources they should be used as efficiently as possible. The use of renewable resources and of sustainably produced materials from local sources should be encouraged and recycling and re-use levels arising from demolition and construction maximised and waste minimised

Local Policy

5.6.25 The Gwynedd Unitary Development Plan (UDP) was formally adopted in 2009 to establish the policy framework for development within the Gwynedd Local Planning Authority area, which includes the study area, and makes provision for development needs from 2001 – 2016.

5.6.26 Chapter C of the UDP addresses prudent use of natural resources and Policy C7 relates to building in a sustainable manner stating that:

Proposals for new development, or for the adaptation and change of use of land or buildings, which have not demonstrated that consideration has been given to matters relating to using more sustainable building materials, energy efficiency, waste recycling and the long term use of the building will be refused.

5.6.27 Of the list of criteria which must be complied with in order to demonstrate that new developments aim to reduce the detrimental effect on the environment, the following are applicable to the content of this chapter:

5) use locally sourced sustainable building materials and materials from certified sustainable sources

6) incorporate waste reduction measures (such as home composting) and waste recycling, sorting, storing and collection facilities

5.6.28 The Isle of Anglesey County Council and Gwynedd Council are required, by law, to prepare local development plans. The Councils have decided to work together to prepare the Anglesey and Gwynedd Joint Local Development Plan (JLDP). This plan sets out the land use planning policy framework over a 15 year period (2011 - 2026); it covers the Anglesey and the Gwynedd Local Planning Authority areas. The deposit plan was subject to public consultation during February and March 2015, it is currently anticipated that the plan will formally be adopted in July 2017.

- 5.6.29 Once the plan is adopted it will provide the starting point for when the Isle of Anglesey County Council and Gwynedd Council consider planning applications. The plan sets out how the Councils will provide for homes, jobs, the environment, and infrastructure.
- 5.6.30 Section 7.2 of the LDP is titled Living Sustainably and outlines how the plan contributes towards the work of achieving sustainable development. Strategic Policy PS5 (Sustainable Development) states that proposals will only be permitted where it is demonstrated that they are consistent with the principles of sustainable development, one of which (of relevance to this Materials assessment) is listed as:

8) Reduce the effect on local resources, avoiding pollution and incorporating sustainable building principles in order to contribute to energy conservation and efficiency; using renewable energy; reducing / recycling waste; using materials from sustainable sources; and protecting soil quality

Baseline Conditions

Geology and Contamination

- 5.6.31 A detailed description of the geological conditions and soils within the study area is provided in Chapter 5.5: Geology and Soils. A brief description of the type of materials that would be excavated during construction of the Scheme is provided below.
- 5.6.32 The Scheme passes over underlying bedrock of Ordovician Age comprising rocks of one formation only, the Nant Ffrancon Subgroup, which is described by the British Geological Survey (BGS) as Nant Ffrancon Subgroup - Siltstone. These are noteworthy, geologically and economically, in that they also contain mudstones that have been locally metamorphosed to slates which have been exploited since at least medieval times.
- 5.6.33 The BGS Geology of Britain Viewer¹⁰⁰ shows that the drift geology may be split into two basic groups. The first and larger group comprises brown and grey-brown largely impermeable Glacial Till that can be locally sandy. These beds provide a regional cover of several metres (up to 39 metres in a borehole northeast of Wig Farm) over the majority of the Scheme and the surrounding area. There are no tidal deposits present.
- 5.6.34 The second group is comprised of varicoloured clays, sands, gravels and boulders, Alluvial Fan Deposits, that form an alluvial cone or outwash fans trending north-west towards the sea from the mountains to the south. These types of deposit generally represent river and outwash deposition occurring during or just after glacial periods.
- 5.6.35 The information provided by the study of old Ordnance Survey maps indicates that the area affected by the Scheme does not contain any significant industry and has not done so for a considerable period of time. The area is mostly rural, with any industry seemingly on a very small scale and centred upon agriculture.

¹⁰⁰ Available at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

5.6.36 The main current land use is farming, which is known to produce potential contaminants such as slurry, sheep dip *etc.* However, it is unlikely that these contaminants have passed into the soils in any significant quantities and they are very unlikely to constitute a source of contamination. See Chapter 5.9 (Community and Private Assets) for further details on agricultural impacts.

5.6.37 A number of cores have been taken through the road pavement layers and have been tested for tar content; the results of these have been negative for the A55(T), but positive for one core taken from Roman Road (Henffordd). If disposed of off-site this material may be classed as a hazardous waste.

Traffic Movements and HGV Site Access

5.6.38 As described in Chapter 2, the Scheme consists of an online improvement along the A55(T) over a length of 2.2km. The improvement commences opposite Tai'r Meibion farm and continues eastwards to terminate approximately 300m south-west of the Abergwyngregyn interchange eastbound slip road (Junction 13). Connectivity to the proposed site from adjacent sections of the A55(T) is considered optimal for transport of materials in terms of network suitability and existing traffic volumes.

5.6.39 It is not currently known where along the scheme the site compound and storage areas would be situated as this will be a matter for the main contractor to determine, though restrictions will exist for some areas of the scheme due to ecological constraints as described in Chapter 5.4 (Nature Conservation). It is currently expected that the number of accesses from/onto the A55(T) will be limited to minimise interface with road traffic, and haul roads adjacent to the A55(T) to the north and south will be used to transport materials along the site.

Landfill

5.6.40 Table 5.6.2 identifies landfill sites for construction waste within a reasonable proximity of the study area according to the NRW waste permitting interactive mapping service¹⁰¹ (non-exhaustive), which could be used as disposal sites for waste material generated during the construction phase of the Scheme.

Table 5.6.2: Landfill Sites for Construction Waste within Close Proximity to the study area

Name and location of landfill site	Type of waste accepted	Distance from study area (approx.)
Nant y Garth Landfill Site	Inert	9 km
Penhesgyn Gors Landfill	Non-hazardous	12km
Pontrug Landfill	Inert	16km
Cae Main Farm	Inert	16km
Nant Newydd Quarry	Inert	17km

¹⁰¹ <http://naturalresources.wales/WastePermitMap?lang=en>

Rhuddlan Bach Quarry	Inert	17km
Ty Mawr East Quarry	Non-hazardous	25km

Environmental Effects

Overview

- 5.6.41 The effects associated with material use and generation of waste as a result of the Scheme are identified and described below and summarized in Table 5.6.5 in accordance with the reporting requirements of IAN 153/11.
- 5.6.42 Material resources encompass the materials and construction products required for the construction of the scheme. The potential environmental impacts are associated with the extraction and transport of primary raw materials, the manufacture of products, and their subsequent transport to, and use on construction sites. Many material resources would originate off site, purchased as construction products and some would arise onsite such as excavated soils or vegetation.
- 5.6.43 For surplus materials and waste, the potential environmental impacts are associated with the production, movement, transport, processing, and disposal of arisings from the construction site. The basis of the assessment of impacts of waste will be to firstly identify the quantities and type of waste, and then try to establish the impacts.

Assumptions and limitations

- 5.6.44 It should be noted that the assessment of impacts upon material resources is only based on the knowledge available at the outline design stage, whereas most decisions regarding material use and management are taken during the detailed design and construction phases of a project. The assessment is therefore based upon current forecasts of material use and knowledge of existing suppliers and haulage options, and the opportunities for resource efficient decisions to be taken during subsequent phases of the project.
- 5.6.45 The construction waste volumes are also based on the current outline design, and at this stage the level of waste resulting from materials which are brought onto the site and not incorporated into the permanent works (*e.g.* offcuts, damaged materials, formwork) has not been considered, as the type and volume of waste generated via this stream is subject to various factors which are currently unknown *e.g.* construction techniques, phasing of works and procurement procedures.
- 5.6.46 The area of construction considered is based upon the land take acquired through statutory procedures. However, it is likely that the main contractor will seek to obtain further land for temporary compounds and storage areas (see Chapter 2). Whilst it is uncommon for such temporary land take to be identified at this stage, certain assumptions have been made in describing mitigation whereby particularly environmentally sensitive areas are not available for such purposes.

Materials Requirements

Materials Balance

- 5.6.47 An estimate of the current earthworks balance for the Scheme is provided in Table 5.6.3, and is split between the three separate elements of the project consisting of the online A55(T) works, the construction of the proposed county road/NMU route to the north, and the improvements to Roman Road (Henffordd), including the provision for a new access track for Wig Farm. This exercise has identified that there is a deficit of fill material in the region of 19,305m³ which will need to be supplemented by imported class 1A granular fill.
- 5.6.48 A modest shortage of 938m³ of topsoil material has been identified in Table 5.6.3 between what is required for the verges and landscaping areas for the Scheme and what is available as site won material. The earthworks balance estimate was based on a nominal topsoil depth won across the whole of the current site and a uniform topsoil finish for all verges and landscape areas across the Scheme (all verges and planting areas). However, the volume of topsoil which will be required during the finishing works for the Scheme will be subject to the detailed landscaping design. NMWTRA have requested that topsoil use within areas of the soft estate considers the encouragement of wildflower establishment (see Chapters 5.3 and 5.4); the successful contractor will therefore be required to consider this objective as well as the need to prevent topsoil being taken from site as waste. Therefore, an overall topsoil balance is predicted.
- 5.6.49 It is currently estimated that 21,676m³ of existing pavement construction will be removed between the A55(T) and Roman Road (Henffordd) to accommodate the scheme. At present this figure has not been used to supplement the volume of material required as general fill or pavement construction for the Scheme, as the availability of the material removed for re-use will depend on the phasing of work utilized by the main contractor.

Table 5.6.3: Estimated earthworks and pavement balance for the Scheme*

Material	A55(T)	County Road/NMU route	Roman Road (Henffordd)	Total
<i>Earthworks</i>				
Earthworks Fill	28,481	1,580	2,119	32,180
Earthworks Cut	11,589	861	425	12,875
Balance	-16,892	- 719	- 1,694	- 19,305
<i>Topsoil (Class 5A material)</i>				
Topsoil Requirement		9,350	538	9,888
Topsoil Strip**		7,837	1,113	8,950
Balance		-1,513	+575	-938
<i>Pavement Construction***</i>				

Bituminous Material	11,865	2,222	958	15,045
Sub-base Material	9,517	3,175	1,081	13,773
Existing Pavement Removal	21,382	-	294	21,676
<p>* All units are in m³</p> <p>** Based on nominal current topsoil depth and a uniform topsoil finish for all verges and landscape areas across the Scheme (all verges and planting areas)</p> <p>*** Balance of road construction material will depend on the contractor's chosen phasing of work and the availability of material removed from the existing A55(T) pavement for use either within improved sections of the A55(T) or Roman Road (Henffordd), or within the proposed County Road/NMU route to the north.</p>				

Type of Materials

5.6.50 A breakdown of the material requirements currently estimated for the construction of the Scheme as well as an estimate, where practicable, of the volume or extent of each type of material required is provided in Table 5.6.4. The requirement for road construction material and/or general fill could be significantly offset by the re-use or recycling of road planings won during removal of the existing pavement.

Table 5.6.4: Estimated materials requirements for the Scheme

Material	Requirement	Type	Likely Origin	Distance
Earthworks Fill	Approx. 19,000m ³ of well-graded granular material	Naturally occurring, secondary aggregate	Bethesda/ Penmaenmawr	9/12km
Road Surfacing	Approx. 15,000m ³ between all grading layers	Man made using primary aggregate (recycled site won road planings may also be used for base layer)	Penmaenmawr	12km
Sub-base	Approx. 14,000m ³ of graded aggregate	Naturally occurring, secondary aggregate (recycled site-won road planings may also be used)	Bethesda/ Penmaenmawr	9/12km
Topsoil	Approx. 1,000m ³ of soil for use in verges and landscape areas	Naturally occurring	Local	<50km
Concrete	Currently unknown volume for use within the central reservation safety barrier, culvert headwalls and agricultural underpass structures	Man-made using primary aggregate (recycled aggregate can also be used based on availability)	Bangor/ Penmaenmawr	4/12km

Steel	Currently unknown volume for use within the central reservation safety barrier (2.2km), culvert headwalls and agricultural underpass extensions	Man-made material using high recycled content (75-100%)	Bangor	4km
Drainage materials	Combination of plastic (some concrete) pipes and chambers which make up the surface water drainage network across the improvement	Man-made synthetic material	Local	<50km
Drainage Surround	Pipe bedding for the drainage network	Naturally occurring, secondary aggregate	Local	<50km
Fencing and Gates	Combination of stock and mammal proof fencing either side of the road for the length of the improvement (approx. 5.5km)	Man-made using sustainable sourced timber posts and galvanized steel mesh	Local	<50km

Source of Materials

5.6.51 Table 5.6.4 contains an estimation of the source of the various materials required for the construction of the Scheme and shows that it is currently estimated that the majority of the construction materials can be obtained locally. It is likely that the bulk fill material can be sourced from either the Penrhyn Quarry at Bethesda or the Penmaenmawr Quarry, both of which are located nearby and are linked via the current trunk road network. Similarly it is likely that material for new pavement construction can be obtained from these sources, and ready-mix plants are available at Penmaenmawr and Bangor to supply concrete for the various structural works across the Scheme. It is envisaged that the remaining construction materials will be obtained through the various suppliers located near Bangor or along the north Wales coastline.

5.6.52 Considering the location of the Scheme and the proximity of material suppliers it is envisaged that all construction materials will be transported to the site along the existing A55(T) and surrounding highway network. Potential disturbance upon the flow of traffic as a result of importing construction materials would be limited by the moderate volume of import and local availability of materials, and would be largely concealed by the traffic management measures associated with construction of the Scheme.

Waste Forecasts

Type and Volume of Waste

5.6.53 The type and volume of excavated waste material expected to be generated from construction of the Scheme is shown in Table 5.6.3. It is currently estimated that the only site-won excavated material which may be surplus to requirements during the construction phase is the existing pavement material which requires removal; this is likely to be

comprised of a combination of bituminous and sub-base material. As explained previously, the recycling of this material within the permanent works will depend upon the main contractor's construction programme, and whether phasing of the work will allow opportunities to use this material in suitable parts of the works on its removal. Conversely, such opportunities may have passed by the time this material is removed. The present estimate of existing road pavement material which will require removal is 21,676m³.

- 5.6.54 Other material which will be encountered during site clearance and may not be suitable for re-use, therefore requiring removal from site includes: existing stock-proof and post and rail fencing material (circa 4400m); hedgerow (circa 4000m) and individual trees; timber/steel gates; concrete removed from existing structures, existing drainage pipes and redundant road signs.

Suitability for re-use, reclamation or recycling

- 5.6.55 It is estimated that earthworks material encountered during excavation would be suitable for re-use within the works. However the main contractor will be required to develop a strategy for removing the bulbs of non-native daffodils when excavating soils from the current central reserve (see Chapter 5.8), as the re-emergence of these daffodils does not form part of the landscaping design. Restrictions will also be associated with the re-use of soils within Local Wildlife Site: Railway Line Wood 2 that may contain *Rhododendron ponticum*, a non-native invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981, to prevent the possibility for this plant to spread beyond the area described in Chapter 5.4.
- 5.6.56 Following removal by planing the existing surfacing material is likely to be suitable for recycling as coarse aggregate required for new pavement construction or as general fill in various areas of the site, including the realigned highway. Further tests along a section of Roman Road (Henffordd) will be required to determine the composition and suitability for re-use/recycling of the existing road surfacing following confirmation of tar content during initial ground investigation studies.
- 5.6.57 Existing gates, fencing materials and redundant road signs encountered during site clearance activities described above may not all be suitable for re-use within the permanent works and would therefore be removed to offsite waste facilities, with most of the materials suitable for recycling.

Construction Impacts

Movements of materials

- 5.6.58 It is envisaged that all construction materials will be transported to the site along the existing A55(T) and surrounding highway network. Potential disturbance upon the flow of traffic as a result of importing construction materials would be limited by the moderate volume of import and local availability of materials, and would be largely concealed by the traffic management measures associated with construction of the Scheme. The balance of earthworks across the site also means that there would not need to be significant haulage of excavated material between different areas of the site during construction, and site-won material could be stored for re-use near to the area it was excavated.

Storage of materials

5.6.59 The land adjacent to the existing highway available to the contractor during construction is made up of agricultural land (see Chapter 5.9 and Figure 5.9.1, Volume 1a) with pockets of ecologically sensitive areas such as the woodland to the north of the A55(T) west of Tai'r Meibion farm (Railway Line Wood 2; see Figure 5.3.4, Volume 1a), and residential properties are well spaced (see Figure 2.1, Volume 1a). Therefore, restrictions on selection of storage areas are considered to be limited.

5.6.60 The level of earthworks associated with the Scheme should not result in significantly large storage areas during construction. It is assumed that all topsoil will be windrowed in low stockpiles near to the position of excavation prior to incorporation within the permanent works. The need for storage of excavated material to be used within the permanent embankment will largely depend on the contractor's construction programme, as is also the case for road planings. Excavated material may need to be segregated into types which are suitable and unsuitable for use within the permanent earthworks or dehydrated in open air before it can be handled further. As discussed above, it is considered that there is sufficient and suitable land available for the materials storage requirements of the Scheme.

Processing of materials

5.6.61 The processing of excavated materials prior to their incorporation into the permanent works is predicted to be minimal. The moisture content of site-won material may need to be reduced to a suitable level before it can be placed within the new embankment, though associated impacts are predicted to be negligible. The processing of existing road surfacing would occur on its removal and further treatment is not expected.

5.6.62 Table 5.6.5 summaries the construction phase environmental effects described above in accordance with the IAN 153/11 reporting matrices. The project activities have been tailored towards the Scheme and do not include operational or maintenance activities.

Table 5.6.5: Environmental Effects Reporting Matrix (source: IAN 153/11, Annex 2)

Project Activity	Potential impacts associated with material resources/waste arisings	Description of environmental effect
Site Clearance	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Adverse, Permanent, Indirect, Negligible Impact
Excavation	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Adverse, Permanent, Indirect, Minor Impact
Construction	Import of materials for the construction which reduces resource and availability of raw construction materials	Adverse, Permanent, Indirect, Minor Impact
	Importation of materials could also introduce contaminating substances or invasive species if sourced from negligent supplier	Adverse, Permanent, Indirect, Minor Impact

Movement of materials	Movement of materials to/from the construction site can cause temporary disturbance to traffic flows and increase local air pollution and noise levels.	Adverse, Permanent, Direct, Minor Impact
	Movement of materials across the site can impact upon the integrity of ecological features and surface water quality, and can also generate dust which can impact environmental and human receptors.	Adverse, Permanent, Direct, Moderate Impact
Storage of materials	Storage of earthworks and construction materials can impact upon sensitive ecological receptors directly through site clearance activities, by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Adverse, Permanent, Direct, Moderate Impact
Processing of materials	Processing of earthworks can impact upon sensitive ecological receptors directly through site clearance activities, by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Adverse, Permanent, Direct, Moderate Impact

Mitigation Measures

5.6.63 Decisions and measures to minimise environmental effects generated from the use of materials and generation of waste would mainly be implemented during detailed design and construction of a project. In order to direct the main contractor and detailed designer towards resource efficient solutions the following series of contractual requirements will provide a framework for sustainable decision making.

CEEQUAL

5.6.64 CEEQUAL is an evidence-based sustainability assessment which aims to deliver improved project specification, design and construction of civil engineering works. As is common for Welsh Government highway improvement projects it is envisaged that the framework provided by the CEEQUAL assessment manual will be used to integrate the principles of sustainable development into the design and construction of the Scheme. Application of the CEEQUAL process will guide the detailed design towards the following resource efficiency and waste minimization considerations, all of which will encourage provisions to reduce the overall impacts of the Scheme further than the measures which can be described for the current outline design stage:

- material resource efficiency planning
- cut and fill optimization
- durability and low maintenance of materials
- soil management
- re-use of site won materials
- use of reclaimed or recycled materials

Site Waste Management Plan

5.6.65 Efficient site waste planning will enable the identification of all potential waste streams associated with a construction project therefore allowing the establishment of measures to

minimize the generation of waste through reduction, recovery and recycling; and also to manage the storage and movement of different types of waste during construction. Part of the duties placed upon the eventual contractor and their designers will be the preparation and early implementation of a Site Waste Management Plan (SWMP), allowing waste management principles to be adopted from the outset, thereby resulting in greater benefits.

Construction Environmental Management Plan

5.6.66 The main contractor will be required to establish a Construction Environmental Management Plan (CEMP, see Chapter 7), the main purpose of which is to enable management of the construction phase to minimize all potential environmental impacts. With particular regard to the content of this chapter, the CEMP would identify procedures to minimize the impacts associated with the following aspects:

- additional land take selection
- use of temporary working areas
- storage of materials next to watercourses
- nuisance caused by construction traffic
- generation of dust

5.6.67 Through application of the procedures described above a range of mitigation measures can be identified and implemented which will reduce the significance of potential environmental effects described in Table 5.6.5.

5.6.68 The re-use of excavated material from earthworks activities would be employed to minimise the volume of imported fill required and the volume of waste removed from site for disposal. Using site-won material within the Scheme would mitigate the potential impacts of using large quantities of raw materials and limiting HGV trips associated with construction. The present estimate of existing road pavement material which will require removal is 21,676m³. The recycling of existing pavement construction material within the permanent works will depend upon the main contractor's construction programme, and appropriate phasing of the work will allow opportunities to use this material in suitable parts of the works on its removal.

5.6.69 This material could also be suitable as surfacing for field accesses or agricultural tracks constructed as part of the Scheme. The geotechnical property of road planings makes it unlikely that any such surplus material would be disposed of, and would likely be used for construction purposes elsewhere should it not be practicable to recycle on site.

5.6.70 Consideration of waste at the detailed design stage through implementation of a SWMP will allow mitigation to be incorporated into the design and for such measures to become part of the scheme; this approach will help to identify opportunities to 'design out' waste prior to construction and allow suitable receptor sites to be identified for surplus waste materials as necessary.

5.6.71 Other than excavated earthworks materials the most potentially significant waste streams during site clearance are estimated to be existing fences, gates and hedgerow material, and the main contractor will be required to develop plans for their treatment based on the waste hierarchy. Some materials could be utilized by adjacent landowners should condition allow and there are likely to be beneficial re-uses for vegetation material on site *e.g.* as

hibernacula for reptiles or as an organic mulch to suppress weed growth along the base of the new hedge line (see Chapters 5.3: Landscape and 5.4: Nature Conservation).

- 5.6.72 Any imported materials required would be from approved sources and the suitability of the material checked. For any imported earthworks materials, appropriate chemical testing would be undertaken to confirm that no contamination is present within the imported materials (see also Chapter 5.5: Geology and Soils).
- 5.6.73 Table 5.6.4 suggests that the material requirement consists of fairly conventional construction products, much of which can be provided by site-won material, secondary aggregates, recycled products and certified sustainable sources. The availability of such products will provide the main contractor with an opportunity to make decisions regarding material sourcing based on sustainability performance, thereby reducing the direct and whole-life impacts of the Scheme.
- 5.6.74 To mitigate the potential impacts of transporting materials to site, material would be derived from the nearest practicably available source and suitable location to keep HGV journey distances to a minimum.
- 5.6.75 Temporary working areas including compounds, storage areas and haul roads will be positioned to avoid sensitive ecological receptors such as watercourses, retained trees, bat roosts and active badger setts (see Chapter 5.4: Nature Conservation). The temporary storage of materials will follow best practice guidance measures to prevent the generation of dust (see Chapter 5.1: Air Quality) and silt-laden run-off towards existing surface water receptors (see Chapter 5.10: Road Drainage and the Water Environment), and would also limit stockpile heights to maintain structure of topsoil during storage (see Chapter 5.5: Geology and Soils). With implementation of sensitive working practices in the selection and management of materials storage areas, coupled with the inert nature of the material to be stored, it is not expected that any impacts to the surrounding natural environment or to human health would occur as a result of materials storage or handling.

Residual Environmental Effects

- 5.6.76 Table 5.6.6 summarises the potential impacts associated with material resources/waste arisings from the project, construction phase mitigation measures and the predicted residual magnitude of effects following their implementation, in accordance with the IAN 153/11 reporting matrices.

Table 5.6.6: Mitigation Measures Reporting Matrix (source: IAN 153/11, Annex 3)

Project Activity	Potential impacts associated with material resources/waste arisings	Description of mitigation measures	How the measures will be implemented, measured and monitored	Description of environmental effect after mitigation
Site Clearance	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Early estimation of waste stream and developing of treatment options based on waste hierarchy	Waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Indirect, Negligible Impact
Excavation	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Early estimation of waste stream and developing of treatment options based on waste hierarchy	Waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Indirect, Negligible Impact
Construction	Import of materials for the construction phase which reduces resource and availability of raw materials	Minimise volume of imported material by allowing re-use of site won material Consider use of secondary material where nett import remains	Waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Indirect, Negligible Impact
	Importation of materials could also introduce contaminating substances or invasive species if sourced from negligent supplier	Source material from reputable and certified supplier and obtain chemical testing results	Environmental protection and biosecurity measures and monitoring procedures to be stipulated in CEMP	Adverse, Permanent, Indirect, No Change
Movement of materials	Movement of materials to/from the construction site can cause temporary disturbance to traffic	Minimise volume of imported material by allowing re-use of site won material.	Waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Direct, Negligible Impact

	flows and increase local air pollution and noise levels.	Identify local suppliers and waste receptor sites to reduce residual traffic-related impacts		
	Movement of materials across the site can impact upon the integrity of ecological features and surface water quality, and can also generate dust which can impact environmental and human receptors.	Implementation of best practice construction site methods during selection and management of haul routes to prevent impacts on environmental and human receptors	Environmental protection measures and monitoring procedures to be stipulated in CEMP	Adverse, Permanent, Direct, Minor Impact
Storage of materials	Storage of earthworks and construction materials can impact upon sensitive ecological receptors directly through site clearance activities, by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Implementation of best practice construction site methods during selection and management of storage/processing areas to prevent impacts upon environmental and human receptors	Environmental protection measures and monitoring procedures to be stipulated in CEMP	Adverse, Permanent, Direct, Minor Impact
Processing of materials	Processing of earthworks can impact upon sensitive ecological receptors directly through site clearance activities, by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Implementation of best practice construction site methods during selection and management of storage/processing areas to prevent impacts upon environmental and human receptors	Environmental protection measures and monitoring procedures to be stipulated in CEMP	Adverse, Permanent, Direct, Minor Impact

Summary

- 5.6.77 This chapter, prepared in accordance with IAN 125/09 and IAN 153/11, has considered the environmental effects associated with the use of material resources and generation of waste for the Scheme. A detailed assessment of the effects of constructing the Scheme on materials has considered the extent, method and programme of the proposed earthworks and construction activities required to complete the construction phase. The impacts have been assessed before and after mitigation measures are applied.
- 5.6.78 The assessment is based on the knowledge available at the outline design stage and has used current forecasts of material use and knowledge of existing suppliers and haulage options, and the opportunities for resource efficient decisions to be taken during subsequent phases of the project.
- 5.6.79 Without mitigation, the key impacts associated with Materials are:
- Generation of waste material to be disposed away from site thereby reducing capacity of local waste management facilities (up to minor adverse);
 - Import of construction materials which reduces resource and availability of raw construction materials and could introduce contaminating substances/invasive species if sourced from negligent supplier (minor adverse);
 - Movement of materials to/from the construction site causing temporary disturbance to traffic flows and increased local air pollution and noise levels (minor adverse);
 - Movement of materials across the site affecting the integrity of ecological features and surface water quality and generating dust (moderate impact), and;
 - Processing/storage of earthworks and storage of construction materials affecting sensitive ecological receptors directly through site clearance activities, silt-laden run-off and dust (moderate impact).
- 5.6.80 Decisions and measures to minimise such environmental effects would mainly be implemented during detailed design and construction. In order to direct the main contractor and detailed designer towards resource efficient solutions the following series of contractual requirements will provide a framework for sustainable decision making:
- CEEQUAL: the framework provided by the CEEQUAL assessment manual will be used to integrate the principles of sustainable development into the design and construction of the Scheme. Application of the CEEQUAL process will guide the detailed design towards resource efficiency and waste minimisation considerations.
 - Site Waste Management Plan (SWMP): part of the duties placed upon the eventual contractor and their designers will be the preparation and early implementation of a SWMP, allowing waste management principles to be adopted from the outset, resulting in greater benefits, and;
 - Construction Environmental Management Plan (CEMP): the main contractor will be required to establish a CEMP (see Chapter 7) to enable management of the construction phase to minimize all potential environmental impacts, including those associated with materials resource use and generation of waste.
- 5.6.81 Through application of the procedures described above a range of mitigation measures can be identified and implemented which will reduce the significance of the identified environmental effects to no more than minor adverse.

5.7 NOISE AND VIBRATION

Introduction

- 5.7.1 This chapter presents an assessment of the potential noise and vibration impacts of the Scheme in accordance with the Simple Assessment method described in the DMRB (Volume 11, Section 3, Part 7; HD213/11 Noise and Vibration).
- 5.7.2 In summary, the following potential impacts/benefits have been identified for further assessment in this chapter:
- Short-term temporary noise effects on nearby sensitive receptors during construction (qualitative assessment)
 - Long-term permanent noise and vibration effects on nearby sensitive receptors in the worst-case year (15 years after opening)
- 5.7.3 It is not possible to evaluate the effects of groundborne vibration during the construction phase as there is insufficient information regarding construction methods and propagation pathways to allow an accurate construction vibration assessment to be made according to BS5228-2. It is recommended therefore that a construction vibration assessment be undertaken by the contractor, and appropriate mitigation measures proposed (if required) prior to works commencing. Any required mitigation measures would form part of the Construction Environmental Management Plan (CEMP), see Chapter 7.
- 5.7.4 The primary access route for construction traffic, including the import of aggregate required to elevate the road surface will utilise the existing A55(T). The number of construction vehicle movements, including HGVs, will be very small in relation to the existing traffic flows on the A55(T), and therefore noise and vibration effects of construction traffic will be negligible and further assessment has been scoped out.
- 5.7.5 In accordance with DMRB, the study area for the assessment includes 1km either side (north and south) of the A55(T) carriageway edge. Within this area, for operational noise impacts the quantitative assessment is required to include the area within 600m of the A55(T) carriageway edge (referred to as the 'calculation area').
- 5.7.6 The noise-sensitive receptors (NSRs) within the study area, and therefore considered within this assessment include (see Figures 2.1, 5.4.1 and 5.4.2-4, Volume 1a):
- Private residential properties within the calculation area (Nos. 1 & 2 Bryn Meddyg, Tai'r Meibion, Wig Farm & The Old School);
 - Public Rights of Way (PRoW); and
 - Protected Areas (SAC, SPA, SSSI and LNR sites in the Menai Strait just over 600m to the north and SAC, SSSI and NNR sites approximately 700m to the southeast.
- 5.7.7 Of the above NSRs, a quantitative assessment of operational impacts is required for the private residential receptors, whilst a qualitative assessment of potential impacts is required for remaining NSRs, due to the temporal nature of exposure (PRoWs) and relative proximity to the scheme.

Methodology

Short-term Construction Noise

- 5.7.8 Construction site noise is assessed differently from noise from permanent operations, as it is recognised that the former is an inevitable by-product of required works and its effects are limited in duration.
- 5.7.9 Advice is contained within BS5228:2009 *Noise and Vibration Control on Construction and Open Sites* (+A1:2014 Part 1 Noise (BS5228-1)). This document contains a database of the noise emission levels from individual items of equipment and certain activities to allow the prediction of noise from construction (and demolition) works to identified receptors. The prediction method provides guidance on the effects of different types of ground and barrier attenuation and on how to assess the impact of fixed and mobile plant. Whilst not mandatory, Annex E of BS5228 provides informative advice to aid the development of noise assessment criteria based on previous published guidance and methodologies adopted successfully for other planning applications.
- 5.7.10 In assessing the requirement for noise limits, or operating period controls relating to construction works, Government Agencies and Local Authorities generally give consideration to the following aspects of the planned works, all of which have a bearing on the 'significance' of the effect:
- duration of planned activities (weeks, months, years);
 - whether activities are planned for the night time period;
 - proximity of development to residential areas, and;
 - predicted short-term noise levels and noise effects at residential areas.
- 5.7.11 Similarly, temporary construction vibration effects are assessed in accordance with advice contained within BS5228:2009 *Noise and Vibration Control on Construction and Open Sites* (+A1:2014 Part 2 Vibration (BS5228-2)). Whilst it states appropriate vibration limits in respect of potential building damage, the consideration of nuisance vibration effects must also take account of the likely exposure period, with mitigation against disturbance provided by prior notification of works and sensitive scheduling of such.

Long-term Operational Road Traffic Noise

- 5.7.12 Noise from a flow of road traffic is generated by both vehicles' engines and the interaction of tyres with the road surface. The traffic noise level at a receptor, such as an observer at the roadside or residents within a property, is influenced by a number of factors including traffic flow, speed, composition (% HGV), gradient, type of road surface, distance from the road and the presence of any obstructions between the road and the receptor.
- 5.7.13 Noise from a stream of traffic is not constant; therefore, to assess the noise impact a single figure estimate of the overall noise level is necessary. The index adopted by the Government (in 'The Calculation of Road Traffic Noise' (CRTN) (1988, first issued in 1975)) to assess traffic noise is $L_{A10,18h}$, which is the arithmetic mean of the noise levels exceeded for 10% of the time in each of the eighteen 1-hour periods between 06.00 and 24.00. A reasonably good correlation has been shown to exist between this index and residents' perception of traffic noise over a wide range of exposures.

- 5.7.14 CRTN provides a standard methodology for predicting the $L_{A10,18h}$ road traffic noise level. Noise levels are predicted at 1m external to the façade of the worst-affected external window or door of a habitable room.
- 5.7.15 In assessing noise nuisance, DMRB defines two methods, the first when there are only gradual changes in noise exposure, and the second when there are step changes. The method recognises that individuals can be more sensitive to step changes. For most properties only a gradual change is expected, but where a sudden change is expected due to an increase in carriageway level the assessment takes this into account.

Long-term Operational Road Traffic Vibration

- 5.7.16 The level of airborne vibration nuisance is closely associated with the accepted $L_{A10, 18hour}$ noise measurement parameter for assessing road traffic noise. DMRB suggests that vibration nuisance levels can be evaluated by subtracting 10% from the equivalent $L_{A10, 18hour}$ noise nuisance level, and this is addressed further in the noise impacts assessment section.

Baseline Information

Regulatory/Policy Framework: National Planning Policy

- 5.7.17 Planning Policy Wales (Edition 9, November 2016) (PPW) sets out the land-use planning policies of the Welsh Government. Under PPW, local authorities are required to consider the effects of all transport infrastructures within Regional Transport Plans (RTPs).
- 5.7.18 The Environmental Noise (Wales) Regulations 2006 and the Environmental Noise (Wales) (Amendment) Regulations 2009 (collectively “the Regulations”) established the legal requirements of the Environmental Noise Directive (Directive 2002/49/EC) (END) in Wales. Under the Regulations, the Welsh Government was required to publish strategic noise maps, and subsequently a Noise Action Plan (NAP) identifying Priority Areas (PA) and Quiet Areas (QA) upon which to focus attention in the development decision process and identify a long-term strategy for noise reduction in Wales. In December 2013, “A noise action plan for Wales 2013-2018” (NAPW) was published by the Welsh Government. The relevant sections of this report are discussed below.

Regulatory/Policy Framework: Short-term Construction Noise

- 5.7.19 On 6th April 2015, BS5228-1 gained Approved Code of Practice status (in England) under the powers conferred by sections 71(1)(b), (2) and (3) of the Control of Pollution Act (CoPA) 1974, as enacted under The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015. Compliance with the best practice noise mitigation requirements stated therein became a statutory obligation under the Act.
- 5.7.20 The Land Compensation Act 1973 makes provision for temporary re-housing where continued occupation is not reasonably possible because of construction noise. The Noise Insulation Regulations 1975 (amended 1988) (NIR) also permit the offer of insulation where construction noise ‘*seriously affects, for a substantial period of time, the enjoyment of the building*’. The Highway Authority may provide sound insulation at its discretion, subject to local conditions. Current road traffic noise levels at the four closest properties ($L_{Aeq, 12hour}$) are in the region of 71 to 81 dB (A). See Table 5.7.1.

- 5.7.21 The NIR provide certain mandatory and discretionary powers in relation to the provision of noise insulation to affected dwellings. Under Regulation 3, noise from a new highway that conditionally exceeds 68 dB(A) $L_{A10, 18hr}$ requires a highway authority to make offers of insulation to eligible dwellings. The conditions are that the noise level must also rise by at least 1 dB(A) with a 1 dB(A) contribution from within scheme limits. Regulation 4 provides discretionary powers in relation to altered highways. Regulation 5 also allows a highway authority to offer insulation where noise from the construction of a new road seriously affects, or would seriously affect for a substantial period of time, the enjoyment of an eligible building. Where development leads to traffic growth on existing roads, there is no obligation to offer noise insulation where noise levels are raised.
- 5.7.22 The Environmental Protection Act, 1990, Part III deals with nuisance resulting from airborne dust, noise and other statutory forms of nuisance. Under this direction, the contractor has a duty to recognise this and to take action to avoid or reduce such nuisance to acceptable levels.

Regulatory/Policy Framework: Long-term Operational Road Traffic Noise

- 5.7.23 Within the provisions of the Land Compensation Act (1973) and the NIR, residential properties may be eligible for noise insulation within 300m of a proposed new or altered highway. Eligibility under the NIR is subject to all of the following conditions being met:
- Dwellings and residential buildings must not be more than 300m from the nearest point on the new or improved carriageway;
 - The anticipated level of L_{A10} (18hour) predicted at 1m in front of the most exposed façade, 15 years from the opening of the highway, must be at least 68 dB (A);
 - The highest annually averaged level within 15 years of opening of the highway, of L_{A10} (18 hour) from all traffic in the area, must be at least 1 dB (A) greater than those that existed prior to the commencement of the development;
- The anticipated level of L_{A10} (18 hour) from the improved section of highway, 15 years from the opening of the highway, must contribute at least 1 dB(A) to the increase in level.
- 5.7.24 Consideration has also been given to Planning Guidance Wales TAN (W) 11: Noise and Development.
- 5.7.25 The Environmental Protection Act, 1990, Part III deals with nuisance resulting from airborne dust, noise and other pollution. Therefore, this should be considered with regard to noise levels generated as a result of the Scheme during its construction and operation.
- 5.7.26 The Wales Transport Strategy (published April 2008) describes key outcomes that it seeks to achieve, including improving the positive impact of transport on the local environment (Outcome 15). An indicator of this is identified as the change in the number of targeted noise action plans related to transport. The noise action plan for Wales (NAPW) included maps showing priority areas (based on 2007 noise maps). The section of the A55(T) adjacent to Nos. 1 & 2 Bryn Meddyg was identified as a priority area (NAPPA ID406), and deployment of a low noise surface is appropriate for this designation.
- 5.7.27 Policy B33 of the Gwynedd UDP provides guidance on Development that Creates Pollution or Nuisance. This states that *“proposals that will cause significant harm to the quality of public health, safety or amenities, or on the quality of the built or natural environment as a result of higher levels of air, water, noise or soil pollution will be refused unless adequate*

controls can be attained by means of planning conditions and powers of regulatory bodies, and that arrangements can be made to monitor discharges.

In addition, proposals located adjacent to an existing source of pollution or nuisance will be refused unless the Local Planning Authority is satisfied that there will be no risk to the health and safety of the local community or potential occupants of the new development that can not be satisfactorily overcome”.

- 5.7.28 The draft Gwynedd and Anglesey JLDP is expected to be adopted in July 2017, superseding the Gwynedd UDP. Policy PCYFF1 (Development Criteria) of the JLDP states that “*planning permission will be refused where the proposed development would have an unacceptable adverse impact on:*

... 11. The health, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance, vibration, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance;...”

Regulatory/Policy Framework: Long-term Operational Road Traffic Vibration

- 5.7.29 Policy B33 of the Gwynedd UDP and Policy PCYFF1 (Development Criteria) of the JLDP as discussed above are also relevant to vibration as a potential cause of nuisance.

Noise

- 5.7.30 Detailed measurements were previously undertaken on 13th/14th October 2003. Weather conditions were suitable for taking ambient noise recordings, and the results are shown in Table 5.7.1. It is acknowledged that the measurement data may be of limited relevance with respect to the existing ambient noise levels in 2016, but baseline measurements are not a requirement of the DMRB Simple Assessment method, and it is not considered necessary in view of the expected noise impacts. The data are therefore presented for informative purposes only. Analysis of the Department for Transport traffic data indicates that the total traffic flow has increased on this section of the A55(T) by 21% between 2003 and 2014, with a slight increase in HGV numbers (8%). This indicates that the baseline noise levels might be expected to have increased by up to 1dB, compared to those presented in Table 5.7.1. There are no additional potentially affected noise or vibration sensitive receptors within the development study area.
- 5.7.31 Measurements were made in accordance with the comparative method given in the Memorandum on Calculation of Road Traffic Noise (CRTN) by the Department of Transport and Welsh Office. The control position chosen was at No. 2 Bryn Meddyg (see Figure 2.1, Volume 1a), where the hourly noise levels were measured continuously over a 24-hour period.
- 5.7.32 From the survey results the existing L_{A10} (18hour) between 0600 and 2400 hrs required by the NIR was obtained. In addition, at least two concurrent measurements of not less than 15 minutes duration were made at affected properties (see Table 5.7.1 below). The mean differences between the control and these comparative sites were then used to derive L_{A10} (18hour) results for all the properties. All figures are corrected to the main affected façades of the properties concerned.

Table 5.7.1: Detailed noise survey results (2003) (see Fig. 2.1, Vol. 1a for property locations)

Position	Property	Sound Pressure Level, dB LA10, 18hour	
		2003 (measured)	2014 (estimated*)
1	No's. 1 & 2 Bryn Meddyg	74.0	75.0
2	Tai'r Meibion	76.1	77.1
3	Wig Farm	61.4	62.4
4	The Old School	68.1	69.1

NB: Estimations are conservative and do not take account of possible noise reduction due to sections of 'low noise' surfacing (left-hand lane of each carriageway and some limited areas of the right-hand lanes).

5.7.33 Noise is generated both by construction activity and the operational use of the road. Despite the quiet, rural atmosphere of the general area a number of residential properties are located very close to the existing carriageway, which is important for carrying local and international traffic through North Wales. These are already subjected to the existing noise levels of traffic using the A55(T) and sensitivity to changes in noise levels can vary subjectively, but the value/sensitivity to change of these receptors is considered to be high.

5.7.34 It should be noted that an increase in traffic volume is not expected as a result of the Scheme. Therefore, noise levels from the 'do-minimum' option would be similar to those with the Scheme, except where it is proposed to increase the carriageway level. However, with the use of low-noise road surfacing materials to all carriageways adjacent to residential properties, noise levels are likely to be reduced slightly with the Scheme, whereas they could increase slightly with a 'do-minimum' option.

Vibration

5.7.35 Low levels of ground-borne vibration are currently experienced as a result of the poor vertical alignment and surfacing of the carriageway. Although constructed to acceptable standards at the time, the vertical rise and fall in the road levels along this stretch of the A55(T) is now very noticeable compared to sections of adjacent carriageway. With vehicle speeds having increased since the time of construction, traffic vibration has also increased and is of particular significance with the high proportion of heavy goods vehicles using the road.

Magnitude of Impacts and Significance of Effects (before mitigation)

Short-term Construction Noise

5.7.36 The five properties within 100m of the Scheme are already subjected to the general, ambient background noise and vibration levels associated with the normal operation of a trunk road, but are considered to be of high value/sensitivity as they are residential receptors. The assigned value/sensitivity is primarily based on the relationship between the amenity associated with a noise-sensitive receptor (NSR) and its susceptibility to noise. Noise-sensitive receptors which have amenities associated with low noise levels, such as

residential properties, are allocated with a 'High' level of sensitivity, whereas nightclubs would be allocated with a 'Low' level of sensitivity. Also, users of Public Rights of Way, such as those within the study area (see Figure 5.8.1, Volume 1a), are assigned a 'Medium' level of sensitivity. This is because although such areas are often valued for their tranquillity, the period of exposure to noise is limited by an individual's relative proximity to the source, which by nature would only be for a short period and at the individual's discretion.

- 5.7.37 Noise and vibration levels would be expected to increase during the construction period due to increased plant machinery being present in the area and disruptions to traffic flows, although these would be masked slightly by the existing ambient levels.
- 5.7.38 Sheet piling may be required during construction of the new culvert for the Afon Wig, which is located approximately 200m from the farm house at Wig Farm. At this distance, the piling works would be audible, but in terms of potential noise level and the likely duration of this operation, the noise impact would not be significant. No other piling or drilling is envisaged as part of the works.
- 5.7.39 The main construction works would include excavation, earth-moving activities, compaction of materials and resurfacing works, including works for the extension of cattle underpasses at Tai'r Meibion and Wig Farm. These impacts are shown in Table 5.7.2.
- 5.7.40 Four properties are within the 100m distance at which construction noise is potentially a serious problem (see Table 5.7.2), but this may be offset by the masking effect of the existing high traffic noise levels.
- 5.7.41 During the construction period, local residents would suffer varying temporary adverse impacts from construction noise and vibration arising from excavation, earth-moving activities, compaction of materials and resurfacing works. Additionally, works for the extension of cattle underpasses at Tai'r Meibion and Wig Farm, and construction of the new culvert for the Afon Wig, would create noise and vibration. These impacts would be limited in duration and associated with the permanent improvement of the A55(T) close to particular properties. It is not anticipated that there would be a requirement to use blasting techniques.
- 5.7.42 Construction noise levels have been estimated using the calculation methods described in BS5228-1. However, a detailed assessment of noise levels arising from the construction period will be required to be undertaken by the Contractor, once actual construction plant and techniques are known. Likewise, the impact from vibration would need to be assessed according to advice provided in BS5228-2.
- 5.7.43 The calculation method described in BS5228-1 takes noise level data from previously measured construction activities and applies corrections for the distance from the site to properties and any intervening ground absorption. The levels in Table 5.7.2 have been obtained by this method and also shown for comparison are the average ambient noise levels ($L_{Aeq, 12hour}$) for the typical construction working hours of 0700 – 1900 hrs as dB(A) figures. $L_{Aeq, T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T. An $L_{Aeq, 12hour}$ is the average noise level over a 12-hour period. The Old School has not been included within this assessment because it is outside

the main area of influence of the construction works and hence there would be no significant impact.

5.7.44 The Noise Insulation Regulations permit the offer of insulation where construction noise '*seriously affects, for a substantial period of time, the enjoyment of the building*'. The criteria necessary for the provision of insulation are open to interpretation and the Welsh Government may provide sound insulation, at its discretion, for the four properties even though some would not qualify under the regulations. The informative section of BS5228-1 also provides guidance with regard to temporary re-housing (TRH) of residents during the noisiest construction periods, and offers appropriate noise thresholds. This is typically used where works are proposed outside of core working daytime hours, and would therefore need to be included in the CEMP, should working be required outside of these periods.

5.7.45 Acceptable levels of construction noise would be agreed with the environmental health department and specified in the Contract Documents before construction work commenced.

Table 5.7.2: Potential Construction Noise Levels and Ambient Road Traffic Noise Levels

Position	Property	Ambient noise level, dB LAeq	Potential Construction noise level dB(A) (unmitigated)
1	No's. 1 & 2 Bryn Meddyg	71.2	81
2	Tai'r Meibion	73.3	77
3	Wig Farm	58.6	61

5.7.46 Assessments for No's. 1 & 2 Bryn Meddyg, Tai'r Meibion and Wig Farm show predicted worst-case (during works in closest proximity to each receptor) levels in excess of the ambient road traffic noise. Road traffic noise would offer limited or no masking of the construction noise and some disturbance would be likely. The predictions in Table 5.7.2 do not include potential noise mitigation provided by physical screening of the works. The use of temporary acoustic barriers would provide up to 10dB broadband attenuation (ref. BS5228-1) to the levels shown, if the source is completely obscured from view from the receptor. Detailed construction noise calculations can be carried out when details of construction activities become available.

5.7.47 Given the separation distances involved (greater than 600m), construction noise (averaged and peak) levels will not be significant at protected sites within the study area (estimated to be less than 45dB LAeq and 70dB LAmax, based on favourable meteorological conditions), see Chapter 5.4 (Nature Conservation) for further details about these sites.

5.7.48 During the construction phase, noise impacts to users of the various PRowS that intersect the scheme (see Figure 5.8.1, Volume 1a and Chapter 5.8) will be negligible to minor adverse due to the temporal and short-term nature of potential exposure.

Long-term Operational Road Traffic Noise

- 5.7.49 The greatest potential impact from noise would be at those locations where raising the level of the road reduces the effect of any existing features currently acting as noise barriers. Numbers 1 and 2 Bryn Meddyg have an existing garden wall and a bank sloping down to the road where it is proposed to raise the level of the nearest (westbound) carriageway by approximately 0.5m, and also bring the level of the eastbound carriageway up to a similar level by elevating it by up to 1.2m. These receptors already benefit from partial 'low noise' surfacing to adjacent carriageways, although the conservative assessment below assumes that all carriageways have this surface in the base and 'do-minimum' scenarios. The predicted noise levels in Table 5.7.3 indicate that these properties would experience only a negligible increase in noise (+0.1 - 0.2dB) as a result of the Scheme.
- 5.7.50 Given the dominance of road traffic noise generated by the A55(T), noise from the very low number of vehicle movements on the new access road, linking Wig Farm and Junction 12, would not be perceptible at the nearest properties. The operational impact would therefore be of negligible adverse significance.
- 5.7.51 No change in noise level directly resulting from the Scheme was determined at Wig Farm and The Old School, whilst Tai'r Meibion is predicted to experience a -3.1dB reduction in 2018, as it does not currently benefit from low noise surfacing. At all other properties in the 'calculation area' (within 600m of the scheme), a similar negligible decrease in road traffic noise level is expected as a result of the full 'low noise' road surfacing as a result of the Scheme.
- 5.7.52 Table 5.7.3 gives predicted levels for the Base Year (BY) 2018 and Future Year (FY) 2033 both with (Do-Something (DS)) and without (Do-Minimum (DM)) the Scheme. Such noise levels have been calculated based on 18-hour AAWT¹⁰² (high growth) flow data as supplied by Gwynedd Council.

Table 5.7.3: Predicted Noise Levels in dB (A)

Position	Property	2016 Base Year (BY)	2018 Do-minimum (BYDM)	2018 Do-something (BYDS)	2033 Do-something (FYDS)
1	No's. 1 & 2 Bryn Meddyg (ground floor)	73.7	73.8	74.0	74.2
	No's. 1 & 2 Bryn Meddyg	76.4	76.5	76.6	76.9
2	Tai'r Meibion	78.0	78.1	75.0	78.5
3	Wig Farm	64.5	64.6	64.6	65.0
4	The Old School	76.9	77.0	77.0	77.4

NB: For Base and 'Do minimum' predictions where there is already full low-noise surfacing, this has been accounted for by including a -3.5dB(A) correction.

For Base and 'Do minimum' predictions where there is already partial low-noise surfacing, a conservative assessment has been conducted assuming all carriageways benefit from these surfaces.

Future 'Do something' predictions include a reduction of 3.5dB(A) for potential benefits from quieter road surfaces at all receptors.

Predictions at 1st floor level unless stated otherwise.

¹⁰² Annual Average Weekday Traffic flow *i.e.* Monday to Friday only.

Table 5.7.4: Noise Level Nuisance Values (%)

	No's. 1 & 2 Bryn Meddyg		Tai'r Meibion	Wig Farm	The Old School
	Ground floor	1 st floor			
Percentage disturbance before works start (2016)	44.1%	52.2%	57.0%	20.8%	53.7%
Percentage disturbance 2018 Do-Minimum	44.4%	52.5%	57.2%	20.9%	54.0%
Change in noise level with the project 2018 (BYDS-BYDM)	+0.2dB	+0.1dB	-3.1dB	+0.0dB	0.0dB
Immediate change in % people bothered by noise with the project	+12.3%	+9.8%	-30.5%	+0.0%	0.0%
Percentage disturbance immediately after completion (2018)	32.1%	42.7%	26.7%	20.9%	54.0%
Percentage disturbance 2033 Do-Minimum	45.6%	53.7%	58.4%	21.8%	55.2%
Change in noise level with the project 2033 (FYDS-BYDM)	+0.6dB	+0.5dB	-2.7dB	+0.4dB	+0.4dB
Percentage disturbance in future assessment year 2033	46.2%	54.0%	49.2%	21.8%	55.2%
Long-term change in % people bothered by noise with the project	+0.6%	+0.3%	-9.2%	+0.0%	0.0%

5.7.53 Table 5.7.4 gives the percentage of people disturbed by traffic noise before the scheme, immediately after the scheme, and 15 years after the scheme. Noise levels for the predicted opening year (2018 Do-something) and the predicted future assessment year (2033 Do-something) have been used. The DMRB, the CRTN and the NIR require the assessment to be conducted based upon the worst-case annual level within 15 years of opening a new road.

5.7.54 The noise nuisance values reflect the change in predicted noise levels, so that there would be a negligible to no increase in the percentage of the population bothered by road traffic noise (in the long-term) as a result of the Scheme, in spite of the forecast increase in road traffic flows. Again, Tai'r Meibion is predicted to benefit from the additional provision of 'low noise' road surfacing adjacent to the property.

5.7.55 The results of the short- and long-term change in noise level (DMRB Assessment Tables A1.1 and A1.2) are presented in Table 5.7.4, but individually for each property, rather than with respect to the community impact of the scheme. In this respect, in the short-term, 2 properties will experience no change, 2 properties will experience a 0.1 - 0.9dB increase and 1 property will experience a 3 - 4.9dB decrease. In the long-term, 4 properties will experience a 0.1 - 0.9dB increase and 1 property will experience a 1 - 2.9dB decrease.

5.7.56 With respect to the protected sites within the study area, road traffic noise from the A55 will be negligible over such propagation distance (greater than 600m), with other localised noise becoming more dominant, and the noise change is assessed as no change to negligible beneficial due to the additional low-noise surfacing to be deployed.

5.7.57 Likewise, whilst the magnitude of change would be similar as those predicted at residential properties above, the sensitivity of PRoW users is less than for permanent residences due to duration and frequency of exposure. The impact significance to users of PRoW would therefore be negligible adverse at worst.

Long-term Operational Road Traffic Vibration

5.7.58 DMRB suggests that the L_{A10} (18hour) (arithmetic average of the loudest six minutes of each hour over an eighteen hour period) has a close association with airborne vibration nuisance levels and the effect of this on residents can be estimated by subtracting 10% from the equivalent noise nuisance level (see Table 5.7.5).

Table 5.7.5: Airborne Vibration Level Nuisance Values

Property	Percentage disturbance before works start	Percentage disturbance 15 years later
No's. 1 & 2 Bryn Meddyg	42%	44%
Tai'r Meibion	47%	39%
Wig Farm	11%	12%
The Old School	44%	45%

NB: Future disturbance takes account of the benefits of a quieter road surface.

5.7.59 As for noise, the impacts of airborne vibration from road traffic are predicted to increase negligibly at No's 1 & 2 Bryn Meddyg, Wig Farm and The Old School due to normal traffic growth, and not as a result of the Scheme. Despite the forecast increase in traffic levels, vibration levels (in the long-term) are expected to reduce at Tai'r Meibion, using the assessment methodology, but in reality there would be no perceivable change.

5.7.60 In respect of ground-borne vibration, DMRB states that, as the new road surface would be free from irregularities *“such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances.”*

Proposed Mitigation Measures

Short-term Construction Noise

5.7.61 Mitigation measures are suggested in DMRB and BS5228-1 and BS5228-2, and may be enforced by the local authority, under Section 60 of the Control of Pollution Act 1974. Under the Conditions of Contract for the works, the contractor would be required to prepare a CEMP (see Chapter 7), for agreement with the Local Authority Environmental Officers, detailing the following:

- Plant, machinery and construction techniques to be used;
- Timings of the works;
- Access routes to the areas included in construction;
- Noise thresholds;
- Standard best practicable means in accordance with the statutory requirement of the Code of Practice documents (BS5228 Parts 1 & 2);
- Noise and/or vibration monitoring (if required, scope to be agreed with LA EHO based on assessed risk and duration of works);
- Communication/prior notification requirements, and;
- A formal complaints process.

- 5.7.62 Mitigation such as the erection of temporary barriers may reduce any impact, but to be effective any such barriers should be sufficiently high to obscure the line of sight to the works and the surface density of the barrier material should be at least 7kg/m².

Long-term Operational Road Traffic Noise

- 5.7.63 The running width of the road would not be changed and the Scheme would not generate more traffic (above that resulting from natural growth) or a larger percentage of HGV's. Therefore, no properties would be eligible for an offer of noise insulation and further mitigation measures are not proposed.

Long-term Operational Road Traffic Vibration

- 5.7.64 An increase in airborne vibration levels would still occur without the Scheme due to normal traffic growth, and the properties already experience relatively high levels of airborne vibration nuisance.

Magnitude of Impacts and Significance of Effects (after mitigation)

Short-term Construction Noise

- 5.7.65 During the construction period, the effect of noise and vibration on those properties within 30m of the existing road is expected to vary up to high magnitude and of major adverse significance. This is due to increased levels of noise and vibration occurring during the short period in which works are occurring at the closest approach.
- 5.7.66 The five properties within 100m of the Scheme are already subjected to the general, ambient noise and vibration levels associated with the normal operation of a trunk road. However, noise and vibration levels would be expected to increase temporarily during the construction period due to increased plant machinery being present in the area and disruptions to traffic flows. Noise and vibration impacts would vary in magnitude up to major adverse depending on the proximity of the work and the receptor to each other. These impacts would be temporary in nature and would cease on completion of the scheme.

Long-term Operational Road Traffic Noise

- 5.7.67 Apart from Wig Farm, all of the affected properties currently experience relatively high noise disturbance levels from traffic using the A55(T). On completion of the scheme there would be no net effect on Wig Farm and The Old School, whilst Tai'r Meibion would experience a reduction in noise levels, and in consequence disturbance, due to the introduction of a quieter road surface adjacent to this property. At No's 1 & 2 Bryn Meddyg a negligible and imperceptible increase in road traffic noise levels and disturbance is predicted as a direct result of the Scheme. This would result in an overall noise impact of minor beneficial to negligible adverse significance.
- 5.7.68 Provided that a quiet road surface is incorporated within the proposals, no properties would be eligible for noise insulation.

Long-term Operational Road Traffic Vibration

- 5.7.69 As is similar for road traffic noise, the Scheme would result in an overall airborne vibration impact of minor beneficial to negligible adverse significance.

5.7.70 DMRB also states that *“low noise road surfacing also creates a relatively smooth running surface that in some cases can help to eliminate ground borne vibration”*.

Summary

- 5.7.71 Despite the rural atmosphere of the area, several residential properties are located very close to the existing carriageway. Therefore, these are already subjected to the existing noise and vibration from traffic using the A55(T).
- 5.7.72 The main effect of the Scheme on noise and vibration levels would be caused by an increase in the carriageway level and the re-construction of the carriageway pavement. These changes to the vertical alignment would result in a marginal increase in noise and airborne vibration at Nos. 1 & 2 Bryn Meddyg.
- 5.7.73 Full low-noise road surfacing forms part of the Scheme works, and this has been accounted for in the calculations above. However, the potential benefit of this provision is limited where either one or both lanes (each direction) already has low-noise surfacing. It is predicted that the use of low-noise road surfacing could reduce traffic noise levels by up to 2.7 dB(A) at Tai'r Meibion (which presently does not benefit from low noise road surfacing), resulting in an overall reduction in noise and vibration levels at this property, despite the normal growth in traffic numbers over the first 15 years of operation.
- 5.7.74 There are no ecological designations or protected habitats within the 'calculation area' (*i.e.* 600m of the scheme), however there are SAC, SPA, SSSI and LNR sites in the Menai Strait just over 600m to the north, as well as SAC, SSSI and NNR sites approximately 700m to the southeast (*i.e.* within the overall 1km study area), see Chapter 5.4 (Nature Conservation). In accordance with DMRB, a qualitative assessment is required for these receptors. Road traffic noise from the A55 will be negligible over such propagation distance, with other localised noise becoming more dominant, and the noise change is assessed as no change to negligible beneficial. Likewise construction noise (averaged and peak) levels will not be significant (estimated to be less than 45dB L_{Aeq} and 70dB L_{Amax} , based on favourable meteorological conditions).
- 5.7.75 There are Public Rights of Way (PRoW) along the route that intersect the A55(T) allowing crossing (see Figure 5.8.1, Volume 1a). The assessment predicts a negligible adverse impact in terms of noise and vibration change at the nearest residential properties as a result of the scheme once operational. Whilst the magnitude of change would be the same, the sensitivity of PRoW users is less than for permanent residences due to duration and frequency of exposure. The impact significance to users of PRoW would therefore be negligible adverse at worst (see also Chapter 5.8: Effects on All Travellers).
- 5.7.76 The Scheme is therefore not expected to significantly conflict with the objectives, policies and plans relating to noise and vibration identified in the Regulatory/Policy Framework section of this chapter.

5.8 EFFECTS ON ALL TRAVELLERS

Introduction

- 5.8.1 This assessment considers the likely effects (both adverse and beneficial) of the Scheme on All Travellers. For the purpose of this assessment, travellers have been categorised into two groups; Non-Motorised Users (NMUs, which include pedestrians, cyclists and equestrians) and Vehicle Travellers.
- 5.8.2 As no specific DMRB guidance currently exists for the new topic Effects on All Travellers, this assessment combines two separate DMRB guidance notes as recommended by 125/09(W) 'Supplementary guidance for users of DMRB Volume 11, Environmental Assessment' (Highways Agency, October 2009):
- DMRB Volume 11, Section 3, Part 8 (June 1993) - Pedestrians, Cyclists, Equestrians and Community Effects; and
 - DMRB Volume 11, Section 3, Part 9 (June 1993) - Vehicle Travellers.
- 5.8.3 The assignment of the receptor value/importance, magnitude of impact and significance of effect was based on the guidance provided in the DMRB, Volume 11, Section 2, Part 5: HA205/08 (see Chapter 4.3 of this ES for further details). Cross references are provided within this chapter to other relevant topics within the ES where there is potential for incremental effects between them and Traveller receptors. Cumulative effects associated with all travellers have been identified and reported in Chapter 6.
- 5.8.4 The scope of the Effects on All Travellers assessment includes the current and future users of the A55(T) and the network of roads (including public and private vehicle users) and NMU routes within the study corridor (see Figure 2.1, Volume 1a; Context Plan) that could be directly affected during the construction or operational phases of the Scheme. It is not considered that any limitations were associated with the assessment which could influence the outcome.

Assessment Methodology and Criteria

Non-Motorised Users

Methodology

- 5.8.5 In accordance with the DMRB, Volume 11, Section 3, Part 8, the assessment of impacts on non-motorised users encompassed:
- Changes in NMUs' journey length (both journey distance and time taken), and;
 - Changes in NMUs' journey amenity (*i.e.* the relative pleasantness of a journey).
- 5.8.6 The method used to undertake the assessment, based on the aforementioned DMRB guidance, is therefore reported under the following headings in comparison with the 'Do Minimum' scenario:
- changes to NMU journey distance and journey times for community and strategic routes,
 - severance of PRoW and other key NMU routes, and;

- changes to journey amenity (*i.e.* journey pleasantness, journey difficulty, journey safety).

Further consideration of potential impacts upon the community is discussed in Chapter 5.9: Community and Private Assets.

5.8.7 The assessment began with a desk study, which included the analysis of maps and plans that covered the study area, including local OS maps.

5.8.8 Information was collected regarding movements and volumes of pedestrians within the study corridor using counters. Monitoring sites were installed in September 2015 to determine usage of the PRow network over a 12 month period (see Figure 5.8.1, Volume 1a for monitoring site locations). Traffic monitoring carried out at junctions 12 and 13 during August and October 2015 also provided an indication of the movements of cyclists in an east-west direction along the Roman Road (Henffordd) (part of National Cycle Network no. 5), and also of any cyclists using the A55(T) carriageway.

5.8.9 The following were contacted by email in July 2015 with regard to the use of the study area by NMUs:

- *Bangor and Bethesda Ramblers*
Ramblers Cymru is a charity whose core work is to safeguard the places where people want to go walking in Wales and encourage them to do so; Bangor and Bethesda Ramblers is the local branch of the association.
- *Gwynedd Council access officers*
As a local highway authority Gwynedd Council has statutory duties to record and keep public rights of way open.
- *Energy Cycles*
Energy Cycling Club is based in Gwynedd and Anglesey and is active in all types of cycling. The ethics within the club are to encourage people into the sport and offer as much guidance and support as people need.
- *Sustrans*
Sustrans, the cycling charity, creates public cycling access and provides information on cycle routes. They work directly with people to bring about behavioural change, therefore influencing government policy.
- *Arriva North Wales*
Bus service provider contacted (September 2015) to verify position of bus stops within the study area.

5.8.10 Consultation responses were received from Sustrans and Arriva North Wales, and are discussed in the Baseline Conditions section of this chapter.

Assessment Criteria

Sensitivity of Receptors

5.8.11 Table 5.8.1 describes the criteria used to assign NMU receptor sensitivity, which are based on the criteria in DMRB Volume 11, Section 3, Part 8.

Table 5.8.1: NMU Receptor sensitivity

Value/Sensitivity	Description
Very High	Pedestrian, cyclist or equestrian routes that are used by vulnerable groups (the elderly, wheelchair users and children) to reach key community facilities
High	Pedestrian, cyclist or equestrian routes which provide frequently used community links, or routes that have high usage as a registered Public Right of Way or as part of a popular recreational trail.
Medium	Pedestrian, cyclist or equestrian routes which are available as links to community facilities but used infrequently, or routes that are moderately used as a registered Public Right of Way or as part of a recreational trail.
Low	Pedestrian, cyclist or equestrian routes that are used on an infrequent basis, have low amenity value and do not provide connection with community facilities

Magnitude of Impacts

5.8.12 Table 5.8.2 describes the criteria for assigning magnitudes of impact on NMU routes due to changes to journey distance, time, user safety and/or amenity as a result of the Scheme, based on the DMRB guidance. As the scheme is an on-line improvement which is not expected to increase traffic flows through the study area beyond normal growth, the criteria for determining permanent impacts associated with increased or decreased severance are not provided as they are not considered likely to be applicable.

Table 5.8.2: Impact magnitude for improvements to NMU routes

Magnitude of Impact	Description
Major	Scheme is expected to substantially increase/decrease travel by active modes due to changes to journey distance, time, user safety and/or amenity.
Moderate	Scheme is expected to perceptibly increase/decrease travel by active modes
Minor	Scheme is expected to slightly increase/decrease travel by active modes
Negligible	Scheme is not expected to noticeably increase/decrease travel by active modes

Significance of effects

5.8.13 The significance of an effect upon NMU routes (adverse or beneficial) is assigned by combining the value (or sensitivity) of the receptor (Table 5.8.1) with the magnitude of impact (degree of change) (Table 5.8.2) affecting it as a result of the Scheme. The matrix used for defining the significance of effect is shown in Table 5.8.3.

Table 5.8.3: Arriving at the Significance of Effect categories

		<i>Magnitude of Impact (Degree of Change)</i>				
		<i>No Change</i>	<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Environmental Value (Sensitivity)	<i>Very High</i>	Neutral	Slight	Moderate or large	Large or very large	Very large
	<i>High</i>	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	<i>Medium</i>	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	<i>Low</i>	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	<i>Negligible</i>	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Vehicle Travellers

Methodology

5.8.14 The DMRB method requires the assessment of two types of impacts on vehicle travellers, namely; 'View from the Road' and 'Driver Stress', which are described in DMRB Volume 11, Section 3, Part 9, Chapter 2 and Chapter 4 respectively.

View from the Road

5.8.15 This is defined as the extent to which travellers, including drivers, are exposed to the different types of scenery through which a route passes. The following aspects are taken into consideration:

- Types of scenery;
- Extent to which travellers may be able to view the scene;
- Quality of the landscape, and;
- Prominence of view or Interesting Features.

5.8.16 For the purpose of this study the east and westbound carriageways have been considered separately. The assessment has been based on the current landscape proposals as shown in Volume 1a, Figures 5.3.7 – 5.3.9. Impacts on views from the road and NMU receptors (such as public rights of way) are also assessed in Chapter 5.3 (Landscape).

5.8.17 The driver's ability to view the surrounding landscape has been assessed at design year 15, unless otherwise stated, when replacement planting would have reached sufficient maturity to meet its environmental function. It has been assumed that by this design year the replacement hedgerows would have become established (see Chapter 5.3: Landscape for more details on the landscape assessment and landscaping mitigation rationale). The ability to see the surrounding landscape has been based on a driver's eye level of 1.2m.

Driver Stress

- 5.8.18 For the purposes of this assessment, Driver Stress is defined as the adverse mental and physiological effects experienced when traversing a road network, which has three main components:
- Frustration;
 - Fear of potential accidents, and;
 - Uncertainty relating to the route being followed.
- 5.8.19 Frustration can arise when the driver is unable to drive at the speed they wish. This can result from high traffic flows, congestion, intersections, road works or being unable to overtake slow-moving vehicles.
- 5.8.20 The presence of other vehicles, inadequate stopping sight distances, inadequate lighting, narrow roads, road works, poorly maintained road surfaces and the likelihood of pedestrians stepping into the road are all contributing factors that can exacerbate the fear of accidents.
- 5.8.21 Route uncertainty can be caused by inadequate signing for an individual's direction of travel or poor route preparation and/or planning.

Assessment Criteria

View from the Road

- 5.8.22 The impact assessment is based on the perceived change in views of the surrounding landscape between the 'Do Minimum' and the 'Do Something' scenarios at design year 15. As the route of the Scheme follows the current alignment only the vehicle travellers' ability to see the surrounding landscape is considered, rather than also considering the types and value of the scenery (see Chapter 5.3: Landscape).

Sensitivity of Receptors

- 5.8.23 As set out in DMRB Volume 11, Section 3, Part 9, Chapter 2, four criteria have been used in the consideration of vehicle travellers' ability to see the surrounding landscape and hence to define the value/sensitivity of views from the road (see Table 5.8.4).

Table 5.8.4: Value/sensitivity of views from the road

Value/Sensitivity	Description
Very High	Open view – view extending over many miles.
High	Intermittent view – shallow cuttings and barriers at intervals
Medium	Restricted view – frequent cuttings or structures blocking view
Low	No view – e.g. road in deep cutting or surrounded by other structures

Magnitude of Impacts

- 5.8.24 Table 5.8.5 describes the criteria for assigning magnitude of impacts of changes in views from the road as a result of the Scheme.

Table 5.8.5: Magnitude of impacts associated with change in views from the road

Magnitude of impacts	Description
Major	Major change in vehicle travellers' ability to see the surrounding landscape
Moderate	Moderate change in vehicle travellers' ability to see the surrounding landscape
Minor	Minor change in vehicle travellers' ability to see the surrounding landscape
Negligible	Negligible change in vehicle travellers' ability to see the surrounding landscape
Neutral	No changes in views from the road

Significance of effects

5.8.25 The significance of an effect upon views from the road (adverse or beneficial) is assigned by combining the value (or sensitivity) of the receptor (Table 5.8.4) with the magnitude of impact (degree of change) affecting it as a result of the Scheme (Table 5.8.5). The matrix used for defining the potential outcomes of significance is shown in Table 5.8.3.

Driver Stress

5.8.26 The impact assessment is based on the estimated change in driver stress throughout the corridor of the Scheme between the 'Do Minimum' and the 'Do Something' scenarios at design year 15.

Sensitivity of Receptors

5.8.27 The DMRB guidance in relation to Vehicle Travellers (Volume 11, Section 3, Part 9, Chapter 4) states that there have been no reliable correlations established between physical factors and driver stress. However, guidance is given on the appropriate category of stress for use in environmental assessments; providing the speeds and flows exist during peak hour flows for at least one kilometre of the route (refer to Table 5.8.6 for dual carriageways). The guidance states that the assessment should be made for the worst year in the first fifteen after opening. Indicative value/sensitivity of driver stress levels based on the categories of stress is therefore also provided in Table 5.8.6.

5.8.28 As discussed above the scheme is not expected to increase traffic flows through the study area beyond normal growth and therefore the design year traffic figures shown in Table 2.2.1 (Chapter 2), have been applied to both the 'Do Minimum' and 'Do Something' scenarios.

Table 5.8.6: Appropriate category of driver stress (and value/sensitivity) for use in environmental assessment (source: DMRB Volume 11, Section 3, Part 9, Chapter 4, Table 2 – dual-carriageway roads)

Average peak hourly flow per lane (vehicles/hour)	Average Journey Speed (km/hour)		
	Under 60	60 - 80	Over 80
Under 1200	High (low value/sensitivity)	Moderate (medium value/sensitivity)	Low (high value/sensitivity)
1200 – 1600	High (low value/sensitivity)	Moderate (medium value/sensitivity)	Moderate (medium value/sensitivity)
Over 1600	High (low value/sensitivity)	High (low value/sensitivity)	High (low value/sensitivity)

Magnitude of Impacts

- 5.8.29 Table 5.8.7 describes the criteria used to assign the magnitude of impacts of changes in driver stress levels as a result of the Scheme.

Table 5.8.7: Magnitude of impacts associated with change in driver stress levels

Magnitude of impacts	Description
Major	Scheme results in significant changes in driver stress levels
Moderate	Scheme results in moderate changes in driver stress levels
Minor	Scheme results in slight changes in driver stress levels
Negligible	Scheme results in negligible changes in driver stress levels
Neutral	No changes in driver stress levels

Significance of effects

- 5.8.30 The significance of an effect upon driver stress (adverse or beneficial) is assigned by combining the value (or sensitivity) of the receptor (Table 5.8.6) with the magnitude of impact (degree of change) (Table 5.8.7) affecting it as a result of the Scheme. The matrix used for defining the potential outcomes of significance is shown in Table 5.8.3.

Baseline Conditions

Regulatory / Policy Framework

- 5.8.31 There is legislation and several planning policies which have relevance to the assessment of 'Effects on All Travellers' and many of these have already been introduced in Chapter 2 of this ES. However, those outlined in this section are considered to be particularly pertinent to the assessment on travellers, and are mainly focussed on the impacts and opportunities for NMUs from new developments.

The Active Travel (Wales) Act 2013

- 5.8.32 This Act is intended to enable more people to walk and cycle and generally travel by non-motorised transport. The Act requires local authorities to continuously improve facilities and routes for pedestrians and cyclists and to prepare maps identifying current and potential future routes for their use. In relation to the Scheme, the Act specifically makes provision for: 'requiring the Welsh Ministers and local authorities, in constructing and

improving highways, to have regard to the desirability of enhancing the provision made for walking and cycling'.

5.8.33 The Active Travel Action Plan complements the *Active Travel (Wales) Act 2013* and sets out the Welsh Government's vision for active travel and how it relates to its wider aims. With regard to the provision of suitable infrastructure for walking and cycling, section 5 of the plan states that: *'Availability of good quality walking and cycling infrastructure in places across Wales is essential to achieve our vision. Whilst there are some exemplary routes, current provision tends to be inconsistent, disjointed and in some cases not fit-for-purpose. We need to move from a situation where people walk and cycle despite a lack of suitable infrastructure, to a situation where people choose to walk and cycle, because it is easy, safe and convenient and desirable'.*

5.8.34 The Welsh Government published statutory Design Guidance to supplement the *Active Travel Act* in December 2014. This Guidance provides advice on the planning, design, construction and maintenance of active travel networks and infrastructure and is to be used at all stages in the process.

Planning Policy Wales (Edition 9) (Welsh Government, 2016)

5.8.35 The PPW documents provide guidance on a wide range of topics in the form of 21 Technical Advice Notes (TANs). While these documents chiefly apply to local planning authorities in preparing their local development plans, it is considered good practice to apply their principles to Welsh Government projects.

TAN16: Sports, Recreation and Open Space

5.8.36 This TAN provides guidance regarding planning for sports, recreation and open space provision as part of new development proposals. The document also refers to the potential benefits of the infrastructure which links areas of recreation in paragraph 3.40:

Safe cycle routes and footpaths which avoid busy roads and other potential hazards, can provide a positive recreational opportunity in themselves..... Promotion of walking and cycling helps to address issues related to climate change, and is consistent with government sustainability objectives such as improved health, safe routes to school, a reduction in car journeys and the encouragement of tourism.

TAN18: Transport

5.8.37 This TAN describes how to integrate land use and transport planning. It explains how transport impacts should be assessed and mitigated and includes advice on walking and cycling, public transport, planning for transport infrastructure, assessing impacts and managing implementation. Chapter 6 of TAN18 discusses the requirement for needs of pedestrians and cyclists to be considered during development planning decisions.

5.8.38 Paragraph 6.2 recommends the following considerations for local authorities in relation to walkers and new developments:

- *ensure that new development encourages walking as a prime means for local journeys;*
- *ensure that pedestrian routes provide a safe and fully inclusive pedestrian environment;*

- *ensure the adoption of suitable measures, such as wide pavements, adequate lighting, pedestrian friendly desire lines and road crossings;*
- *support the use of public rights of way for local journeys*

5.8.39 Paragraph 6.3 recommends the following considerations for local authorities in relation to cyclists and new developments:

- *ensuring that new development encourages cycling by giving careful consideration to location, design, access arrangements, travel 'desire lines' through a development, and integration with existing and potential off-site links;*
- *securing provision of cycle routes and priority measures in all major developments*

North Wales Joint Local Transport Plan 2015

5.8.40 The North Wales Joint Local Transport Plan (JLTP) for Anglesey and Gwynedd sets out a delivery programme for 2015-2020, and a framework for Schemes until 2030. It seeks to remove barriers to economic growth by improving connections to employment.

5.8.41 There is a focus on the most deprived communities, such as rural communities, seeking to address the issues faced with improvements to the walking and cycling connections. Outcome 4 of the LTP is '*Increased Levels of Walking and Cycling for both necessary travel and recreation, by residents and visitors.*'

5.8.42 Higher Level Intervention 6 entitled '*Encouraging Sustainable Travel*' is concerned with infrastructure improvements to increase levels of walking and cycling both for travel and for leisure; this may include cycle routes, footway/footpath provision, and safe routes to school.

Gwynedd Unitary Development Plan 2001-2016

5.8.43 The Gwynedd Unitary Development Plan establishes a policy framework and makes provision for development needs for the period from 2001 to 2016. It is used by Gwynedd Council to guide and control development, providing a basis for consistent and appropriate decisions on planning applications.

5.8.44 The plan includes the following relevant policies:

- Policy CH22 (Cycling Network, Paths and Rights Of Way): All parts of the cycling network, paths and public rights of way (including footpaths, public footpaths, bridle paths and byways) will be safeguarded and promoted by:
 - assessing any proposal that would infringe upon a cycle route, path or public right of way with the aim of ensuring that the cycle route, path or public right of way is satisfactorily incorporated within the development and if this cannot be achieved that:
 - appropriate provision is made to divert the route, or
 - an alternative new route is provided which safely and attractively maintains or improves the local network
 - refusing any proposal which is likely to prohibit plans to extend the existing cycling network, paths and public rights of way unless an alternative path can be provided which is just as safe, attractive and accessible.
- Policy CH29 (Safeguarding and Improving Links For Pedestrians): Proposals within Centres and Villages that fail to provide safe, attractive and direct links for pedestrians across and out of the site, wherever there are clear opportunities to

make such provision, will be refused. From a planning point of view, special emphasis will be placed on the provision of footpaths from a development site to:

- a bus stop or station or a bus or train exchange point
- community services and facilities in the area e.g. school, village shop, children's play area
- existing cycle networks, paths and public rights of way

Joint Local Development Plan (JLDP) for Anglesey and Gwynedd – Draft

5.8.45 The JLDP is currently expected to be adopted in July 2017 and comprises a deployment strategy of sustainable development over the next 15 years. The JLDP promotes walking and cycling opportunities, on a local level, as more work is needed to improve healthier lifestyles amongst the residents of the area by ensuring that existing and new communities have an opportunity to participate in physical activity, including opportunities for cycling and walking.

5.8.46 The JLDP states that all development proposals are required to progress towards achieving the relevant objectives and policies:

- Objective 8: Reducing the need to travel and encourage alternative modes of transport, placing particular emphasis on walking, cycling and using public transport.
- Strategic Objective 21: Improve and maintain safe, efficient, high quality, modern and integrated transport networks to employment, services and education/training facilities particularly by foot, bicycle and public transport, thus reducing where possible the number of journeys in private cars.
- Strategic Policy PS2: Alleviating the effects of climate change: add to opportunities for walking or cycling in preparation for a time when fuel will become scarcer or more expensive.
- Strategic Policy PS22: Support transport improvements that maximise accessibility for all modes of transport, but particularly by foot, cycle and public transport. This is set out to be achieved by improving and enhancing the public footpath and cycleway network to improve the accessibility by these modes of travel to encourage people to live healthier lifestyles.
- Sustainability Appraisal (SA) Deposit Plan, Feb 2015:
 - SA Objective 10: Promote and enhance good transport links, including the proposed increase in the percentage of cycle network and access to services and facilities by public transport, walking and cycling.

Gwynedd Rights of Way Improvement Plan 2007 – 2017

5.8.47 The Rights of Way Improvement Plan provides a ten-year challenge and opportunity for the council to adapt and review the network to meet modern day needs and so to help deliver wider benefits for both Gwynedd's residents and its visitors. The following all have relevance to NMUs:

- Development proposals will be refused if they create an unacceptable increase in traffic on Rural Lanes where walkers, cyclists or horse riders are expected to be the main users.
- One of the main responsibilities of the Rights of Way Section is to advise in the planning process on the effect of proposed development on Public Rights of Way and assist in the processing of applications to create, divert or extinguish Public Rights of Way to suit the needs of developers, including through public inquiry and beyond if necessary.

- Cyclists want the existing rights of way networks to be better integrated with planned cycle routes and those currently found on the highway network, in addition to linking towns and villages with the countryside.

Non-Motorised Users

Trip generators/Desire lines

5.8.48 Trip generators are considered as places of employment, education, retail, recreation or community facilities that the public might travel to on foot or by bicycle; and may be located either within or near to the study area. Such features are not abundant in this instance as the Scheme is located in a largely rural setting. Most trip generators are located outside of the study area and include primary and secondary schools in Bangor, Llandygai and Llanfairfechan, Ysbyty Gwynedd (Bangor), doctors' surgeries in Bangor and Llanfairfechan and employment and recreation sources east and west of the study area. Therefore, most journeys to key community facilities are currently expected to be via motorised vehicle and impacts on these are considered in the vehicle travellers aspect of this assessment.

5.8.49 A desktop study has identified that the only trip generators for consideration in the study area are the surrounding bus stops. The nearest bus stops are located on each side of the class 3 road to Tal-y-Bont, approximately 130m west of Junction 12 at Tan-y-Lôn and serving both westbound and eastbound passengers. There is also a bus stop located adjacent to the A55(T), approximately 170m east of Junction 13 at Abergwyngregyn, which serves eastbound passengers. The westbound bus stop is located within the village of Abergwyngregyn. These bus stops are all currently being utilised by the 5, 5X, 5C and 5S bus services (between Caernarfon and Llandudno¹⁰³) and the 9 bus services (between Bangor and Llandudno Junction on Sundays only); all services travel through the study area. The bus operator has confirmed that stops for the X5 at Wig Farm and Bryn Meddyg are not used.

5.8.50 Desire lines are routes that people travelling on foot or by bicycle are likely to take in order to access any trip generators identified. Such routes are sparse within the study corridor in light of the surrounding setting and lack of trip generators identified, and only consist of residents at Tan-yr-Allt Cottages travelling on foot towards the bus stops at Tal-y-Bont (identified anecdotally) via the Class 3 road to the west and the bridge at junction 12. This route has been assigned a **low** value/sensitivity due to the expected associated level of use.

Pedestrians

5.8.51 For the purpose of this assessment, pedestrians are considered to be any travellers who carry out their journey on foot. Pedestrian usage along the existing carriageway is minimal, being generally restricted to residents and ramblers using the local footpath network, and motorists whose vehicles may have broken down. Historically, the various footpaths in the locality were used by local residents to access the shoreline to collect

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https://diogel.cyngor.gwynedd.gov.uk/GwasanaethauGwe/FfeiliauSystemau.Allanol/AmserlenBws/Ffeil?llwybr=%5B05_X5_5C_5S%5D-%5BLlandudno - Conwy - Bangor - Caernarfon%5D-%5BLlandudno - Conwy - Bangor - Caernarfon%5D%2Epdf (Accessed 09/09/2016)

cockles and for other uses. No permissive footpaths were identified during the baseline study.

5.8.52 There are five PRoW in the vicinity of the Scheme which are directly affected by it (see Figure 2.1, Volume 1a: Context Plan) and these are described in Table 5.8.8 below. The value/sensitivity for the PRoWs is categorized according to the criteria described in Table 5.8.1. No response was received from either Gwynedd Council footpaths unit or Bangor and Bethesda Ramblers regarding the value/sensitivity of the PRoW network surrounding the Scheme.

5.8.53 Due to the level of use associated with the PRoWs discussed in Table 5.8.8 combined with the direct connectivity of these paths onto/from the A55(T), thereby reducing amenity value and potentially compromising user safety, the overall value/sensitivity of these footpaths has been considered to be **low**.

Cyclists

5.8.54 The existing section of carriageway is currently not conducive to use by cyclists and presents a potential hazard to this group of road users; this is because of the high speed of traffic, traffic volume and the absence of hardstrips/ shoulders.

5.8.55 The North Wales Coastal Route (National Cycle Network no. 5) which connects Holyhead with Chester passes through the study area. Rather than follow the A55(T) within this section the route follows the narrow and winding Roman Road (Henffordd) running south of the A55(T) between junction 12 and Abergwyngregyn. Correspondence received from Sustrans indicates that this section of the route is fairly popular; however no counter information regarding the number of users was available from Sustrans.

5.8.56 Even though the section of Roman Road (Henffordd) discussed above is designated as part of a national cycle network the value/sensitivity of existing facilities for cyclists is considered to be **low** due to the current alignment of the road which generally renders it unsuitable for cyclists, particularly considering the current design standards for NMU routes provided in *Design Guidance: Active Travel (Wales) Act 2013*.

Equestrians

5.8.57 There are currently no bridleways within the study area and equestrians are considered extremely unlikely to use the A55(T) due to safety concerns. The Roman Road (Henffordd) discussed above is the only east-west alternative route available to horse riders and as previously described, is hazardous for NMUs. There is a network of county roads that give access to the shore and the mountains to the north and south respectively. However, these are severed by the A55(T) which can only be crossed safely at junctions 12 and 13 at either end of the study area. There is a current lack of safe facilities for equestrians in the area, the value/sensitivity of which for users at present is therefore considered to be **low**.

Table 5.8.8: Public Rights of Way and Cycleways affected by the Scheme (see also Figure 5.8.1, Volume 1a)

Name	Type	Description	Value/ Sensitivity
<i>PRoW 1 Aber</i>	<i>Footpath</i>	The footpath is located on the southern side of the A55(T) opposite Wig Farm, and from the A55(T) where it begins, the path extends to Roman Road (Henffordd), south of Crymlyn. The path is approximately 521m in length. An average of 2 pedestrian users per day was recorded over the monitoring period.	<i>Low</i>
<i>PRoW 2 Aber</i>	<i>Footpath</i>	The footpath is located on the northern side of the A55(T) and from the A55(T) it extends approximately 1644m to Bryn Gwylan linking with the coastal path. An average of 2 pedestrian users per day was recorded over the monitoring period.	<i>Low</i>
<i>PRoW 09 Llanllechid</i>	<i>Footpath</i>	The footpath is located on the northern side of the A55(T), starting from the unclassified road which crosses over the A55(T) to the east of junction 12 and continuing north beneath the mainline railway before veering to the north-west towards the mouth of the Afon Ogwen. No user survey information is available for PRoW 9 (Llanllechid).	<i>Low</i>
<i>PRoW 42 Llanllechid</i>	<i>Footpath</i>	The footpath is located on the southern side of the A55(T) from Tai'r Meibion Farm south to Roman Road (Henffordd) and is approximately 346m in length. An average of 5 pedestrian users per day was recorded over the monitoring period.	<i>Low</i>
<i>PRoW 43 Llanllechid</i>	<i>Footpath</i>	The footpath crosses the A55(T) west of Tai'r Meibion farm. It commences opposite Tan-yr-Allt Cottages and runs north-west across the A55(T) to connect with other public footpaths near Aber Ogwen and is approximately 920m in length. Two counters were placed on PRoW 43, one south of the A55(T) and 1 north of the A55(T). An average of 2 pedestrian users per day was recorded on the south side of the A55(T) over the monitoring period, and an average number slightly above 0 was recorded to the north.	<i>Low</i>
<i>The North Wales Coastal Route (NCN 5)</i>	<i>Unclassified Road (Roman Road)</i>	The route follows the narrow and winding Roman Road (Henffordd) running south of the A55(T) between junction 12 and Abergwyngregyn. This route is considered potentially hazardous for cyclists due to the narrowness of the lane, the high hedges and lack of passing places; and a consequent warning is provided within the route information on the Sustrans website. Traffic data indicate that mid-week use of NCN 5 along the Roman Road (Henffordd) is approximately 15-20 daily cyclists, with an even split between journeys to the east and west.	<i>Low</i>

5.8.58 For the 'Do Minimum' option (see Chapter 3) it is expected that the existing NMU routes identified within the study area would remain on their existing alignments and would be maintained by the local highway authority to allow continual use throughout the year.

Maintenance works on public footpaths are expected to consist of cutting back vegetation to allow access in spring and summer as well as replacement of gates and stiles as necessary. Maintenance works along NCN5 are expected to involve cutting back roadside vegetation to allow forward visibility for motorists and NMUs.

Vehicle Travellers

View from the Road

Westbound carriageway (to Bangor)

- 5.8.59 Views to the south from the westbound carriageway are restricted due to the height of the adjacent cutting and hedgerow, which runs next to the carriageway for the majority of the route. Where the height of the cutting falls, open views to the south are still limited because the hedge line is almost continuous.
- 5.8.60 In contrast, views to the north are more open, affording extensive views of the open lower coastal slope, the Menai Strait and the Isle of Anglesey. These views become more restricted towards Tai'r Meibion farm, due to the screening influence of a number of small copses and plantations.

Eastbound carriageway (to Chester)

- 5.8.61 The eastbound carriageway affords mainly open views to both north and south. To the south, the verge and hedge line do not present a visual barrier and there are open views across fields and the moorland of the lower slopes of Moel Wnion.
- 5.8.62 To the north there are open views towards the Great Orme and the Isle of Anglesey. Views to the north are restricted in the western sector of the road due to the presence of a number of copses and plantations.
- 5.8.63 In general, views for vehicle travellers are considered to be of **high** value/sensitivity to change due to the open views afforded mainly to the north, although this may be subjective depending on each vehicle traveller affected. In addition to high quality views of the surrounding landscape, immediate views from the road are enhanced temporarily in spring by the emergence of daffodils within the currently grassed central reserve.

Driver Stress

- 5.8.64 Driver stress is caused by various factors including road layout and geometry, road surface characteristics, junction frequency, speed and traffic flow per lane. These cause drivers to experience discomfort, annoyance, frustration or fear resulting in varying degrees of tension. This existing section of the A55(T) is considered to create more driver stress than adjacent sections as a result of the lack of hard strips, the undulating vertical alignment, gaps in the central reserve and number of accesses/junctions.
- 5.8.65 Available research evidence does not permit the finely-graded assessment of driver stress and it will vary between drivers. However applying the criteria presented in Table 5.8.6 to the design year traffic flows (see Table 2.2.1, Chapter 2) it is considered that **low** (high value/sensitivity) driver stress levels can be assigned to the current road alignment through the study area.

- 5.8.66 Perceived driver stress is considered to be generally lower on most other uninterrupted lengths of the A55(T), and it is likely that some drivers make a compensatory reduction in speed along this section because of the perceived greater risk due to the central reserve gaps and lack of hard strips, which serve to make it psychologically narrower than adjacent sections. It is therefore considered that the improvement of this section of highway to current standards could lead to vehicle speeds along this section increasing slightly to be similar to those on adjacent sections.
- 5.8.67 It is not expected that implementing the 'Do Minimum' option would interfere with the views currently experienced for vehicle travellers. The 'Do Minimum' option is unlikely to perceptibly change current driver stress levels as only a normal growth in future traffic volume is expected. Temporary disturbances to traffic flow to accommodate the various improvements and maintenance operations described in Chapter 3 are expected to increase driver stress levels intermittently, but these operations are unlikely to change ongoing stress levels for vehicle users within the study area.

Magnitude of Impacts and Significant Effects (including good practice and embedded design measures)

- 5.8.68 This section considers the magnitude of impacts and significance of effects in conjunction with the following good practice and embedded design measures, which are expected to be applied during the construction and operational phases respectively. As a result of these, no further specific mitigation measures are proposed and the magnitude of impact and significance of effect are not expected to change from what is reported in this section.

Construction Period

- 5.8.69 Good site working practices during the construction phase including clear signage and consideration of the effects on all travellers when designing traffic management measures would be expected to reduce the severity of any temporary impacts caused by severance of NMu routes and driver stress. However, adverse effects from temporary delays leading to longer journey times would remain until the completion of the works due to the temporary disruption to the travel routes affected and this is discussed in the following section.

Operational Phase

- 5.8.70 The embedded design measures (described below) within the Scheme are aimed at providing ongoing access for all travellers within the study corridor on completion of the work. One of the main aims of the Scheme is to improve safety standards for users of this section of the A55(T). Beneficial effects are therefore predicted for this group and no mitigation measures during the operational phase are proposed.

Non-Motorised Users - Construction Period

Pedestrians

- 5.8.71 It is currently envisaged that access to PRoWs Nos. 1 and 2 (Aber) and No. 42 (Llanllechid) would be permanently prevented at the point where they currently meet the A55(T), thereby potentially disrupting pedestrian movements within the wider area. Similarly access to PRoW No. 43 (Llanllechid) would be prevented at the point where it currently meets the A55(T) from both north and south directions thereby severing this route for the construction period.

5.8.72 However, impacts associated with severance have not been assigned due to the obstruction already posed by the existing A55(T) alignment, and PRoWs Nos. 1 and 2 (Aber) and No. 42 (Llanllechid) currently start/finish where they meet the A55(T). As pedestrian access onto the A55(T) is considered to be hazardous due to the high volume and speed of traffic, the prevention of these movements by restriction of access could be considered as an improvement to the current situation. The restriction of pedestrian movements due to the closure of PRoWs where they meet the A55(T) is likely to result in a **negligible adverse** impact of **slight significance**.

Cyclists

5.8.73 Due to the unsuitability of the current alignment of the A55(T) through the study area it is not expected that temporary impacts upon the flow of traffic associated with the construction works would result in impacts upon cyclists. However as discussed previously the unclassified Roman Road (Henffordd) to the south of the A55(T) between junction 12 and Abergwyngregyn is used by cyclists as part of the North Wales Coastal Route (National Cycle Network no. 5).

5.8.74 The Roman Road (Henffordd) would be improved over a length of approximately 860m between the access to Tai'r Meibion farm and a point approximately 180m to the west of Crymlyn; over this length a 4.8m carriageway width would be provided and the junction for a new private means of access to maintain access to the Wig farm land to the south of the A55(T) would be constructed. It is currently expected that the improvements to Roman Road (Henffordd) would be completed over a period of approximately 4 months during which throughway for traffic would be restricted. Traffic management during this period will require the main contractor to make alternative arrangements for cyclists and implementation of diversion routes during temporary periods of road closures may therefore increase journey length. These works are currently expected to occur during the first phase of construction (see Section 2.5.6) in autumn/winter 2017 to coincide with the most suitable period for hedge translocation. However, the precise timing and duration would depend upon the construction programme of the eventual main contractor, details of which will be agreed with the overseeing organisation to ensure minimal disturbance to road users. Temporary traffic management during works on Roman Road (Henffordd) could therefore result in a **moderate adverse** impact of **slight significance** for movement of cyclists in the area during the construction phase.

Equestrians

5.8.75 The value/sensitivity of the facilities for equestrians in the study area is considered to be low, with Roman Road (Henffordd) providing an east-west alternative to the A55(T) corridor along this section. Due to the potential disruption to the use of this road during the construction works described above it is considered that a **moderate adverse** impact of **slight significance** can be expected upon equestrians during the construction phase.

Vehicle travellers - Construction Period

View from the road

5.8.76 The current route offers open views towards the north in both directions of travel and views towards the slopes of lower Snowdonia from the eastbound carriageway. The removal of existing boundary features would open up views to the surrounding landscape even further until new hedge lines become established. However there would be

temporary adverse visual impacts from construction plant and activities immediately adjacent to the route. Therefore, overall there is considered to be a **negligible adverse impact** to the Views from the Road during construction of **slight significance**, which would be temporary and short term for the duration of the construction period (see also Chapter 5.3: Landscape).

Driver Stress

5.8.77 The traffic management arrangements during the construction period are currently unknown, however it is expected that two lanes of traffic would remain open in each direction of movement throughout the construction phase (see Section 2.5). There would however be an adverse impact on driver stress during the construction period due to disruption to usual traffic flows and potential delays brought about by a temporary mandatory speed limit, probably narrow lanes and temporary concrete barriers. The implementation of traffic management during the construction phase is expected to incur a **moderate adverse impact of moderate significance**.

5.8.78 In addition to construction phase impacts upon vehicle travellers along the A55(T) some disturbance upon users of Roman Road (Henffordd) is also expected to occur during periods of traffic management and road closures as this road is widened. Local residents that use Roman Road (Henffordd) can currently enter the A55(T) at either junction 12 or 13, depending on the position of their property along the road and direction of their outward journey (which could include regular journeys to key community facilities *e.g.* schools, hospitals, doctors' surgeries, employment and recreation locations). Traffic movements between junction 12 of the A55(T) and properties along Roman Road (Henffordd) will be restricted for a 4 month period along the length of the proposed 860m improvement, thereby temporarily urging residents to follow Roman Road (Henffordd) to the east towards junction 13 or to possibly follow a route from Crymlyn towards junction 12 via Bronydd Isa and Ty'n yr Hendre, both of which could incur additional time to normal journeys; at other times travellers may be impeded by temporary traffic management measures *i.e.* signal lights.

5.8.79 The precise timing and duration of any road closures and traffic management would depend on the construction programme of the eventual main contractor, which would be agreed with the overseeing organisation to minimise disturbance to road users. It is not possible to measure driver stress upon local residents that use Roman Road (Henffordd) by the criteria described earlier in this chapter due to the type of road affected; however considering the volume of traffic affected and duration of works to Roman Road (Henffordd) the implementation of road closures and traffic management during the construction phase is expected to incur a **moderate adverse impact of slight significance**.

Non-Motorised Users – Operational Phase

Design Measures

5.8.80 It is considered that some of the measures embedded within the outline design for the Scheme would provide opportunities to improve safety and accessibility for NMUs within the study corridor and therefore could represent significant beneficial effects during the operational phase. The proposed changes to the NMU network within the study area are displayed in Figure 5.8.1, Volume 1a.

- 5.8.81 The most significant of these measures is a new county road, Private Means of Access and NMU route which would be constructed parallel to the eastbound A55(T) carriageway, to provide alternative access to the fields and properties to the north. The new county road would commence at the junction with Tal y Bont road near Llain y Ffwlbart and continue for approximately 1.6km in an easterly direction parallel with the A55(T) eastbound carriageway and connect with the existing county road to Wig Crossing Cottages. The new county road would be constructed to a general width of 4.8m with 0.5m wide verges.
- 5.8.82 A 4.8m wide Private Means of Access accommodating NMUs would provide vehicular access towards Wig farm from the new county road at the Afon Wig crossing, and from Wig farm a 2 - 2.5m wide NMU route would continue for approximately 1.7km towards the Abergwyngregyn interchange at junction 13. For the purpose of further discussion below this new route will be referred to as a county road/NMU route.
- 5.8.83 To the south of the A55(T), the unclassified Roman Road (Henffordd) would be widened over a length of approximately 860m from the access to Tai'r Meibion farm to approximately 180m west of the settlement of Crymlyn. Over this length a 4.8m carriageway width and 0.5m wide verges would be provided. A new private means of access/access track would be provided to maintain access for Wig farm land.
- 5.8.84 A new footway is proposed between Tan yr Allt cottages and Llain y Ffwlbart to improve pedestrian access to the local bus service. This would generally have a 2m width from Tan yr Allt to the existing A55(T) overbridge. From the overbridge to Llain y Ffwlbart the width would be 1.8m. The new footway would be approximately 870m in length.
- 5.8.85 With the measures described above incorporated into the design it is not expected that the Scheme would act to sever existing NMU routes, in fact issues of existing severance are expected to be relieved as a result of the Scheme.

Pedestrians

- 5.8.86 The Scheme aims to integrate the surrounding PRoW network while removing the interface between pedestrians and the volume of traffic associated with the A55(T). The proposed changes in PRoW alignment are shown in Figure 5.8.1, Volume 1a and described below.
- 5.8.87 Access to PRoW No. 1 (Aber) would be permanently closed where it currently meets the A55(T) and a new footway link would be created with the proposed new access track to Wig Farm towards the proposed county road/NMU route to the north of the A55(T) using the Wig farm cattle underpass.
- 5.8.88 Access to PRoW No. 2 (Aber) would be permanently closed where it currently meets the A55(T) and instead would be linked to the proposed county road/NMU route to the north of the A55(T), thereby improving pedestrian accessibility to the east and west.
- 5.8.89 Access along PRoW No. 9 (Llanllechid) would be maintained from its new interface with the new county road.
- 5.8.90 Access to PRoW No. 42 (Llanllechid) would be permanently closed where it currently meets the A55(T), but a new footway link would be created towards the proposed county

road/NMU route to the north of the A55(T) using the Tai'r Meibion farm cattle underpass, thereby improving safety and making the wider area more accessible for pedestrians.

- 5.8.91 Access to PRow No. 43 (Llanllechid) would be permanently closed where it currently meets the A55(T) from the north and south. From the north this path would be re-directed west along the proposed county road and then along a new footway which would run over the A55(T) via the bridge at junction 12 and then east along the county road to Tan-yr-Allt cottages. This would involve a longer but safer route instead of crossing the A55(T) at grade. This is considered a safer journey for pedestrian users of this route, however the relief of current severance by the A55(T) would be offset to a degree by an increase of approximately 1.7km for a journey from one side of the A55(T) to the other.
- 5.8.92 The changes in amenity of the existing PRow network within the study area are not expected to be significant, though a small benefit by removing access onto/off the A55(T) is plausible. Overall the changes described above are expected to slightly increase the use of PRows within the study area by making the network of footpaths safer and better integrated than the current situation, thereby generating a **minor beneficial** impact of **slight significance**.

Cyclists

- 5.8.93 The new County road/NMU route would remove the need for cyclists travelling east-west along the North Wales Coastal Route (National Cycle Network no. 5) to deviate towards Roman Road (Henffordd) to the south, which is generally considered unsuitable for NMUs. The proposed county road/NMU route to the north of the A55(T) would be surfaced with a bituminous finish thereby catering for all types of cyclists, and would link the study area to neighbouring sections of the North Wales Coastal Route which are of similar suitability.
- 5.8.94 The Scheme would largely remove the interface with traffic which currently exists for cyclists within the study area, although some vehicular traffic use would occur along the proposed county road/NMU route as it would provide access for Wig farm as well as the Wig Crossing Cottages. However, this route would not offer a through road for other traffic and its width and alignment would result in a far safer alternative for cyclists than Roman Road (Henffordd).
- 5.8.95 Overall the changes described above are expected to slightly increase the number of cyclists within the study area by providing a suitable route which is a safer link between neighbouring sections of the North Wales Coastal Route (National Cycle Network No. 5) than the current situation, thereby generating a **moderate beneficial** impact of **slight significance**.

Equestrians

- 5.8.96 Similar to the expected benefits for cyclists it is considered that the Scheme would provide a suitable east-west route for equestrians through the study corridor via the new county road/NMU route, where such a route does not currently exist. Even though there are no bridleways in the surrounding area, a network of county roads exists at either end of the Scheme, which provides access to the shore and the mountains to the north and south respectively, and can be safely linked by the introduction of the proposed county road/NMU route.

5.8.97 Overall the changes described above are expected to slightly increase the number of equestrians within the study area by providing a suitable route which is a safer link to the surrounding countryside, thereby generating a **minor beneficial** impact of **slight significance**.

Vehicle travellers – Operational Phase

View from the road

Westbound carriageway (to Bangor)

5.8.98 The Scheme would slightly open up views from the carriageway to the south by increasing the verge width and introducing hardstrips, thereby having the effect of moving back both the top of the cutting slope and the associated hedgeline by approximately 3-4m (see Figures 2.6 and 2.7, Volume 1a for indicative cross sections).

5.8.99 To the north the introduction of a solid concrete safety barrier within the central reserve at a height of 0.8m is not expected to obstruct views towards the Menai Strait and the Isle of Anglesey, and no other features of the Scheme are expected to act as a barrier to the views currently offered from the road.

Eastbound carriageway (to Chester)

5.8.100 The currently open views to the north and south would be expected to change little as a result of the Scheme. The widening of the highway would offer slightly increased views of the mountainous slopes to the south, which are not expected to be obstructed by the central reserve barrier. The views of the Great Orme and the Isle of Anglesey to the north are not expected to be less open than they are at present as a result of the Scheme.

5.8.101 Immediate views would be affected by the replacement of the currently grassed central reserve with a hard standing surface. The daffodils currently within the central reserve are not indigenous and therefore the planting of the bulbs elsewhere within the highway boundary does not form part of the landscape design, as the introduction or re-introduction of non-native plants does not comply with Welsh Government policy. Views of drivers are subsequently expected to deteriorate slightly during the period in spring when daffodils would be in flower.

5.8.102 Overall however it is considered that the currently open views provided from the carriageway would remain, and that the Scheme would introduce a **minor beneficial** change of **slight significance** in vehicle travellers' ability to see the surrounding landscape. See Chapter 5.3 for the assessment of impacts on the landscape.

Driver Stress

5.8.103 The main aim of the Scheme is to improve safety standards and minimise the problems caused by the current constraints. It is considered that the increased forward visibility resulting from the improved vertical alignment, the provision of hard strips, the closure of the central reserve gaps and accesses and the improved junction would all assist in reducing driver stress.

5.8.104 The improvement of this section of highway to current standards could lead to vehicle speeds along this section increasing slightly to be similar to those on adjacent sections, as

currently some drivers may reduce their speed along this section due to the substandard nature of the road. However, using the parameters for driver stress levels provided in Table 5.8.6 combined with the design year traffic flows (see Table 2.2.1, Chapter 2) the driver stress levels associated with the Scheme are expected to remain at a **low** level. As improvements to road standards are likely to reduce the perception of risk for drivers as well as improve the flow of traffic through the study area, a **minor beneficial** improvement in driver stress levels of **slight significance** is expected.

5.8.105 On completion of the works the Scheme is expected to increase safety and reduce driver stress levels for residents of properties within the study area, which would benefit from improved access/egress on/from the A55(T) to/from key facilities on a day to day basis. A marked improvement in driver stress levels for residents of properties along the western (junction 12) side of Roman Road (Henffordd), Wig Crossing Cottages and all properties directly adjoining the A55(T) is expected as a result of the Scheme.

Summary

5.8.106 This section of carriageway is currently not conducive to use by NMUs and presents a potential hazard to this group. Provision for NMUs would be improved by the proposed county road/NMU route adjacent to the eastbound carriageway between the Tal-y-Bont Interchange (Junction 12), Wig Farm and Abergwyngregyn (Junction 13). This represents a minor/moderate beneficial impact for NMUs travelling in this area and would also contribute to improving the wider NMU network.

5.8.107 Five public footpaths would be affected by the scheme. Footpath No.1 would be closed at the A55(T) and diverted along the new Wig farm access track to join the NMU route on the northern side of the A55(T), via the Wig underpass. Footpath No. 2 would be closed at the A55(T) and would link to the NMU route improving accessibility to the surrounding countryside and adjacent footpaths. Footpath No. 9 would be maintained with a new access from the new county road. Footpath No. 42 would be diverted through the Tai'r Meibion underpass and link with the new county road/NMU route to avoid the need for users to cross the A55(T). A section of Footpath No. 43, across the field opposite Tan-yr-Allt cottages, would be permanently closed to prevent users crossing the A55(T). From the north this path would be re-directed west along the proposed county road and then along a new footway which would run over the A55(T) via the bridge at junction 12 and then east along the county road to Tan-yr-Allt cottages. This would involve a longer but safer route instead of crossing the A55(T).

5.8.108 There would be temporary disruption to normal traffic flows along the carriageways during the construction period, but the least disruptive method of working would be adopted in order to minimise any nuisance and delays. Similarly, temporary disruption to movements of vehicle users and NMUs are expected along Roman Road (Henffordd) during improvement works to an 860m section of this road.

5.8.109 One of the main aims of the scheme is to improve safety standards for the users of this section of the A55(T). The increased forward visibility, provision of hard strips, closure of the central reserve gaps/accesses, improved westbound access junction and improved access/egress on/from the A55(T) to/from key facilities would all assist in reducing driver stress.

5.8.110 The widening of the verges and provision of hardstrips would create a slightly wider angle of view than at present in places, which would increase views from the road.

5.8.111 The Scheme is not expected to conflict with the objectives, policies and plans relating to travellers and community severance identified in the Regulatory/Policy Framework section of this chapter.

5.9 COMMUNITY AND PRIVATE ASSETS

Introduction

5.9.1 This chapter addresses impacts in relation to Community and Private Assets associated with the Scheme. 'Community and Private Assets' was introduced as a new topic under IAN 125/09(W). At present the Environmental Assessment Techniques section of the DMRB Volume 11 is being revised and there is no specific methodology developed for 'Community and Private Assets'. IAN 125/09(W) therefore advises that existing DMRB assessment guidance is followed:

- DMRB Volume 11, Section 3, Part 6 (June 1993) - Land Use
- DMRB Volume 11, Section 3, Part 8 (June 1993) - Community Effects

5.9.2 Following review of the respective DMRB assessment guidance chapters and an initial desktop study of the land surrounding the Scheme it was considered that the Community and Private Assets chapter should focus on the following aspects:

- Effects on agricultural land

The following sections of the assessment guidance chapters have therefore been scoped out of this assessment:

- Loss of land used by the community: no loss of land used by the community (as defined) due to the Scheme identified;
- Effects on development land: no impacts upon development land (as defined) due to the Scheme identified;
- Community severance: community severance is defined as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows. Community severance has not been considered within this assessment due to the lack of community facilities affected (see also Chapter 5.8), the online nature of the Scheme, and the fact that traffic flows through the study area are not expected to increase beyond normal growth. The construction phase would be managed to limit impacts upon vehicle traffic flows on the A55(T) and surrounding side roads and property accesses as discussed in Section 2.5: *Construction, Operation and Long Term Management* and Chapter 5.8 (Effects on All Travellers). Community effects are discussed further in the context of effects upon all travellers in Chapter 5.8: *Effects on All Travellers*;
- Demolition of private property: no loss of private property expected as a result of the Scheme.

Methodology

5.9.3 An agriculture and land use assessment has been carried out in accordance with the guidance in the DMRB Volume 11, Section 3, Part 6: Land Use. The DMRB recommends that the scope of the agricultural assessment covers:

- the type of husbandry currently employed;
- the value and amount of agricultural land that the scheme is likely to take;
- the likely impacts of severance arising from a scheme;
- the likely impacts of major accommodation works for access, drainage and water supply.

The potential impacts upon views from the agricultural holdings within the study area as a result of the Scheme have been considered within Chapter 5.3: Landscape Effects.

Potential impacts on soils are also addressed in Chapter 5.5: Geology and Soils.

- 5.9.4 An assessment was carried out in August – September 2015, which included an assessment of the quality of agricultural land in the scheme corridor and a farm viability assessment.
- 5.9.5 The scope of the study area was based on the permanent Scheme footprint and a pre-determined temporary working corridor required during the construction phase, and any directly surrounding land.
- 5.9.6 The successful contractor may agree with an adjacent landowner to utilise further agricultural land temporarily during the construction phase for welfare facilities and storage of materials, and as the extent and location of these areas are currently unknown their impact has not been determined within this assessment. The potential locations of welfare facilities and temporary storage of materials is addressed in Chapter 5.6: Materials.

Agricultural Land Quality

- 5.9.7 An Agricultural Land Classification (ALC) survey was carried out in 2002 covering a corridor of approximately 35m either side of the A55(T) to determine the quality of the agricultural land to be affected by the improvements. In August 2015, the previous ALC survey area was subject to a walkover survey to identify if there had been any changes to land use which could have altered the original findings. No significant changes were identified and the results of the previous survey form the basis for this assessment.
- 5.9.8 The original ALC survey discussed above was limited to the main area of improvements along the A55(T) and did not extend to the western section of the new county road, the improvements to the existing unclassified Roman Road (Henffordd) and new PMA. The land-take associated with these areas is however relatively small and has been categorised based on the ALC 1 inch series map No.107 first published in 1970 (see Figure 5.9.2, Volume 1a), all affected areas are therefore included in the impact assessment.

Agricultural Assessment

- 5.9.9 The agricultural assessment comprised the principal tasks:
- properties which would be affected by the proposals were identified from preliminary drawings showing the proposed line of the route;
 - those occupiers operating an agricultural business potentially affected by the scheme were visited and details were collected about their farming business including the type of husbandry employed; at the same time the proposals were discussed with them and potential effects discussed and recorded for evaluation against the detailed drawings;
 - from drawings produced by the project engineers, an assessment was carried out to determine the effect of land-take, severance/fragmentation and the impact of proposed accommodation and mitigation works in line with the recommendations of the DMRB - the land-take figures were obtained from YGC;
 - the effect on each farm was then classified into one of three categories: slight, moderate and severe;
 - the degree to which the effect could be mitigated was assessed and the impact reconsidered in the light of the effect of mitigation/accommodation works.

5.9.10 Following the initial assessments and the scheme revisions, the six farm holdings previously identified were revisited in August 2015 and the current occupiers interviewed to identify any changes to the baseline which could affect the agricultural assessment. The findings of these recent visits have been used as the basis for assessing the potential impact on the six farm holdings.

Assessing the Significance of Effects

Agricultural Land Quality

5.9.11 The Welsh Government's Agriculture Department and DEFRA have adopted a system of classifying agricultural land known as the Agricultural Land Classification System of England and Wales (ALC). This system classifies land into five basic grades numbered 1 – 5; land in Grade 3 is sub-divided into Sub-Grades 3a and 3b. The principal physical factors influencing land quality are climate, site and soil. These factors, together with interactions between them, form the basis for classifying agricultural land into one of the five main grades.

5.9.12 The 'best and most versatile' agricultural land falls into Grades 1, 2 and Sub-Grade 3a. Grade 1 land is excellent quality agricultural land, with few limitations on cropping. Grade 2 land is very good quality agricultural land with minor limitations which affect crop yield, cultivations or harvesting; a wide range of agricultural and horticultural crops can usually be grown. Land in Sub-Grade 3a is good quality agricultural land capable of consistently producing moderate to high yields of a narrow range of arable crops.

5.9.13 Land in Sub-Grade 3b is of moderate quality capable of producing moderate yields of a narrow range of crops. Poor quality agricultural land is assessed as Grade 4. Grade 5 land is very poor quality agricultural land. Land that is not agricultural cannot usefully be classified; such land is referred to as 'other' in the text and its full description is 'other land not primarily in agricultural use' and includes roads, houses and woodland.

5.9.14 Wales Planning Policy seeks to conserve 'best and most versatile' agricultural land and steer development to areas of lower agricultural quality. Agricultural land of Grades 1, 2 and 3a is therefore considered a sensitive receptor to development. The sensitivity assigned to each grade however may vary depending on the availability of 'best and most versatile' land within the region. Gwynedd only contains a small percentage of land classed as 'best and most versatile' and therefore Grades 1 – 3a are considered to be of high sensitivity as shown in Table 5.9.1 below.

Table 5.9.1: Sensitivity of Receptor

Sensitivity	Characteristics
High	Grades 1, 2 and 3a (best and most versatile agricultural land)
Medium	Sub-Grade 3b
Low	Grades 4, 5

5.9.15 The magnitude of impact on agricultural land will depend on the amount to be lost due to the scheme. There is little current guidance on what area of loss is considered significant, however, 20ha is the threshold adopted in Town and Country Planning (General

Development Procedure) Order 1995 (S.I .No 1995/419) for Local Planning Authorities to consult the Welsh Government before granting any planning permission which would involve the loss of Grades 1, 2 or 3a agricultural land. This threshold is taken into consideration in the assessment of the magnitude of impacts as shown in Table 5.9.2. The significance of effect is then determined by considering the magnitude of impact against the sensitivity of the receptor as shown in Table 5.9.3. Effects of moderate level of significance and above are considered to be significant.

Table 5.9.2: Magnitude of Impact

Magnitude	Area of Effect
High	≥ 50 ha
Medium	20 – < 50 ha
Low	5 – < 20 ha
Negligible	< 5 ha

Table 5.9.3: Matrix for Determining Significance

Magnitude of Impact	Sensitivity of Receptor		
	High	Medium	Low
High	Very Large	Large	Moderate
Medium	Large	Moderate	Slight
Low	Moderate	Slight	Neutral
Negligible	Slight	Neutral	Neutral

Agricultural Assessment

- 5.9.16 The sensitivity of a farm holding to change depends on a number of factors such as size and nature of the holding. Larger farm holdings are likely to have a greater capacity to change enterprise, mix and scale, and therefore absorb impacts, which smaller farm holdings would be less able to do. Farm types which have some degree over flexibility of operations, such as combinable arable enterprises and grazing livestock farms, are likely to be less sensitive than those where the operation of the enterprise is dependent on the relationship with key infrastructure, such as dairying (where access to fields and dairy parlour must be maintained). In addition, the type of tenancy held would also affect the sensitivity of the farm. A business with a long-term agricultural tenancy is likely to be more sensitive than where land is contract-farmed or farmed without a tenancy arrangement and no long-term security. Owner-occupied farm businesses may gain financially from the sale of land.
- 5.9.17 Road schemes can impact on farms by affecting the scale and efficiency at which current enterprises can be practised, usually by reducing the land area available to the business or severing land from the main block of land or buildings. These would ultimately manifest themselves in an increased cost or a lower return to the business. Therefore, the effect of such a scheme on a farm can be assessed largely, though not exclusively, from the financial impact on the business.

5.9.18 In cases where agricultural land is occupied by people who do not derive their livelihood from it, the impact is assessed by considering the effect the scheme would have on the capability of the land. Principally this is achieved by considering the loss of high quality land, the loss of fixed equipment and other factors.

Table 5.9.4: Sensitivity of Receptor

Sensitivity	Characteristics
High	Small farm size < 50ha Dependent relationship with key infrastructure Long-term Agricultural Holdings Act tenant
Medium	Average farm size > 50ha < 100ha Some flexibility over operations Mixed business farming some owned land and some medium- or short-term rented land
Low	Large farm size > 100ha Large degree of flexibility Short-term tenancy/licence or owner-occupied

5.9.19 The magnitude of impacts has been classified into three categories: 'slight', 'moderate' and 'severe' as shown in Table 5.9.5. The significance of effect is then determined by considering the magnitude of impact against the sensitivity of the receptor, as shown in Table 5.9.6.

Table 5.9.5: Magnitude of Impact

Magnitude	Characteristics
Severe	The viability of the business is threatened and strategic management of the farm business requires a major shift in enterprise mix.
Moderate	The viability of the business is not threatened, but significant changes in the day to day management are required which may significantly affect the size and scale of the enterprises.
Slight	The viability of the business is not threatened. Only minor changes would be required to the enterprises and the type and range of enterprises is unaffected.

Table 5.9.6: Matrix for Determining Significance

Magnitude of Impact	Sensitivity of Receptor		
	High	Medium	Low
Severe	Very Large	Large	Moderate
Moderate	Large	Moderate	Slight
Slight	Moderate	Slight	Neutral

5.9.20 When assessing effects, the 'severe' classification can only be attributable to agricultural businesses that were viable at the time of the survey. Where a business loses land that is held on an unsecured arrangement it is considered, due to the lack of long-term security of this land, that the effect of this loss cannot be classified as severe. However, if the farm is not viable but provides the main source of income, the effect can be classified as severe.

Baseline Environment (Value/sensitivity to change)

Regulatory/Policy Framework

- 5.9.21 Planning Policy Wales (PPW)¹⁰⁴ outlines the land use planning policies of the Welsh Government. PPW states Grades 1, 2 and 3a agricultural land, which constitute the best and most versatile land, should be conserved as a finite resource for the future. Land within these grades should only be developed if there is an overriding need for the development, there is no alternative lower quality land or the lower quality land has other environmental value. If best and most versatile land needs to be developed, this should be directed to the lowest grade.
- 5.9.22 Technical Advice Note 6 (TAN 6) 'Planning for Sustainable Rural Communities'¹⁰⁵ refers to the requirement of Article 10(1) of the Town and Country Planning (General Development Procedure) Order 1995 for Local Planning Authorities to consult the Welsh Government before granting any planning permission which is not in accordance with the development plan, and would involve the loss of 20ha or more of grade 1, 2 or 3a agricultural land, individually or cumulatively.
- 5.9.23 TAN 6 also refers to the factors that should be considered when assessing impacts on farming such as land take, severance and fragmentation, effects on use of buildings, equipment and capital investments and drainage systems.
- 5.9.24 The Gwynedd Unitary Development Plan 2001-2016¹⁰⁶ recognises the value of agricultural land and Policy C28 seeks to protect best and most versatile land from development.

POLICY C28 - SAFEGUARDING AGRICULTURAL LAND

Proposals that will lead to the loss of grade 1, 2 or 3a agricultural land will be refused unless there is an overriding need for the development and it can be demonstrated that:

- 1. there is no previously developed land available; and*
- 2. there is no land of lower agricultural grades available, other than land that has an environmental value recognised by a landscape, wildlife, historic or archaeological designation which outweighs agricultural considerations.*

- 5.9.25 The requirement to safeguard agricultural land is also taken forward in the Anglesey and Gwynedd Joint Local Development Plan (2011 - 2026), Deposit Plan¹⁰⁷. Policy PCYFF1 states that planning permission should be refused where there is an unacceptable adverse impact on the best and most versatile land.

Agricultural Land Quality

- 5.9.26 The areas of each ALC grade within the study area are shown in Table 5.9.7 and Figure 5.9.2 (Volume 1a). During the original ALC survey undertaken in 2002 the majority of the land either side of the A55(T) was assessed as Sub-Grade 3b, which is moderate quality

¹⁰⁴ Welsh Government (2016). Planning Policy Wales. Edition 9, Chapter 4, November 2016.

¹⁰⁵ Welsh Assembly Government, (2010). Technical Advice Note 6: Planning for Sustainable Rural Communities.

¹⁰⁶ Gwynedd Council, (2009). Gwynedd Unitary Development Plan 2001-2016.

¹⁰⁷ The Isle of Anglesey County Council and Gwynedd Council, (2015). Joint Local Development Plan Anglesey & Gwynedd (2011 - 2026). Deposit Plan (2015) Written Statement.

land. A smaller portion of the land was assessed as Sub-Grade 3a, which is good quality agricultural land and is classed as best and most versatile agricultural land.

- 5.9.27 As shown by Figure 5.9.2 (Volume 1a), the land outside of the ALC survey area surrounding the route is primarily Grade 3 with some areas of Grade 4 and non-agricultural land. For the purpose of this assessment, in order to provide a worst-case scenario, it is assumed that the Grade 3 land directly affected by the scheme is Sub-Grade 3a (see Table 5.9.7).

Table 5.9.7: ALC Grades within the Survey Study Area

ALC grade of land	Approximate area (ha)	Approximate percentage
Grade 1	0	0%
Grade 2	0	0%
Grade 3a	6.01	53%
Grade 3b	4.51	40%
Grade 4	0.79	7%
Grade 5	0	0%
Other	0	0%
Total	11.31	100%

Altitude and Relief (see also Chapters 5.3: Landscape and 5.5: Geology and Soils)

- 5.9.28 The route follows the lower land adjoining Conwy Bay, with the uplands of Llanllechid common immediately to the south. The line of the route is relatively flat, maintaining a height of about 30m AOD between Tai'r Meibion farm and Abergwyngregyn. Relief provides no real limitation to agricultural use for the land immediately adjoining the route of the road.

Climate

- 5.9.29 Climatically the area is typical of the coastal lowlands of North Wales. There is a risk of exposure to north or north-east winds in winter, which can be damaging to sensitive crops. The combination of low rainfall evenly spread throughout the year, coupled with mild winters and a moderately high accumulated temperature from January to June normally provides only a moderate limitation to agricultural use.

Soils (see also Chapter 5.5: Geology and Soils)

- 5.9.30 The predominant soil type covering the majority of the route corridor is classed as Soilscape 17 under the Soilscape soil classification system viewed at <http://www.landis.org.uk/soilscapes/>. Soilscape 17 soils are described as slowly permeable, seasonally wet acidic, loamy and clayey soils with low fertility where the main risks are associated with overland flow from compacted or poached fields.
- 5.9.31 Such soils can provide good agriculture, but have slowly permeable subsoils, which can restrict cultivation and trafficking in winter, and provide moderate limitations to agricultural use.
- 5.9.32 As higher ground is approached to the south of the A55(T), fine loamy and silty soils predominate, which are well drained although often stoney and shallow. These soils form the best agricultural soils within the survey area. A typical profile would show:
- 0-30 cm brown, medium, clay loam;
 - 30-60+cm brown, sandy, clay loam, increasingly stoney with depth.

Farm Businesses

- 5.9.33 The line of the proposed route crosses the following six farm holdings (see Figure 5.9.1, Volume 1a), all of which are considered viable farms:
- Tai'r Meibion Farm;
 - Ty'n yr Hendre Farm;
 - Wig Farm;
 - Glyn Farm;
 - Pentre Aber Farm (formerly College Farm), and;
 - Farmland still in the ownership of the Bangor University.
- 5.9.34 The extent of farm ownership is shown in Figure 5.9.1 (Volume 1a) and is derived from YGC data.
- 5.9.35 Land use within the area is a mixture of dairying, livestock rearing and arable. The agriculture along the section is based principally around beef and sheep farming and is considered to be of local and not national significance.
- 5.9.36 Only the farm within the ownership of Bangor University is within a Glastir advanced scheme.
- 5.9.37 Cropping is a mixture of winter and spring cereals, leys, permanent pasture and rough grazing. Winter fodder is usually silage, made as big bales on the smaller units, and a mixture of clamp silage and big bales on the larger units.
- 5.9.38 Stock is good quality. The majority of the beef cattle are continental crosses. Some of the progeny are sold as stores while some are finished on the farm. Sheep are mainly Welsh Mountain, with the progeny generally being sold as finished lambs.
- 5.9.39 Capital expenditure on agricultural improvements on the viable units has been maintained at fairly high levels on the affected farms. Generally, stock housing is provided in modern portal framed buildings and the traditional stone/slatted buildings have been adapted to house calves and for general storage.
- 5.9.40 Further information on each farm holding and their corresponding sensitivity is provided in Table 5.9.8.

Table 5.9.8: Description of the Farm Holdings

Farm	Description of the business	Cropping	Stocking	Access	Sensitivity
Bangor University	<p>This farm business extends to approximately 284ha (701.76 acres) of owner-occupied or secure land. In addition the university has grazing rights on adjoining mountain land. Land north of the A55(T) includes the Henfaes Research Centre and the Henfaes Ffridd in Llanfairfechan. The land south of the A55(T) constitutes the Centre for Hill and Upland Management and is managed under a Glastir agreement. It extends to some 210ha (519 acres). The land boundary adjoins the westbound carriageway of the A55(T). Grazing rights are held for the Aber and Llanfairfechan Commons.</p> <p>The ewes are all Welsh Mountain who lamb outside in March/April. Replacement rams are purchased in with selected ewe lambs retained and all others from the lamb crop sold either as stores or as finished animals through Dolgellau and Ruthin markets. There was a number that were sold on the hook in 2014.</p> <p>The holding is in the Glastir advanced scheme.</p> <p>This is considered to be a viable agricultural business.</p>	<p>6.32ha (15.61 acres) cereals/potatoes</p> <p>181ha (447.25 acres) permanent grassland</p> <p>87ha (214.98 acres) woodland</p> <p>9.68ha (23.92 acres) of other land</p> <p>Winter fodder is conserved mainly as big bale silage.</p>	<p>1,600 breeding ewes (upland and lowland flocks)</p> <p>320 replacement ewe lambs for the hill flock</p> <p>30 rams</p> <p>16 horses</p>	<p>Access to the land bordering the A55(T) is primarily off Roman Road (Henffordd) though there is access off the westbound carriageway of the trunk road.</p>	Low
Glyn	<p>This farm extends to approximately 204.77ha (506 acres) of land. Of this area 60.7ha is taken near Bangor on a Farm Business tenancy agreement</p>	<p>20ha (50 acres) of woodland/scrubland</p>	<p>1,580 breeding ewes</p>	<p>Access to the land, house and buildings is via a drive directly off the westbound carriageway of the</p>	Low

Farm	Description of the business	Cropping	Stocking	Access	Sensitivity
	<p>that was started in 2008 and has 8 years of the term remaining. The rest of the farmed land is owned with 144.07ha (356 acres) at Glyn with the rest spread along the A55(T), Anglesey and Bangor. There are grazing rights on adjacent mountain land. All of the land, the house and buildings at Y Glyn are situated to the south of the existing A55(T).</p> <p>This is considered to be a viable agricultural business.</p>	<p>123.83ha (306 acres) of temporary and permanent leys</p> <p>Hay is made off 8.09ha (20 acres) of the Bangor land and brought in.</p>	<p>230 ewe lambs 30 rams</p> <p>Some 700 store lambs were purchased last year for rearing on.</p>	<p>existing A55(T). An alternative access, which is not suitable for large agricultural traffic, is along Roman Road (Henffordd), which runs from Abergwyngregyn to Tai'r Meibion.</p>	
Pentre Aber	<p>The total farming business extends to approximately 80.94ha (200 acres) all of which are owner-occupied.</p> <p>The beef cattle are sold as prime finished livestock at up to 30 months of age. Most of the cattle are bought in at 12 months age from a dealer. They are mostly housed from the end of October through to April. Some cattle are purchased and housed for their entire time on farm – it depends on market conditions. Cattle numbers on the farm at any one time can rise to 400+. They are housed in February for March calving.</p> <p>The sheep flock is a new enterprise and it is intended to increase the flock size to between 100 and 150 head.</p>	<p>10.12ha (25 acres) of winter wheat</p> <p>16.19ha (40 acres) of spring barley</p> <p>1.62ha (4 acres) of woodland</p> <p>52.61ha (130 acres) of permanent and temporary leys</p> <p>Winter fodder is mainly conserved as pit silage.</p>	<p>260 beef cattle</p> <p>70 ewes and ewe lambs</p>	<p>Access to the farmstead and diversified business is off the Abergwyngregyn slip road off the east carriageway. There are roadside gates off the eastbound carriageway of the existing A55(T) which can be used for access with a tractor and slurry tanker.</p>	Low

Farm	Description of the business	Cropping	Stocking	Access	Sensitivity
	<p>There is a diversified enterprise on the farm; a dog boarding and a cattery business, which is separate to the farm business.</p> <p>This is considered to be a viable agricultural business.</p>				
Tai'r Meibion	<p>The holding extends to approximately 176ha (434.9 acres) of which the 154.99ha (383 acres) at Tai'r Meibion is rented on a Full Agricultural Tenancy, with 16.06ha (39.7 acres) owner-occupied in the Conwy valley and two blocks of land taken on farm business tenancies of 1.86ha (4.6 acres) and 3.07ha (7.6 acres). In addition, the tenant has grazing rights on adjoining mountain land.</p> <p>This is considered to be a viable agricultural business.</p>	<p>This is an all grass farm. There was a limited amount of silage made in 2015 as there was stock from the previous year.</p>	<p>950 breeding ewes 270 ewe lambs 200 cull ewes 40 rams</p> <p>The sheep are Welsh Mountain lambing outside in March and April. The majority of the lambs crop is sold deadweight from July onwards.</p>	<p>Access to the house and buildings is via a drive off a by-road between Llandygai and Abergwyngregyn, whilst a subway under the A55(T) provides access for livestock and small vehicles to the block of about 100ha (250 acres) between the A55(T) and the sea. All other vehicular access to this land is obtained by crossing the west bound carriageway, waiting in the central reserve and then crossing the eastbound carriageway. At peak times this can be a lengthy and hazardous process with as many as 120 vehicle movements a day in each direction being made during silage making.</p>	Low

Farm	Description of the business	Cropping	Stocking	Access	Sensitivity
Ty'n yr Hendre	<p>This farm extends to approximately 100ha (248 acres) of land taken primarily on a secure lifetime Full Agricultural Tenancy agreement. There are an additional 12.9ha (32 acres) of land taken under a 5 year Farm Business Tenancy with the same landlord. There are grazing rights on adjacent mountain land for 1,000 ewes. Whilst the house and buildings are situated to the south of the existing A55(T) there is land on the north that has fixed equipment in terms of livestock handling facilities and concrete flooring which has in the past been used for storage of agricultural produce to the north of the A55(T).</p> <p>The farm runs a Bed and Breakfast diversified enterprise. Buildings formerly used by the farm have subsequently been taken back by the landlord and leased to a third party. These have been converted to function rooms capable of catering for large groups.</p> <p>Waste from the housed cattle is spread or stored in temporary field heaps throughout the winter.</p> <p>This is considered to be a viable agricultural business.</p>	<p>All of the land is down to temporary and permanent leys</p> <p>Winter fodder is made in the form of wrapped big bales off 32.37ha (80 acres)</p>	<p>58 spring calving suckler cows</p> <p>70 store cattle</p> <p>3 bulls</p> <p>850 breeding ewes</p> <p>170 ewe lambs</p> <p>20 rams</p>	<p>Access to the land, house and buildings south of the A55(T) is via a drive off an unclassified road.</p> <p>Access to the land north of the A55(T) is via a concrete access from the same road.</p>	Low

Farm	Description of the business	Cropping	Stocking	Access	Sensitivity
Wig Farm	<p>The farm extends to approximately 169.16ha (418 acres), of which 115.74ha (286 acres) is rented on a Full Agricultural Tenancy with a further 53.42ha (132 acres) taken on a farm business tenancy from the same landlord. Also about 37.23ha (92 acres) are taken on a grass keep basis on Anglesey. The tenant has grazing rights for 1,110 ewes on adjoining mountain land at Abergwyngregyn.</p> <p>The store cattle are sold finished at up to 30 months of age. All lambs are sold finished.</p> <p>This is considered to be a viable agricultural business.</p>	<p>13.35ha (33 acres) of spring barley</p> <p>4.85ha (12 acres) of spring oats</p> <p>5.26ha (13 acres) of woodland</p> <p>92.27ha (228 acres) of permanent and temporary leys</p>	<p>20 suckler cows</p> <p>50 store cattle</p> <p>1,650 breeding ewes</p> <p>30 rams</p> <p>It is intended to bring the suckler cow numbers to 50 head. There are 9 pedigree Simmental cows in the herd.</p> <p>Winter forage is mainly conserved as big bale silage.</p>	<p>Access to the house and buildings is directly off the eastbound carriageway of the existing A55(T). Access to the land block on the south of the existing A55(T) for livestock and a small tractor or Land Rover is via a subway. Any other vehicular access is via an at grade crossing over both east and west bound carriageways.</p>	Low

Magnitude of Impacts and Significance of Effects (before mitigation)

Agricultural Land Quality

5.9.41 The Scheme would result in both permanent and temporary land take. Temporary land take would occur during the construction phase and consist of a pre-determined temporary working corridor. This would be a short term temporary impact. The Scheme would result in the loss of the following approximate areas of agricultural land (see Table 5.9.9).

Table 5.9.9: Summary of agricultural land area to be lost

ALC grade	Approximate temporary agricultural land take (ha)	Approximate permanent agricultural land take (ha)
Grade 1	0	0
Grade 2	0	0
Grade 3a	5.5	2.8
Grade 3b	2.8	2.9
Grade 4	0.8	0
Grade 5	0	0
Total	9.1	5.7

5.9.42 The Scheme would result in the permanent loss of approximately 2.8ha of Sub-Grade 3a land, the best and most versatile agricultural land in the area, and approximately 2.9ha of Sub-Grade 3b land. The small permanent loss of Sub-Grade 3a land is considered to be of negligible magnitude and together with the high sensitivity of this grade of agricultural land, the significance of the permanent loss of agricultural land is considered to be slight adverse. The permanent loss of Sub-Grade 3b land is considered to be of negligible magnitude and neutral significance.

5.9.43 The Scheme would also involve the temporary loss of 5.5ha of Sub-Grade 3a, 2.8ha of Sub-Grade 3b and 0.8ha of Grade 4 agricultural land for working space, the use of which would be covered by easements and licences. The temporary loss of Sub-grade 3a land is considered to be of low magnitude and moderate adverse significance, while the loss of Sub-Grade 3b land is considered to be of negligible magnitude and neutral significance. The temporary loss of Grade 4 land is considered to be of negligible magnitude and neutral significance. All such land would be returned to the landowners on completion of the works. The Welsh Government would seek a 'licence' from the landowners to cover this use.

Farm Businesses

5.9.44 In line with the DMRB, Volume 11, Section 3, Part 6 guidance the assessment considers the effects of land take, severance and major accommodation works for access, drainage and water supply.

5.9.45 Affected landowners and agricultural tenants had been consulted regarding previous studies for the Scheme and therefore the outline design has largely been developed with the needs of farm businesses in mind. As a consequence the consultation exercise carried

out as part of this impact assessment did not reveal many concerns from surrounding occupiers, and Table 5.9.10 summarises the feedback received on the outline design presented and any subsequent actions taken by the design team.

Table 5.9.10: Summary of feedback from landowners and occupiers during consultation process and subsequent design change or proposed action

Feedback	Change/Action
Construction phase could impact upon agricultural operations by restricting access of movement	Contract conditions will dictate that the successful contractor manages the works and the site to allow continual movement of stock and machinery for agricultural users (see <i>Design and Mitigation</i> below).
Construction phase could impact upon agricultural operations by restricting availability of existing services or facilities	Contract conditions will dictate that the successful contractor manages the works and the site to allow continual use of existing services and facilities, and ensuring replacement facilities are provided prior to decommission of existing ones (see <i>Design and Mitigation</i> below).
Inundation of current surface water drainage provisions beneath the A55 affecting land use (namely streams 1 and 8 at Ty'n yr Hendre and Pentre Aber)	Measures have been incorporated into the design to enhance the capacity of current drainage provisions and/or include scour protection measures to prevent future loss of land (see <i>Design and Mitigation</i> below and also Chapter 5.10).
Position of balancing pond removing agricultural land from Wig Farm holding	It is proposed to position the balancing pond within the site of Wig Bach thereby preventing loss of agricultural land.
Alignment of NMU route affecting the southern boundary of Pentre Aber holding	The option of realigning the NMU route to the north of the A55(T) between Wig Farm and Abergwyngregyn to limit impacts upon Pentre Aber was investigated. An alternative route along the coastline presented disadvantages in comparison to the proposed alignment, mainly increased length and reduced safety standards, and was subsequently dismissed.
Concerns about excess land take from Glyn farm land due to new access track for Bryn Meddyg properties and associated bund to prevent headlight glare	The proposed landscape bund to prevent headlight glare between the new access track and the A55(T) was omitted in favour of a close-boarded fence; this fulfils the same function but enables the land take from Glyn farm to be reduced slightly.

5.9.46 In the interest of safety almost all field and private accesses to the A55(T) would be stopped up as part of the Scheme, generating a major impact for the users of these accesses. Private access tracks would be provided to mitigate this impact and there would be one junction provided on the westbound A55(T) carriageway for access to the Bryn Meddyg properties and Glyn farm. In instances where the tracks would be for joint use, the land would be acquired by the Welsh Government with the intention of returning the land to the original owner, but with rights of access across it granted to others. These changes would generate a **moderate, positive impact** through improved road safety.

5.9.47 The existing cattle underpasses cannot be used by large agricultural vehicles and crossing the existing dual carriageway is potentially hazardous, with the driver having to stop in the central reserve to wait for a suitable break in the traffic. This is exacerbated particularly if

tractors and trailers are in use when crops are being harvested, necessitating an increase in the number of crossing movements. The proposed new PMAs, access tracks and the closure of the central reserve gaps and field gates to the A55(T) would eliminate this manoeuvre, making it safer for the day-to-day running of the farms and benefiting the farmers and road-users. Again, this would generate a **moderate, positive impact** on road safety.

5.9.48 At present, large articulated lorries making deliveries to Wig Farm have to slow down and use the outside lane to turn left thereby blocking the whole of the carriageway. The proposed new junction at the Tal-y-Bont interchange, county road and PMA would ensure that such vehicles would be able to turn off the main carriageway and access Wig Farm more safely. This would also result in a **moderate, positive impact** upon road safety.

5.9.49 The six agricultural farm holdings would be individually affected by the scheme as follows:

Tai'r Meibion

Land take

5.9.50 Approximately 1.71ha of grazing land would be permanently taken. This represents 0.97% of the land area farmed by this business and would largely be for the new county road to service the properties and land to the north of the A55(T), as well as serving as a non-motorised user route (see Figure 2.3, Volume 1a). This new access would run through land farmed from Tai'r Meibion, entering the land at the southern end of field NG 5554 and running along the southern boundary of the adjacent fields to the boundary of field NG 2100. Some land take would also occur due to the proposed widening and realigning of the unclassified Roman Road (Henffordd) (see Figure 2.4, Volume 1a).

5.9.51 Approximately 1.96ha of agricultural land would be required on a temporary basis during the construction period. Temporary land used for construction may be subject to changes in soil structure due to compaction by heavy plant and vehicles (see Chapter 5.5: Geology and Soils).

Severance

5.9.52 No permanent severance impacts are predicted on Tai'r Meibion.

Access

5.9.53 In addition to the proposed road works, the existing subway at Tai'r Meibion is to be extended in length. It is understood that the extended subway would be able to accommodate farm traffic and movement of livestock in the same way as the existing one, as it would be the same height and width. The Public Right of Way Llanllechid no. 42 would be diverted through the subway in order to create a safer means for pedestrians to cross the carriageway (see Figure 5.8.1, Volume 1a). Depending on frequency of usage of the subway there may be a slight impact due to greater interaction between pedestrians and farm traffic *i.e.* particularly when droving ewes.

5.9.54 Extending the subway would involve temporary restrictions on its use. This could result in there being temporary adverse impacts during the construction phase due to livestock being unable to access land severed from the buildings by the A55(T). This could cause issues relating to the management of enterprises on the farm that may result in them being stopped on a temporary basis, or cause increased costs to those enterprises. It is anticipated that such issues, if occurring, would be resolved by financial compensation.

5.9.55 The new county road is proposed over an internal access track north of the A55(T) running from the existing subway to fields to the west (see Figure 2.3, Volume 1a). Access for farm vehicles would be via new field accesses off the county road, with new gates linking the fields from within. A vehicular and livestock link between the two fields either side of the woodland would be provided which would require culverting a section of stream 3 (see Figure 2.2, Volume 1a). The construction of the county road could have a temporary severance effect during the construction phase if access to the fields is not provided.

Services

5.9.56 The water supply to the house and buildings could be affected by the Scheme. There are two troughs close to the subway on the north of the A55(T) that may need to be moved.

Wig

Land take

5.9.57 Approximately 1.17ha of land would be permanently taken. This represents 0.69% of the area of land farmed and 1.01% of land in Full Agricultural Tenancy and would largely be for the new county road and the new agricultural access track (PMA) for the southern part of the land, accessing directly off Roman Road (Henffordd) (see Figures 2.3 - 2.5, Volume 1a).

5.9.58 Approximately 2.18ha of agricultural land would be required on a temporary basis during the construction period.

Severance

5.9.59 The new PMA from Roman Road (Henffordd) through the Wig farm fields (see Figure 2.4, Volume 1a) would result in the severance of some land along the field boundaries from the main body of the fields. However, this access would be traversable by livestock and for this reason the land is not regarded as lost to the business.

Access

5.9.60 The proposals would close the existing access off the eastbound carriageway and provide a new main access to the farm (and other properties) by means of the county road along the north of the A55(T). Additional access to the farm would be achieved to land south of the A55(T) along the new agricultural access track via Roman Road (Henffordd) and through the subway beneath the A55(T) (see Figure 2.4, Volume 1a). PRoW Aber no. 1 would be diverted through the subway in order to create a safer means for pedestrians to cross the carriageway (see Figure 5.8.1, Volume 1a). Depending on frequency of usage of the subway there may be a slight impact due to greater interaction between pedestrians and farm traffic *i.e.* particularly when droving ewes.

5.9.61 The extension of the existing subway beneath the A55(T) is also likely to result in temporary adverse impacts during the construction phase on operations of Wig Farm, similar to that described for Tai'r Meibion. It is anticipated that such issues, if occurring, would be resolved by financial compensation.

5.9.62 As with Tai'r Meibion, on completion of the scheme the subway would continue to be able to accommodate farm traffic and livestock as at present. Larger vehicles that are currently unable to use the subway, so cross the carriageway instead, would need to travel along the widened section of Roman Road (Henffordd) to access the southern land or use the new county road to access the northern land. This could result in a minor increase in travel time between the northern and southern land.

Pentre Aber

Land take

- 5.9.63 Approximately 0.74ha of grazing land would be permanently taken, mainly due to the proposed NMU route. This represents 0.91% of the area of land farmed.
- 5.9.64 The farm currently contains strong vegetative field boundaries which are required to contain excitable cattle (older cattle brought onto the farm can become excited when first turned out). The vegetative screen along the A55(T) is likely to be lost due to the proposed NMU route (see Figure 2.5, Volume 1a), which could impact on the ability to contain the cattle.
- 5.9.65 There is currently a very limited area of land between the Pentre Aber farmstead and the A55(T). There is a hedge between the farmstead and the A55(T), which may be lost due to the proposed NMU route.
- 5.9.66 There would be approximately 2.83ha taken on a temporary basis during the construction period.

Severance

- 5.9.67 No permanent severance impacts are predicted on Pentre Aber.

Access

- 5.9.68 The roadside field gates off the eastbound carriageway would be lost as a result of the Scheme. Therefore, the management of the farm's slurry disposal system would need to be modified in order to access the steeper ground adjacent to the A55(T). The central access track between the A55(T) and the railway line could continue to be used for accessing the land at Pentre Aber; this might result in more wear/damage to that track requiring it to be repaired/patched more often.

Services

- 5.9.69 Roadside drainage from the existing A55(T) carriageway is discharged into an open ditch system, which crosses under the railway (Stream 8). During the heavy rainfall periods of the winter 2001/02, soil erosion and ponding occurred on fields adjoining the A55(T) and the railway. Therefore, it is proposed to upgrade and extend the current watercourse culvert underneath the A55(T) from a 300mm to a 1200mm diameter pipe and include measures to minimise potential scour in the future (see Chapter 5.10: Road Drainage and the Water Environment).

Bangor University

Land take

- 5.9.70 Approximately 0.47ha of grazing land would be taken due to the addition of a 1m wide hardstrip along the westbound carriageway and drainage cut-off channel (see Figure 2.5, Volume 1a). This represents 0.17% of the area of land farmed. Approximately 0.63ha of agricultural land would be required on a temporary basis during the construction period.

Severance

- 5.9.71 No permanent severance impacts are predicted on the university farm.

Access

- 5.9.72 The existing roadside access off the westbound carriageway would be lost, but access would continue to be available via the Abergwyngregyn interchange (junction 13) and Roman Road (Henffordd). However, this could generate a minor increase on travel times.

Glyn

Land take

- 5.9.73 Approximately 0.91ha of grazing land would be taken (0.44% of the land farmed by this enterprise), mainly due to the improved junction off the westbound carriageway and the new PMA to the Bryn Meddyg properties and the farm land (see Figure 2.5, Volume 1a).
- 5.9.74 Approximately 0.32ha of agricultural land would be required on a temporary basis during the construction period.

Severance

- 5.9.75 No permanent severance impacts are predicted on Glyn.

Access

- 5.9.76 The access off the A55(T) is to be retained and improved, with some land take to form a new track to the Bryn Meddyg properties; this would run across land farmed from Glyn (see Figure 2.5, Volume 1a).

Ty'n yr Hendre

Land take

- 5.9.77 Approximately 0.59ha of land would be permanently taken, largely by the installation of the new county road. This represents 0.52% of the area of land farmed and 0.59% of land within secure lifetime Full Agricultural Tenancy agreement.
- 5.9.78 A proportion of the sheep handling area and a concrete area used for the storage of supplies (such as fodder) would be lost to the farm. The loss of the portion of the sheep handling area would require the relocation of the whole facility.
- 5.9.79 Approximately 1.14ha of agricultural land would be required on a temporary basis during the construction period.

Severance

- 5.9.80 No permanent severance impacts are predicted on Ty'n yr Hendre.

Access

- 5.9.81 The proposed county road along the southern boundary of the field occupied by the farm (see Figure 2.3, Volume 1a) would not impact on the house or buildings, but would temporarily limit access during the construction phase to land farmed on the north of the A55(T). There is access to the fields to the west directly from the sheep handling facility and fields to the east are accessed via a bridge over a ditch. Depending on the extent of land take, particularly during the construction period, these accesses could be lost and would need replacing.
- 5.9.82 This land is often used for the winter application of manures to land and loss of access to this land would affect the farm's ability to carry out its normal manure application operations.

5.9.83 There are rights of way for railway staff to access the North Wales railway line; this access runs down the eastern end of the sheep handling facilities. In addition, there is a public footpath down this same line (PRoW no. 9, see Figure 5.8.1, Volume 1a). To one side of this access is a ditch (Stream 1) that runs in a northerly direction. As with Pentre Aber Farm, during the storm of 2001/02 there was significant damage caused to this ditch by water flow and there has been subsequent erosion caused. In places the ditch depth is estimated to be some 4m - 6m deep, the protective fence/field boundary is subsiding into it and there is now a potential health and safety issue for walkers and livestock. Scour protection would be installed downstream of the new outfall headwall and measures applied to protect the stream banks downstream of the outlet (see Chapter 5.10: Road Drainage and the Water Environment).

Services

5.9.84 Mains water supply pipes are located in the area of the sheep handling area. These could become damaged during the construction activities. If supplies are relocated, this could necessitate an alternative water supply for the sheep handling facilities.

Design and Mitigation Measures

Agricultural Land Quality

5.9.85 With the correct specification as to soil stripping, storage and replacement (see Chapters 5.5: Geology and Soils and 5.6: Materials), it is considered that the land utilised temporarily during the construction phase can be restored close to its former productive capacity in the medium term.

5.9.86 Care would be applied during the construction period to ensure that the temporary land-take would not extend beyond the figures provided in Table 5.9.9. This would be achieved by fencing the extent of the scheme footprint thereby preventing access onto adjacent areas of agricultural land.

Farm Businesses

General

5.9.87 While it is possible to identify the principal works of mitigation in advance of construction, it is not possible to comprehensively itemise them at this stage as mitigation works to limit the deleterious effects of a proposal on a farm form part of the farmer's claim for compensation; as such they must be agreed with an independent valuer before they can be offered as firm commitments.

5.9.88 The following general accommodation works would normally be provided or paid for by way of compensation. However, all such works would have to be agreed with the landowner/occupier beforehand and therefore are not currently firm scheme commitments.

Services

5.9.89 Special attention would be paid to maintaining existing services currently serving the land. Typical examples are the maintenance of water supplies, irrigation mains and drainage.

These are accommodation works so compensation could be paid instead to ensure that the works can be carried out.

Returning Land used for Temporary Construction to the Owner

5.9.90 Where land is acquired for construction, it would be returned at a suitable gradient to allow current agricultural practises to continue.

5.9.91 With the correct specification as to soil stripping, storage and replacement (see Chapters 5.5: Geology and Soils and 5.6: Materials), it is considered that the land can be restored close to its former productive capacity in the medium term. The assessment has been made on the assumption that restoration would be carried out to a high standard and compensation would be paid for loss of profits as a result of the Scheme.

5.9.92 During the period when land is in aftercare, any shortfall in production can be made up through the payment of compensation. The business should therefore not be disadvantaged in the short term.

Reorganisation of Field Boundaries

5.9.93 Appropriate access to the affected fields would be provided where required and any farm boundaries such as hedgerows, fences and walls affected during construction would be reinstated to maintain the boundary and restore landscape and ecology features (see Chapters 5.2: Cultural Heritage, 5.3: Landscape and 5.4: Nature Conservation for further details). Farm boundaries would generally be reinstated like for like.

5.9.94 Further design and mitigation measures would be provided for the six agricultural holdings as follows and as summarised in Table 5.9.11. As with the above, many of the measures outlined are accommodation works to be discussed and confirmed with the relevant landowner/occupier and are therefore not firm commitments as part of the scheme.

Tai'r Meibion

5.9.95 Any land required on a temporary basis during the construction period would be returned to the landowner on completion of the work.

5.9.96 The existing subway would be retained during construction to allow for livestock movement during this period. During the improvement of the existing subway, access to the northern land farmed at Tai'r Meibion would be along the minor road towards Ty'n yr Hendre to the west and then through that farm's land by means of the proposed county road along the northern section of the A55(T) that would also serve Wig Farm and other properties (see Figures 2.3 – 2.5, Volume 1a). This could result in an increase in travel times, although this would be a short term temporary impact. Co-ordination would be applied during the construction phase to ensure that this would be possible, as access to the northern land would need to be maintained throughout the construction phase.

5.9.97 Access to the fields north of the A55(T), to the west of the existing subway would be maintained during the construction of the county road to avoid temporary severance of land. Any affected access gates and farm boundaries would be reinstated.

5.9.98 Any field land drains and/or ditch systems encountered during construction would be effectively re-instated. The mains water supply to the house and buildings would be required to be kept in working order both during and after construction of the Scheme.

Wig

5.9.99 Any land required on a temporary basis during the construction period would be returned to the landowner on completion of the work. The new access track (see Figure 2.4, Volume 1a) would be mostly at the same level as the surrounding fields, except for the southernmost 110m where it increases in height to tie in with Roman Road (Henffordd) junction; the slopes on this elevated section would have a maximum gradient of 1:8. The new access road to the farm would be sufficiently robust to handle articulated vehicles and allow for their turning into the farm.

5.9.100 Access to and off the farm would be maintained during the construction period until the new county road/PMA is provided.

5.9.101 As with Tai'r Meibion, the existing subway would be retained during construction to allow for livestock movement during the construction period. During the improvement of the subway, access to the southern land farmed at Wig would need to be maintained. Co-ordination would be applied in the construction phase to ensure that this would be possible. On completion of the scheme the extended subway would continue to be suitable for such movements by agricultural vehicles (together with trailers) and livestock as currently occurs.

5.9.102 The proposed new agricultural access track to the farm's land to the south of the A55(T) runs over a watercourse (Stream 5; Afon Wig) and due consideration for avoiding adverse impacts to the watercourse would be incorporated into the design of the access track (see Chapter 5.10: Road Drainage and the Water Environment).

5.9.103 Any field land drains and/or ditch systems encountered during construction would be effectively re-instated. The mains water supply passes under the existing A55(T) and would be required to be kept in working order both during and after construction of the Scheme. Any affected access gates and farm boundaries would be reinstated.

Pentre Aber

5.9.104 Any land required on a temporary basis during the construction period would be returned to the landowner on completion of the work.

5.9.105 The field boundaries would be reinstated between the fields and the NMU route. In order to contain cattle, strong, high boundaries are required and consideration given to erecting a fence if there is space available to provide screening until such time as any new planting becomes effective.

5.9.106 Any field land drains and/or ditch systems or other services encountered during construction would be effectively re-instated.

5.9.107 Measures to dissipate the flow energy of Stream 8 are proposed and are discussed in Chapter 5.10: Road Drainage and the Water Environment.

Bangor University

5.9.108 Any land required on a temporary basis during the construction period would be returned to the landowner on completion of the work.

5.9.109 Access to the land would continue to be possible during the construction phase and operation of the scheme via the Abergwyngregyn interchange (junction 13) and under the A55(T) flyover to Roman Road (Henffordd) from the east.

5.9.110 Any field land drains and/or ditch systems or other services encountered during construction would be effectively re-instated.

Glyn

5.9.111 Any land required on a temporary basis during the construction period would be returned to the landowner on completion of the work.

5.9.112 An improved access would be provided by the new westbound junction off the carriageway, which would also serve the Bryn Meddyg properties (see Figure 2.5, Volume 1a).

5.9.113 Any field land drains and/or ditch systems or other services encountered during construction would be effectively re-instated.

Ty'n yr Hendre

5.9.114 Any land required on a temporary basis during the construction period would be returned to the landowner on completion of the work.

5.9.115 The sheep handling area may need to be relocated subject to agreement, and the access would need to be of sufficient size to cater for the needs of the business in terms of loading and unloading stock. Any damage caused during this operation would be compensated for. A storage area for feed, such as the one that is to be lost would also need to be replaced/compensated for. In the area of the sheep handling facilities there are mains water supply pipes; these would be located and protected (or relocated if required) during the construction period as water is needed for the sheep handling facilities.

5.9.116 To allow manure-spreading operations during the construction period in winter, an alternative access to the field not used for the road improvement would be made (if such operations continue at that time). Equally, it would be ensured that the storage of manures in temporary field heaps would not be hindered by the construction of the scheme.

5.9.117 To reduce the risk of members of the public not closing farm gates behind them when using public footpaths, thereby increasing the risk of livestock getting onto the A55(T), provision of such furniture as a "kissing gate" would be considered subject to agreement. The ditch (Stream 1) running in a northerly direction from the western extent of the new county road would be improved as part of the scheme (see Chapter 5.10: Road Drainage and the Water Environment).

Magnitude and Significance of Impacts after Mitigation

Agricultural Land Quality

5.9.118 The Scheme would result in the permanent loss of approximately 2.8ha of Sub-Grade 3a land of **negligible** adverse magnitude and **slight** significance, and approximately 2.9ha of Sub-Grade 3b land of **negligible** adverse magnitude and **neutral** significance.

5.9.119 A temporary working corridor either side of the Scheme would involve the temporary loss of 5.5ha of Sub-Grade 3a and 2.8ha of Sub-Grade 3b and 0.8ha of Grade 4 agricultural land for working space. These losses would result in **low** impacts of **moderate** adverse significance for Sub-Grade 3a land and **neutral** significance for Sub-Grade 3b and Grade 4 land. All such land would be reinstated and returned to the landowners on completion of the works. The Welsh Government would seek a 'licence' from the landowners to cover this use.

Farm Businesses

5.9.120 The Scheme would result in temporary loss of land during the construction period to facilitate that work as well as changes to current access arrangements. All land required on a temporary basis during the construction period would be restored to its former productive capacity and returned to the landowner on completion of the work.

5.9.121 The Scheme would result in a small permanent loss of land for all of the six farm holdings, which would be less than 1% of the farm holdings in all cases. However some changes would be required to the farm management, primarily in terms of changed access arrangements. With the proposed mitigation measures the Scheme would have a **slight** adverse impact on the farm holdings which is assessed to be of **neutral** significance (see Table 5.9.11).

5.9.122 The magnitude of impact on all farms is described as **slight** adverse, the viability of the businesses are not threatened by the proposals. Farm income is derived from the difference between total output and total input. Because the area of land take is so small, there is not likely to be a reduction in output that can be attributed entirely to the proposals. External factors such as weather and prices will have a much more significant impact on output than losses of land that represents less than 1% of the farm holdings.

Table 5.9.11: Summary of Magnitude and Significance of Effects on Farm Businesses

Farm	Approximate Permanent Land loss (ha)	Approximate Severance (ha)	Access affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of impact	Significance
Tai'r Meibion	1.71 (0.97% of land farmed)	0	Yes	<p>Co-ordination would be applied throughout the construction phase to ensure that access to the land on both sides of the carriageway is maintained. The existing subway access would be retained during construction to enable movement of livestock. Once alternative access to the fields north of the A55(T) is possible the existing subway would be extended. Access to the fields would be maintained during the construction of the county road.</p> <p>Disruption to services: any field land drains/ditches or other services disturbed would be re-instated.</p> <p>On completion of the scheme field accesses and boundaries would be reinstated as appropriate.</p>	Slight adverse	Neutral
Wig Farm	1.17 (0.69% of land farmed and 1.01% of land in Full Agricultural Tenancy)	Only severance limited to traversable access track/foot path	Yes	<p>Co-ordination would be applied throughout the construction phase to ensure that access to the land on both sides of the carriageway is maintained. The existing cattle underpass access would be retained during construction to enable movement of livestock to take place. Once alternative access to the fields north of the A55(T) is possible the existing subway would be extended.</p> <p>The new access track would be mostly at grade (with a maximum gradient of 1:8 where slopes are required) and the new county road would be sufficiently robust enough for articulated vehicles and allow for their turning into the farm.</p>	Slight adverse	Neutral

Farm	Approximate Permanent Land loss (ha)	Approximate Severance (ha)	Access affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of impact	Significance
				<p>Disruption to services: any field land drains/ditches or other services disturbed would be re-instated.</p> <p>On completion of the scheme field accesses and boundaries would be reinstated as appropriate.</p>		
Pentre Aber farm	0.74 (0.91% of land farmed)	0	Yes	<p>The roadside field gates off the eastbound carriageway would be closed. Therefore, the management of the slurry disposal system may need to be modified in order to access the steeper ground adjacent to the A55 (T) and increased use of the alternative access could result in increased wear/damage.</p> <p>Drainage: Improvements to Stream 8 are proposed to accommodate increased flows and dissipate flow energy where erosion has been identified as an existing problem.</p> <p>Disruption to services: any field land drains/ditch systems or other services disturbed would be re-instated.</p> <p>On completion of the scheme field accesses and boundaries would be reinstated as appropriate. Reinstated field boundaries would be sufficient to contain cattle.</p>	Slight adverse	Neutral
Bangor University	0.47 (0.17% of land farmed)	0	Yes	The existing roadside access off the westbound carriageway would be lost. However, access to this land is possible via the Abergwyngregyn interchange, under the A55(T) flyover to Roman Road (Henffordd) from the east.	Slight adverse	Neutral

Farm	Approximate Permanent Land loss (ha)	Approximate Severance (ha)	Access affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of impact	Significance
				<p>Disruption to services: any field land drains/ditches or other services disturbed would be re-instated.</p> <p>On completion of the scheme field accesses and boundaries would be reinstated as appropriate.</p>		
Glyn Farm	0.91 (0.44% of land farmed)	0	Yes	<p>Improved access to and from the A55(T) would be provided by the construction of a new junction on the westbound carriageway. This would result in land take of a small portion of farmland used by Glyn farm, but would improve the safety of the access to and from the A55(T) westbound carriageway.</p> <p>Disruption to services: any field land drains/ditches or other services disturbed would be re-instated.</p> <p>On completion of the scheme field accesses and boundaries would be reinstated as appropriate.</p>	Slight adverse	Neutral
Ty'n yr Hendre	0.59 (0.52% of land farmed and 0.59% of land in Full Agricultural Tenancy)	0	Yes	<p>The sheep handling area may need to be relocated with any damage compensated for and access sufficient to allow vehicles to load and unload livestock. A storage area for feed to replace the one lost would either be replaced or compensated for.</p> <p>To allow manure-spreading operations during winter, an alternative access to the field not used for road improvement should be made (if operations continue at that time). Equally the storage of manures in temporary field heaps should not be hindered by the</p>	Slight adverse	Neutral

Farm	Approximate Permanent Land loss (ha)	Approximate Severance (ha)	Access affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of impact	Significance
				<p>improvement operations.</p> <p>The watercourse with eroded banks (Stream 1) is to be improved as part of the scheme.</p> <p>Due to a potential increase in members of the public using the area on completion of the works the installation of footpath furniture such as a “kissing gate” is to be considered with the landowner/occupier.</p> <p>Disruption to services: any field land drains/ditches or other services disturbed would be re-instated.</p> <p>On completion of the scheme field accesses and boundaries would be reinstated as appropriate.</p>		

Summary

- 5.9.123 This chapter addresses the impacts on Community and Private Assets associated with the Scheme. At present there is no specific DMRB methodology developed for 'Community and Private Assets'. IAN 125/09(W) therefore advises that existing DMRB assessment guidance is followed:
- DMRB Volume 11, Section 3, Part 6 (June 1993) - Land Use
 - DMRB Volume 11, Section 3, Part 8 (June 1993) - Community Effects
- 5.9.124 No land allocated for housing, employment or retail development under the Gwynedd Adopted Unitary Development Plan or the deposit Anglesey/Gwynedd Joint Local Development Plan would be acquired for the Scheme. There will be no loss of land used by the community, effects on developed land or community severance. The Community and Private Assets chapter therefore focuses on effects on agricultural land.
- 5.9.125 The dominant land use affected by the scheme is pastoral agriculture. Agriculture along this section of the A55(T) is based principally around beef and sheep farming and is considered to be of local and not national significance.
- 5.9.126 The Scheme would involve the temporary loss of 5.5ha of Sub-Grade 3a and 2.8ha of Sub-Grade 3b and 0.8ha of Grade 4 agricultural land for working space. These losses would result in low impacts of moderate adverse significance for Sub-Grade 3a land and neutral significance for Sub-Grade 3b and Grade 4 land. All such land would be reinstated and returned to the landowners on completion of the works. The Welsh Government would seek a 'licence' from the landowners to cover this use.
- 5.9.127 The Scheme would result in the permanent loss of around 2.8ha of Sub-Grade 3a land and around 2.9ha of Sub-Grade 3b land. The significance of the permanent loss of 'best and most versatile' agricultural land (Sub-Grade 3a) is slight adverse and the loss of Sub-Grade 3b land is of neutral significance.
- 5.9.128 The effects on farm businesses, such as the changes to current access arrangements, are considered to be of neutral significance as the viability of the businesses is not threatened by the proposals. Mitigation works to limit the deleterious effects of the proposal on a farm form part of the farmer's claim for compensation and as such they would be agreed with an independent valuer appointed by the Welsh Government.
- 5.9.129 Moderate, beneficial impacts are predicted as a result of the closure of agricultural access onto/off the A55(T) and their replacement with safer alternative access provisions.

5.10 ROAD DRAINAGE AND THE WATER ENVIRONMENT

Introduction

- 5.10.1 This chapter provides an assessment of the water environment related to the Scheme and considers the existing water environment conditions for the study area and the legislative context. It investigates the likely effects of the Scheme on the quality of surface water, groundwater, hydromorphology, hydrogeomorphology and flood risk. Generic and specific effects on the water environment during the construction phase and the operational phase are identified and assessed. Implications relating to abstraction and existing discharge of water have also been assessed.
- 5.10.2 The water environment assessment includes consideration of water quality, flood risk and erosion control. Reference is also made to a Flood Consequence Assessment (FCA), a Water Framework Directive (WFD) report, a Drainage Strategy report and water quality tests undertaken using the Highways Agency Water Risk Assessment Tool (HAWRAT) (see Technical Appendix D, Volume 2 for further details regarding these). A summary of the findings of the WFD assessment and FCA is as follows:

Water Framework Directive Assessment Summary

- 5.10.3 Water quality samples collected in 2015 indicated that the water quality of the streams within the Scheme study area was of 'moderate' and 'good' status. The presence of hydrocarbons within the waters was below the toxicity threshold and therefore it has been assumed that the current level of pollution to the streams is not considered significant. The construction risk of pollution would be managed using best working practices and ensuring that all works within watercourses have supporting mitigation measures. The assessment concluded that, since the Scheme would not increase traffic volumes along the section, increased pollution is not expected post-construction. However, the proposed drainage design will incorporate improved pollution control measures and thus during operation the proposals will reduce the risk of pollution reaching the watercourses, which is considered to be an improvement to the current situation.

Flood Consequence Assessment (FCA) Summary

- 5.10.4 The FCA, prepared in accordance with TAN 15¹⁰⁸, outlined those areas that are currently at risk of flooding and those that would be at risk of flooding post-Scheme. Through upsizing culvert capacity, streams would be carrying greater volumes of water, with the potential to cause flooding downstream of the upsized culverts; hydraulic modelling was carried out to identify such areas. The pre- and post-works models were run for 1 in 100 year and 1 in 1000 year events. From the models it was clear that, post improvement, the scheme (including mitigation measures) significantly reduced flood risk to the A55(T) and Wig Crossing Cottages. The assessment illustrated the improved road drainage and reduced flood risk to the road and properties following the Scheme.

Methodology

- 5.10.5 The water quality assessment has been based on the methodology detailed in the DMRB Volume 11, Section 3, Part 10, HD45/09: Road Drainage and the Water Environment, and is described in this section. Cross references are provided within this chapter to other relevant topics within the ES where there is potential for incremental effects between them and water receptors. Cumulative effects associated with water receptors have been identified and reported in Chapter 6 of this ES.
- 5.10.6 Consideration has been given to:
- Volume 11, Section 2, Part 5 (HA 205/08);
 - Groundwater protection: principles and practice (GP3) EA 2013, and;
 - CIRIA C648 (2006).

¹⁰⁸ Welsh Assembly Government (2004). Technical Advice Note 15: Development and Flood Risk.

Data sources

5.10.7 Ongoing correspondence and consultation with the WG and NRW have been a key part of defining the scope of work for investigating water quality, drainage and hydrology, as well as guiding the production of the FCA. Data sources are detailed in Table 5.10.1.

Table 5.10.1: Data Sources used within the assessment

Source	Dataset/ information	Date on dataset	Description
Environment Agency	West of Wales River Basin Management Plan	2006/2007/2015	Identification of the river basin management plan.
NRW	Data request for the Scheme, including low flow data (Q95) - defined as the flow exceeded in a watercourse for 95% of the time. GIS and maps were provided with information on the aquifers within the study area.	2006/2007/2015	Data request for items including but not limited to: abstractions, discharges, environmental permits, location of any routine water quality monitoring points within the Scheme. Details of any present aquifers within the study area.
North and Mid Wales Trunk Road Agent	Information on known flood history	2006/2007/2015/2016	Flood hotspot areas identified along the A55(T).
Flood Estimation Handbook (FEH) CD ROM version 3.0	Information on the catchments that exist within the Scheme area.	2015	Hydrology assessment of the streams within the Scheme area.
Gwynedd Council	Information of known flood history	2006/ 2007/2015	Flood hotspots and reasons for flooding identified.
UK Soil Observatory	Information on the soil types within the Scheme footprint	2016	Identification of the soil types and characteristics within the Scheme footprint
British Geological Survey (BGS)	Maps on the geology and rock types within Scheme footprint.	2016	Identification of the rock types and geology within the footprint of the Scheme.
Ordnance Survey Maps	Maps to identify topography and features within the Scheme footprint	2016	Identification of the properties, watercourses, forested areas, roads and other features.

Prediction and evaluation of effects

5.10.8 The prediction and evaluation of the effects of the Scheme on road drainage and the water environment follows the requirements and detailed assessment methods as set out in HD45/09 and outlined in Table 5.10.2. The results of the FCA, outlined under the assessment criteria, have been taken into account when determining significance of effects.

Table 5.10.2: Methods used within the water environment assessment

Method	Description
Method A	This method focuses on the dilution of routine runoff and pollutants. This method is a simple assessment and includes the use of HAWRAT considering dilution of indicator metals (dissolved zinc and dissolved copper). The HAWRAT tool is designed to make an assessment of the short-term risks related to the intermittent nature of road runoff as well as the long-term risks. All discharges have been tested using HAWRAT. The methodology for routine runoff involves

	tests to predict future concentrations of zinc and copper in receiving watercourses with addition of discharge from the Scheme. This is based on Annual Average Daily Traffic flows (AADT), catchment size for the road, dilution flows (Q95 ¹⁰⁹) and current water quality (hardness) for each receiving watercourse.
Method B	In the event that, following the assessment using Method A, application of mitigation still fails against Environmental Quality Standards (EQS), Method B should be applied. This is a rare occurrence. Method B assesses the bioavailability of the soluble fraction of pollutants (dissolved zinc and copper).
Method C	This method focuses on groundwater effects. This is the standard method for assessing the impact of a proposed scheme on ground water quality. Typically this considers the risk of pollution to groundwater of discharges from a proposed scheme.
Method D	This method focuses on the probability of a serious spillage risk occurring that would affect the water environment. The method provides the return period of a serious accident based on road length, road characteristics (e.g. presence of junctions, roundabouts and crossroads) AADT, percentage of Heavy Goods Vehicles (HGVs), spillage risk factors and emergency services response time (based on site environment - e.g. urban/rural). An assessment has been undertaken for each outfall to test whether the probability of an accidental spillage causing a pollution incident represents an unacceptable risk.
Method E	Hydrological Assessment of Design Floods. This gives generic guidance to estimation of flood events for catchments.
Method F	Hydraulic Assessment- This gives direction as to what is required in a FCA and the process of hydraulic modelling to determine flood risk.

5.10.9 The specific requirements or thresholds to protect the surface water environment are shown in Table 5.10.3. For Method A, the thresholds are Environmental Quality Standards (EQS) which are outlined in legislation and must not be exceeded. Runoff Specific Thresholds (RSTs) also provide an assessment of the short-term impacts of the Scheme for a range of pollutants, including soluble metals. For Method D, the threshold is expressed as the minimum return period of an accident or spillage occurring and is set as a standard within HD45/09.

Table 5.10.3: Water quality thresholds

Method	Test	Limit
Method A RST	Range of pollutants including metals	Range of thresholds (pass/fail)
Method A EQS	Downstream dissolved zinc concentrations	7.8 µg/l
Method A EQS	Downstream dissolved copper concentrations*	1 µg/l for <50mg/l CaCO ₃ 6 µg/l for >50–100 mg/l CaCO ₃ 10 µg/l for 100–250 mg/l CaCO ₃ 28 µg/l for >250 mg/l CaCO ₃
Method D	Risk of serious spillage	<200 years

Key: EQS = Environmental Quality Standards; RST = Run-off Specific Threshold; * the maximum limit for dissolved copper is dependent on hardness of the receiving water. Source HD45/09: Table A1.

Assessment criteria

5.10.10 The DMRB methodology firstly requires identification of the importance of the environmental attributes within the Scheme study area. The magnitude of impact of the Scheme on the attribute is then determined using historical records, calculations and tests from the DMRB, before and after the influence of mitigation measures. The combination of the importance of an attribute and the magnitude of impact on that attribute gives the significance of potential effect on the water environment.

5.10.11 The criteria for evaluating the importance of water attributes are shown in Table 5.10.4 and the assessment criteria are outlined in Tables 5.10.5 and 5.10.6 (all adapted from those in HD45/09).

¹⁰⁹ The flow in cubic metres per second which was equaled or exceeded for 95% of the flow record.

Potential impacts of both construction and operation have been investigated in accordance with HD45/09.

5.10.12 The significance of potential effects on the water environment has been determined by assessing:

1. Importance of the water receptors;
2. Magnitude of the impacts of the Scheme, and;
3. Influence of mitigation measures.

The matrix for determining significance of effects is shown in Table 5.10.6.

Table 5.10.4: Evaluating the importance of water environment attributes

Value	Criteria	Typical examples
Very high	Attribute has a high quality and rarity on regional or national scale	<p>Surface Water</p> <ul style="list-style-type: none"> • European Community (EC) Designated Salmonid/ Cyprinid fishery • WFD Class High • Site protected/ designated under EC or UK wildlife legislation (SAC, SPA, SSSI, Ramsar Site, salmonid water)/species protected by EC legislation <p>Groundwater</p> <ul style="list-style-type: none"> • Principal aquifer providing a regionally important resource or supporting site protected under EC and UK Habitat legislation. • SPZ 1 <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain or defence protecting more than 100 residential properties from flooding • Existing likelihood of fluvial flooding affecting property* • Existing likelihood of pluvial flooding affecting properties based on topography
High	Attribute has a high quality and rarity on a local scale	<p>Surface water</p> <ul style="list-style-type: none"> • WFD Class Good • Major Cyprinid Fishery. Species protected under EC or UK habitat legislation. <p>Groundwater</p> <ul style="list-style-type: none"> • Principal aquifer providing locally important resource or supporting river ecosystem • SPZ 2 <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding • Flooding of key infrastructure during a 1 in 30 year event
Medium	Attribute has a medium quality and rarity on a local scale	<p>Surface water</p> <ul style="list-style-type: none"> • WFD Class Moderate <p>Groundwater</p> <ul style="list-style-type: none"> • Aquifer providing water for agricultural or industrial use with limited connection to surface water • SPZ 3 <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain or defence protecting 10 or fewer industrial properties from flooding • Likelihood of pluvial flooding of infrastructure based on topography
Low	Attribute has a low quality and rarity on a local scale	<p>Surface water</p> <ul style="list-style-type: none"> • WFD Class Poor <p>Groundwater</p> <ul style="list-style-type: none"> • Unproductive strata <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain with limited constraints and a low probability of flooding residential and industrial properties

Key: SAC = Special Area of Conservation; SPA = Special Protection Area; SPZ = Special Protection Zone; SSSI = Site of Special Scientific Interest; WPZ = Water Protection Zone; *= Scheme specific example. Source: adapted from HD45/09: Table A4.3

Table 5.10.5: Assessing the magnitude of impact on water environment attributes

Magnitude	Criteria	Typical example
Major adverse	Results in loss of attribute and/ or quality and integrity of the attribute	<p>Surface water</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) and compliance failure with EQS values (Method B). • Calculated risk of pollution from accidental spillage >2% annually (Method D) • Loss or extensive change to a fishery • Loss or extensive change to a designated nature conservation site. <p>Groundwater</p> <ul style="list-style-type: none"> • Loss of, or extensive change to, an aquifer • Risk score >250 (Method C) • Calculated risk from spillages >2% annually (Method D) • Loss or extensive change to groundwater designated wetland. <p>Flood Risk</p> <ul style="list-style-type: none"> • Increase in peak flood level of (1% annual probability) >100mm (methods E and F).
Moderate adverse	Results in effect on integrity of attribute or loss of part of attribute	<p>Surface Water</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) but compliance with EQS values (Method B) • Calculated risk of pollution from accidental spillages >1% annually and <2% annually (Method D) • Partial loss in productivity of a fishery <p>Groundwater</p> <ul style="list-style-type: none"> • Loss of, or extensive change to, an aquifer • Risk score >250 (Method C) • Calculated risk from spillages >2% annually (Method D) • Loss or extensive change to groundwater designated wetland <p>Flood Risk</p> <ul style="list-style-type: none"> • Increase in peak flood level of (1% annual probability) >50mm
Minor adverse	Results in some measurable change in attributes quality or vulnerability	<p>Surface water</p> <ul style="list-style-type: none"> • Failure of either soluble or sediment-bound pollutants in HAWRAT • Calculated risk of pollution from accidental spillages >0.5% annually and <1% annually (Method D). <p>Groundwater</p> <ul style="list-style-type: none"> • Risk score <150 (Method C) • Calculated risk of pollution from accidental spillages >0.5% annually and <1% annually (Method D). • Minor effects on groundwater supported wetlands <p>Flood Risk</p> <ul style="list-style-type: none"> • Change in flood peak (1% annual probability) <10mm
Negligible	Results in effect on attribute but of insufficient magnitude to affect the use or integrity	<p>The Scheme is unlikely to affect the integrity of the water environment.</p> <p>Surface water</p> <ul style="list-style-type: none"> • No risk identified by HAWRAT and risk of pollution from accidental spillages <0.5% <p>Groundwater</p> <ul style="list-style-type: none"> • No measurable impact upon an aquifer and risk of pollution from accidental spillages <0.5% <p>Flood Risk</p> <ul style="list-style-type: none"> • Change in flood peak (1% annual probability) < +/- 10mm
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	<p>Surface water</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) and compliance failure with EQS values (Method B). • Calculated risk of pollution from accidental spillage >2% annually (Method D) • Loss or extensive change to a fishery • Loss or extensive change to a designated nature conservation site.

		<p>Groundwater</p> <ul style="list-style-type: none"> Loss of, or extensive change to, an aquifer Risk score >250 (Method C) Calculated risk from spillages >2% annually (Method D) Loss or extensive change to groundwater designated wetland. <p>Flood Risk</p> <ul style="list-style-type: none"> Increase in peak flood level of (1% annual probability) >100mm (methods E and F).
Moderate beneficial	Results in moderate improvement on attribute quality	<p>Surface Water</p> <ul style="list-style-type: none"> Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) but compliance with EQS values (Method B) Calculated risk of pollution from accidental spillages >1% annually and <2% annually (Method D) Partial loss in productivity of a fishery <p>Groundwater</p> <ul style="list-style-type: none"> Loss of, or extensive change to, an aquifer Risk score >250 (Method C) Calculated risk from spillages >2% annually (Method D) Loss or extensive change to groundwater designated wetland <p>Flood Risk</p> <ul style="list-style-type: none"> Increase in peak flood level of (1% annual probability) >50mm
Major Beneficial	Results in major improvement of attribute quality	<p>Surface water</p> <ul style="list-style-type: none"> Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse <p>Groundwater</p> <ul style="list-style-type: none"> Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring Recharge of an aquifer <p>Flood Risk</p> <ul style="list-style-type: none"> Reduction in peak flood levels (1% annual probability) >100mm

Adapted from HD45/09: Table A4.4

Table 5.10.6: Determining the significance of effect on water environment attributes

Importance of attribute	Magnitude of impact			
	Negligible	Minor	Moderate	Major
Very High	Neutral	Moderate/large	Large/very large	Very large
High	Neutral	Slight/moderate	Moderate/large	Large/very large
Medium	Neutral	Slight	Moderate	Large
Low	Neutral	Neutral	Slight	Slight/moderate

Limitations

5.10.13 There was limited information available from NRW for a number of the streams in relation to the Q95 flow and WFD current status (NRW held no information regarding the Q95 flow of streams 2, 3, 7 and 8). This required assumptions to be made based on site information, topographical information and rainfall data. For the purpose of the Highways Agency Water Risk Assessment Tool (HAWRAT) the assumed flow of 1.70l/s has therefore been allocated to streams 7 and 8. As this tool is not required to assess streams 2 and 3 the Q95 has not been assumed for these. However, upon visual inspection the flow observed in streams 2 and 3 was similar to that seen in stream 1.

Flood Consequence Assessment (FCA)

5.10.14 An FCA has been produced in accordance with TAN 15¹¹⁰ and in consultation with NRW and the lead local flood authority. The methodology is summarised below and the full FCA can be found in Technical Appendix D, Volume 2. The approach for the FCA was developed in accordance with the

¹¹⁰ Welsh Assembly Government (2004). Technical Advice Note 15: Development and Flood Risk.

methodology set out in HD45/09 Annex I, Method E. The parameters used were agreed in principle with NRW and liaison will continue as the Scheme progresses. A full hydraulic model was developed for Stream 5 (Afon Wig) to illustrate the pre- and post- Scheme flood risk to the downstream properties of Wig Crossing Cottages. The full assessment can be found within the Flood Consequence Assessment report (see Technical Appendix D, Volume 2).

5.10.15 The sources of flood risk considered in the FCA are:

- Fluvial;
- Pluvial (direct surface runoff);
- Increased Surface Water Runoff from the new road, and;
- Groundwater

5.10.16 The following stakeholders were consulted in relation to flood risk (records of consultation are held by YGC - see Table 5.10.7 for a summary):

- Gwynedd Council - as lead local flood authority for the study area;
- NMWTRA - to identify any known flood risk issues associated with the existing trunk road links and access roads that could potentially be affected by the Scheme, and;
- NRW - to gather flood-related background information.

Table 5.10.7 Summary of consultation to date

Name and organisation	Subjects Discussed	Key issues raised	Date
Gwynedd Council	Flood and Water Management Act, Land Drainage Act and Council culverting policy in relation to ordinary watercourses	Rights and responsibilities, consents required and what works can be undertaken	2016
NMWTRA	Flooding of the highway Access roads within the Scheme area	Maintenance of the culvert grids, response to flooding and length of flooding on the highway Identifying all roads that may be affected by the Scheme	2016
Emyr Gareth (NRW) Iwan Huws (NRW)	Flood Risk	Incorporation of flood mitigation for Wig Crossing Cottages and inclusion of mitigation in hydraulic model. Railway culvert downstream of Wig Crossing Cottages to be included in the hydraulic model.	2015/17 2016
Phil Oliver (NRW)	Biodiversity	NRW to provide results of stream surveys regarding fish.	2016
Walter Hanks (NRW)	Fish Mitigation	Timeframe of when works may be carried out within river and mitigation measures to reduce siltation, advice on fish rescues.	2015/2016
Mark Medway (NRW)	Pollution controls	Incorporation of grassed swales into design	2016
Environment Liaison Group Meeting- Jenny Emmett – GAPS Emily Meilleur – GC	Environmental Protection	Pollution prevention measures, mammal passages, hydrogeomorphology and	2016

Jill Jackson – NMWTRA Peter Evans – NRW Mark Medway – NRW Phil Oliver – NRW Ruth Prichard – NRW Luci Collinwood – WG Sasanka Fernando – WG Chris Jones – YGC David Meller – YGC Christian Middle – YGC Nancy Wilkinson – YGC Robert Williams – YGC		hydromorphology.	
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5.10.17 The watercourses which were considered as part of the FCA are (see Figure 5.10.1, Volume 1a for locations):

- Stream 1 (Grid Ref: 262195, 371160)
- Stream 2 (Grid Ref: 262502, 371417)
- Stream 3 (Grid Ref: 262799, 371613)
- Stream 4 (Grid Ref: 263080, 371755)
- Stream 5 (Afon Wig) (Grid Ref: 263449, 371917)
- Stream 6 (Grid Ref: 264012, 372157)
- Stream 7 (Grid Ref: 264512, 372369)
- Stream 8 (Grid Ref: 264976, 372569)

Water Framework Directive (WFD) compliance assessment

5.10.18 In agreement with NRW, a supplementary WFD compliance assessment has been undertaken (see Technical Appendix D, Volume 2). The assessment is based on the methodology in Environment Agency draft guidance as agreed with NRW and considers whether the Scheme could potentially impact on waterbodies within the locality of the affected streams or downstream.

5.10.19 The WFD compliance assessment considers hydromorphological, biological (aquatic ecological) and groundwater quality impacts. The environmental objectives used to assess WFD compliance are based on internal Environment Agency guidance, as follows:

1. The Scheme would not cause deterioration in any element of water body classification.
2. The Scheme would not prevent the WFD status objectives from being reached within the water body or other downstream water bodies.
3. The Scheme would not negatively impact critical or sensitive habitats within the water body.
4. The Scheme would contribute to the delivery of the Western Wales River Basin Management Plan where required by the Plan (*i.e.* if an affected water body is at less than Good ecological status/potential, an examination of whether pre-determined mitigation measures could be incorporated into the Scheme should be considered).
5. Proposed energy dissipation techniques to be agreed with relevant stakeholders at detail design.

5.10.20 The WFD compliance assessment is based on the current Scheme as described and assessed in this ES. Changes at the detailed design stage may require an updated WFD detailed compliance assessment to be produced.

Baseline Environment

Policy and Legislation Context

5.10.21 European legislation is implemented in the UK through specific sets of Regulations. The Welsh Government is responsible for all aspects of water policy in Wales, the aim of which is to protect both public health and the environment by maintaining and improving the quality of natural waters. These include surface water bodies (*e.g.* rivers, streams, lakes and ponds) and ground water. Management and enforcement of water policy is the responsibility of NRW. The protection

of specific water resources, water quality and related policy relevant to the Scheme is set out in the following:

- The Water Framework Directive (2000/60/EC)
- The Urban Waste Water Treatment Directive (91/271/EEC)
- The Habitats Directive (92/43/EEC)
- Priority Substances Directive (2013/39/EU)
- Protection of Groundwater Directive(2006/18/EC)
- Groundwater Regulations (2009)
- River Basin Management Plans (Western Wales)
- Local Flood Risk Management Strategy (Gwynedd) (2013)

5.10.22 The following national legislation is also relevant to the Scheme:

- Environmental Protection Act (1990)
- Water Industry Act (1991)
- Environmental Act (1995)
- Water Act (2003)
- Water Environment (Water Framework Directive) (England and Wales) Regulations (2003)
- Environmental Damage (Prevention and Remediation) Regulations (2009)
- Flood Risk Regulations (2009)
- Water Resources Act (1991) (Amendment) (England and Wales) Regulations (2009)
- Environmental Permitting Regulations (England and Wales) (2010)
- Flood and Water Management Act (2010)

National Planning Policy

Wales Transport Strategy

5.10.23 The Wales Transport Strategy, published by the Welsh Assembly Government in April 2008, identifies the importance of adapting to climate change in Wales. The WTS outlines various Outcomes aimed at achieving a sustainable transport strategy for Wales. Outcome 13 requires transport networks to adapt to cope with the impacts of climate change and support increased resilience; an indicator of this is the proportion of the transport network protected against future flood risk.

Technical Advice Notes (Welsh Government)

5.10.24 The context for planning policy in Wales is set out within the Planning Policy Wales¹¹¹ document referencing European and national legislation and supplemented by a series of Technical Advice Notes (TAN) and Policy Clarification Letters.

5.10.25 The general approach of Planning Policy Wales (Edition 9, November 2016), supported by TAN 15, is to advise caution in respect of new development in areas at high risk of flooding by setting out a precautionary framework to guide planning decisions. Information from NRW shows that no floodplains lie within the study area.

5.10.26 TANs provide local authorities with guidance when considering the effects of new developments. The TANs identified below can be useful to refer to when assessing the effect of road developments on the water environment:

- TAN 5: Nature Conservation and Planning (2009) gives advice as to the consideration of impacts on designated sites in relation to the water environment.
- TAN 15: Development and Flood Risk (2004) provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding.

¹¹¹ Welsh Government (2016). Planning Policy Wales. Edition 9, November 2016.

Water Legislation

5.10.27 Water resources in England and Wales are protected by law under the Water Resources Act 1991, a consolidation of the Water Act 1989, and the Environmental Protection Act 1990 (as amended by the Environment Act 1995). The Water Resources Act 1991 is the principal legislation relating to water resources in England and Wales.

Water Framework Directive (WFD)

5.10.28 In October 2000 the WFD was adopted and came into force in Wales in December 2004. The purpose of the Directive, in relation to surface waters, is to establish a framework for the protection of inland surface waters (rivers and lakes). The Directive aims to ensure that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands, meet 'good status' by 2015. The WFD's requirements are being implemented through The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.

5.10.29 The WFD has replaced the existing Groundwater Directive (80/68/EEC) requirements to prevent or limit the introduction of pollutants into groundwater. The WFD established a framework for management of water resources throughout the European Union.

5.10.30 The main aims and objectives of the framework are to:

1. Prevent deterioration, enhance and restore bodies of surface water, achieve good chemical and ecological status of such waters and reduce pollution from discharges and emissions of hazardous substances.
2. Protect, enhance and restore all bodies of groundwater, achieve good chemical and quantitative status of groundwater, prevent the pollution and deterioration of groundwater, and ensure balance between groundwater abstraction and replenishment.
3. Preserve protected areas.

5.10.31 NRW's monitoring programmes will allow the classification of surface water bodies into one of five WFD ecological status classes (high, good, moderate, poor, bad) and one of two chemical status classes (pass/ fail). One of the main goals of the WFD is to aim for at least 'good' ecological status and 'good' chemical status for surface waters and groundwater by 2015.

Flood and Water Management Act 2010

5.10.32 Following the floods of 2006/2007 the government commissioned Sir Michael Pitt to undertake a review of all the issues and actions associated with this flood event. His report in December 2008 produced 92 recommendations, 15 of which the government acted upon immediately. DEFRA followed up on this report and the first draft of the Flood and Water Bill was produced. Part of the concept of the Bill was that a 'Lead Local Flood Authority' would be set up to coordinate all local flood-related activities.

5.10.33 The term Lead Local Flood Authority (LLFA) refers to a County Council or Unitary Authority, hence Gwynedd Council (GC) is the LLFA for the area affected by the Scheme. The main objective of the Bill was the requirement to produce a Preliminary Flood Risk Assessment.

5.10.34 The Flood and Water Management Act came into force on 1st October 2010. The Act pulls together many of the Pitt recommendations, and will require Gwynedd Council to undertake new duties to deal with local flood risk. In brief the main new duties for Gwynedd Council as LLFA will be to develop, maintain, apply and monitor a local flood risk management strategy in its area which covers flood risk from surface runoff, groundwater, and ordinary watercourses.

Groundwater Legislation

5.10.35 Historically, the main European legislation related to groundwater protection is the Groundwater Directive (80/68/EEC), which is transposed by the Groundwater Regulations 1998 (as amended). The WFD has integrated the majority of the Groundwater Directive.

5.10.36 Other legislation related to groundwater includes the Water Resources Act 1991, the Control of Pollution Act 1974, the Environmental Protection Act 1990 and the Town and Country Planning Acts.

5.10.37 The vulnerability of groundwater to diffuse pollutants depends on the presence and nature of the overlying soil, the presence and nature of drift, the nature of the strata and the depth of the unsaturated zone. The Soil Survey and Land Research Centre have developed three soil vulnerability classes for the Environment Agency based on physical soil properties. These are:

- soils of high leaching potential (H1, H2, H3)
- soils of intermediate leaching potential (I1, I2)
- soils of low leaching potential (L).

5.10.38 Principles for groundwater protection are detailed in 'Groundwater Protection: Principles and Practice' (GP3)¹¹².

Land Drainage Legislation

5.10.39 Section 23 of the Land Drainage Act 1991 states that '*No person shall a) erect any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or b) erect any culvert that would be likely to affect the flow of any ordinary watercourse or alter any culvert in a manner that would be likely to affect any such flow, without the consenting in writing of the drainage board concerned.*'¹¹³

5.10.40 Any works that are within or likely to affect Ordinary Watercourses will require consent from the LLFA and must meet the requirements of the Flood and Water Management Act. The LLFA must consider if the benefits of the work will outweigh the harmful consequences to natural heritage, preservation of cultural heritage, or people's enjoyment of the environment or of cultural heritage before any consent would be made.

5.10.41 Any works that are within or likely to affect Main Rivers (including culverting or discharging upstream), will require consent and permission from Natural Resources Wales, as stated within the Water Resources Act 1991¹¹⁴.

Local Authority Guidance

Anglesey and Gwynedd Joint Local Development Plan (2011 – 2026) – deposit plan (2015)

5.10.42 Gwynedd Council and the Isle of Anglesey County Council are preparing a Joint Local Development Plan for the Anglesey and Gwynedd Local Planning Authority Areas. The JLDP, expected to be formally adopted in July 2017, is a land use development strategy for a period of 15 years which concentrates on sustainable development. It will aim to achieve the following:

- Guide the development of housing, retail, employment and other uses;
- Include policies which will aid the Local Planning Authority's decision with regard to planning applications, and;
- Protect areas to ensure the maintenance and enrichment of the natural and built environment.

5.10.43 Strategic Policy PS5: Sustainable Development states that "*proposals will only be permitted where it is demonstrated that they are consistent with the principles of sustainable development*". In the context of the water environment all proposals are therefore required to: "*reduce the amount of water used and wasted; reducing the effect on water resources and quality; managing flood risk and maximizing use of sustainable drainage schemes; and progressing the objectives of the Western Wales River Basin Water Management Plan*".

¹¹² Groundwater protection: Principles and practice (GP3) August 2013 Version 1.1 (Environment Agency)

¹¹³ Land Drainage Act 1991, Chapter 59

¹¹⁴ Water Resources Act 1991 Chapter 3 Part 1 Section 17 (1)

5.10.44 Strategic Policy PS8: Proposals for Large Infrastructure Projects explains, in relation to flood risk, that *“The Councils will therefore aim to ensure conformity, as far as is appropriate or relevant, with the following criteria: The provision of flood protection measures to manage flood risk and, where feasible, deliver improvements in the locality”*.

5.10.45 In addition, JLDP Policy PCYFF1: Development Criteria states that *“planning permission will be refused where the proposed development would have an unacceptable adverse impact on: the quality of ground or surface water.”*

5.10.46 Policy PCYFF5: Water Conservation explains that *“proposals should incorporate water conservation measures where practicable, including Sustainable Urban Drainage Systems (SUDS). All proposals should implement flood minimisation or mitigation measures where possible, to reduce surface water run-off and minimise its contribution to flood risk elsewhere”*.

Gwynedd Unitary Development Plan (2001 – 2016)

5.10.47 The current adopted development plan framework for Gwynedd comprises the Gwynedd Unitary Development Plan 2001-2016. The plan establishes a policy framework and makes provision for development needs for the period up to 2016.

5.10.48 Policy B32 provides guidance on Increasing Surface Water and states that *“proposals that do not include flood minimisation or mitigation measures that will reduce the volume and rate at which runoff reaches rivers and other watercourses will be refused.*

When a development is approved planning conditions or agreements will be used to ensure that the necessary flood minimisation or mitigation measures are implemented, in accordance with submitted details which were approved”.

5.10.49 Policy B33 provides guidance on Development that Creates Pollution or Nuisance and states that *“proposals that will cause significant harm to the quality of public health, safety or amenities, or to the quality of the built or natural environment as a result of higher levels of air, water, noise or soil pollution will be refused unless adequate controls can be attained by means of planning conditions and powers of regulatory bodies, and that arrangements can be made for monitoring discharges.*

In addition, proposals located adjacent to an existing source of pollution or nuisance will be refused unless the Local Planning Authority is satisfied that there will be no risk to the health or safety of the local community or potential occupants of the new development that cannot be satisfactorily overcome”.

5.10.50 Policy C29 provides guidance on Safeguarding Water Resources. This states that *“proposals that will cause significant harm which cannot be mitigated or managed effectively, on surface water, ground water sources or freshwater ecosystems will be refused”*.

Nature Conservation designations (see Figures 5.4.1 – 4, Volume 1a)

5.10.51 Although not lying within the study area Y Fenai a Bae Conwy SAC, SSSI, LNR and Traeth Lafan SPA are between approximately 410m and 1km north of the Scheme, and are connected to it via the eight watercourses that flow north underneath the A55(T) and eventually discharge into the Menai Strait. Please refer to Chapter 5.4 (Nature Conservation) for further details about these and other nature conservation designations.

Surface Water

5.10.52 Eight streams and two field drainage features run north across the length of the Scheme. Most flow into Conwy Bay at Traeth Lafan in the Menai Strait and are shown on 5.10.1, Volume 1a. Each of the eight streams forms part of one of three larger catchments. There are four catchments within the Scheme area. Table 5.10.8 summarises the overall Water Framework Directive

classification of the water quality (ecological) of each catchment. Within this and subsequent sections of this chapter, all eight watercourses are defined as 'streams' in this assessment.

Table 5.10.8: WFD Classification of water quality of the catchments within the Scheme area

Stream	Catchment Name	WFD Ecological/Biological Classification	WFD Chemical Classification	Overall WFD Classification
1	Ty'n Hendre	Moderate	Good	Moderate
2	Ty'n Hendre	Moderate	Good	Moderate
3	Ty'n Hendre	Moderate	Good	Moderate
4	Un-named	Moderate	Good	Moderate
5	Wig	Moderate	Good	Moderate
6	Un-named	Good	Good	Good
7	Un-named	Good	Good	Good
8	Un-named	Good	Good	Good

5.10.53 The streams are described as follows:

Stream 1

Stream 1 is culverted from a point adjacent to Ty'n Hendre and runs north into a series of chambers. The system picks up drainage from filter drain networks on both sides of the A55(T) carriageway, passing under the Tal y Bont Interchange (Grid Reference: 262195 371160), and then outfalls some 80m north-west of the A55(T) and flows north towards the Menai Strait. Within the study area it is classed as an ordinary watercourse, falling under the responsibility of the riparian landowner. It is classed as a 'Main River' by NRW (Afon Ty'n Hendre) from the point at which it passes under the railway line (approximately 280m north of the proposed county road).

NRW estimated data show that Afon Ty'n Hendre has an Average Daily Flow of 15.7 l/s and a Q95 (flow that is exceeded 95% of the time) low flow discharge of 1.6 l/s.

Stream 2

Stream 2 passes under the A55(T) through a 1050mm diameter pipe (Grid Reference: 262502 371417) and receives a portion of the surface water for the adjacent junction through two gullies located on the junction. The stream outfalls directly north of the A55(T) and the pipe would be extended to pass under the proposed county road.

Stream 3

A 1050mm diameter pipe carries stream 3 under the A55(T) (Grid reference: 262799 371613) to two chambers before outfalling at a headwall on the north side of the A55(T). The pipe would be extended to pass under the proposed county road.

Stream 4

Stream 4 is culverted from a point near Roman Road (Henffordd) to the south of the A55(T) to a chamber at the south side of the westbound carriageway. From here a 600mm diameter pipe carries the stream under the A55(T) (Grid Reference: 263080, 371755) to a chamber at the north side of the eastbound carriageway and subsequently into a stone culvert, carrying the stream north towards the railway.

It is classed as a 'Main River' by NRW (Afon Tai'r Meibion) from the point at which it passes under the railway line (approximately 310m north of the new county road).

NRW estimated data show that Afon Tai'r Meibion has an Average Daily Flow of 23.8 l/s and a Q95 low flow discharge of 2.4 l/s.

Stream 5 (Afon Wig)

Stream 5 is culverted under the A55(T) via a 1050mm diameter pipe, which outfalls at the north side of the eastbound carriageway. Stream 5 flows northwards through Coed Wern-Porchell and is culverted under the A55(T) (Grid Reference: 263449 371917), upon which it becomes classed as a 'Main River' by NRW (Afon Wig). It is shaded by trees on both sides of the A55(T), although to a greater extent on the northern side.

NRW estimated data show that it has an Average Daily Flow of 66.6 l/s and a Q95 low flow discharge of 6.7 l/s, indicating that the stream generally carries more water than Streams 1, 4, 6 and 7 (and probably 2, 3 and 8), particularly during periods of low flow.

Stream 6

Stream 6 is culverted under the A55(T) via an 800mm diameter pipe, there is an overflow pipe located in the chamber in the central reserve, and eventually outfalls back into stream 6 some 28m north of the outlet headwall.

Stream 6 runs steeply through an open field on the southern side of the existing carriageway before entering a culvert, which takes it under the A55(T) (Grid Reference: 264012, 372157). The stream re-emerges in an area of woodland and then flows through an area of open, improved pasture before reaching the coast.

Stream 6 varies widely in its characteristics and is heavily influenced by local topography and landscape features. It is not classified as a 'Main River' but NRW estimated data show that it has an Average Daily Flow of 16.95 l/s and a Q95 low flow discharge of 1.7 l/s.

Stream 7

Stream 7 is carried under the A55(T) via a 900mm diameter pipe to a chamber in the central reserve (Grid Reference: 264512, 372369) and then continues to another chamber in the verge of the eastbound carriageway before emerging approximately 280m downstream, in open grazed pasture where it passes under the railway line to run through more pastureland before entering the sea.

Stream 7 varies widely in its characteristics and is heavily influenced by local topography and landscape features. NRW did not hold any data on low flows though stream 7. On visual inspection, the stream is similar in flow to Stream 6. As an estimate and for the purpose of this assessment the Q95 value of stream 6 (1.7 l/s) has therefore been used for Stream 7¹¹⁵.

Stream 8

Stream 8 passes under the A55(T) (Grid Reference: 264976, 372569). NRW held no additional information on this stream. Stream 8 was similar in flow on visual inspection to Stream 6. As an estimate and for the purpose of this report the Q95 value of stream 6 (1.7 l/s) has therefore been used for Stream 8.

¹¹⁵ NRW held no information regarding the Q95 flow of streams 2, 3, 7 and 8. For the purpose of the Highways Agency Water Risk Assessment Tool (HAWRAT) the assumed flow of 1.70l/s has been allocated to streams 7 and 8. As it is not required to assess streams 2 and 3 using this tool the Q95 has not been assumed. However, upon visual inspection the flow seen in streams 2 and 3 was similar to that seen in stream 1.

Table 5.10.9: Summary of the surface water features within the Scheme study area

Stream	Catchment	Grid Ref	Current ecological potential/status	Current chemical potential/status	Status objective by 2027	Importance	Q95 (l/s)	Main river/ordinary watercourse
1	Ty'n Hendre	262195 371160	Moderate	Good	Good	High	1.6	Main River 280m north of Scheme. Ordinary watercourse within Scheme boundary
2	Ty'n Hendre	262502 371417	Moderate	Good	Good	High	n/a	Ordinary watercourse
3	Ty'n Hendre	262799 371613	Moderate	Good	Good	High	n/a	Ordinary watercourse
4	Un-named	263080 371755	Moderate	Good	Good	High	2.4	Main River 310m north of Scheme. Ordinary Watercourse within Scheme boundary
5	Wig	263449 371917	Moderate	Good	Good	High	6.7	Main River north of A55(T). Ordinary watercourse to south
6	Un-named	264012 372157	Good	Good	Good	High	1.70	Ordinary watercourse
7	Un-named	264512 372369	Good	Good	Good	High	1.70*	Ordinary watercourse
8	Un-named	264976 372569	Good	Good	Good	High	1.70*	Ordinary watercourse

* estimated using the Q95 data for stream 6

Water Quality Sampling

5.10.54 In 2006/2007, NRW stated that there were no existing River Ecosystem and General Quality Assessment (GQA) data available for the surface watercourses within the study area. Therefore, it was decided to take a precautionary approach and gather water samples from fixed points on six watercourses (Streams 1, 2, 3, 5, 6 and 7). Further consultation with NRW in 2015 revealed that they still held no water quality measurements from these watercourses so water quality was tested again in 2015.

5.10.55 Water samples were obtained from each of the streams within the Scheme study area in 2015, following consultation with NRW. The study area was delineated by the hydrological catchments of the potentially affected water features. Initially, investigations concentrated on an area incorporating the Scheme and a zone within 500m of its boundary. The study area was extended if impacts were perceived beyond this area.

5.10.56 The water samples tested in 2015 were based on the parameters requested by NRW as a minimum: pH, conductivity, chloride, solids, turbidity, zinc, hydrocarbons and oil (visibility test). The following parameters were tested in 2008 and are included in this chapter as background information:

Biochemical Oxygen Demand and/ or Chemical Oxygen Demand, ammonia, nitrate, phosphate and additional metals such as lead, iron and nickel.

5.10.57 The parameters of particular concern are the level and type of hydrocarbons present within the watercourses. High levels of hydrocarbons within the watercourses would indicate high pollution levels from the road resulting in poor pollution control on the drainage outlets.

5.10.58 Water sampling was carried out on 5/11/15 and 11/11/15. A sample was not obtained for stream 4 as access was not possible. See Technical Appendix D, Volume 2 for the full results of the water sampling. The 2015 sample results indicate that there has been no significant change to the water quality of the streams within the study area; it is therefore assumed that the ecological status of the water remains the same as when sampled in 2006/2007 and the Main River System catchments within the study area have been classed as follows using the WFD guidelines:

- Afon Wig - overall status: MODERATE
- Afon Ty'n Hendre - overall status: MODERATE.

Under the WFD all watercourses should be at a GOOD status by 2015; in some cases exceptions will be made and improvement of water status can be extended to 2021 or 2027.

5.10.59 Based on the previous water quality testing and with reference to the classification in Table 5.10.4, Streams 5, 6, 7 and 8 are considered to have a chemical GQA (General Quality Assessment) of Grade A. Streams 1, 2 and 3 are also considered to have a chemical GQA of Grade A, although this assumption is based purely on the water quality results obtained for dissolved oxygen. During the 2006/2007 sampling streams 4 and 8 were dry and therefore no data were collected. During the 2015 sampling, access to stream 4 was not possible and therefore no data were collected.

5.10.60 The WFD assessment report (see Technical Appendix D, Volume 2) describes the potential pollution and effects on the waterbodies affected by the Scheme. From the results of the water samples it was estimated that the water quality is of moderate or good status with the objective to reach overall good status by 2017 following the WFD guidelines. The level of pollution recorded indicates that the streams are currently not receiving high levels of pollution from the surrounding land and the presence of hydrocarbons within the streams indicates their close proximity to the A55(T). The Scheme is not expected to increase traffic volume; however, the overall footprint of the impermeable surface and increased drainage require proper regulation and design to ensure that increased levels of pollution, especially hydrocarbons, do not enter the streams. The Scheme is not expected to increase pollution levels or have adverse effects on the streams within the Scheme area; therefore, further detailed WFD assessment is not required.

Groundwater

5.10.61 Groundwater Source Protection Zones are defined by NRW to identify and protect groundwater sources that supply water to potable or equivalent standards. NRW information shows the study area to be outside any defined Zones.

5.10.62 The Scheme is situated over a Secondary B aquifer for bedrock and predominantly unproductive aquifer for the drift/superficial as it consists of Till (Devensian). Secondary Aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage and are subdivided into two types:

- **Secondary A** have permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers;
- **Secondary B** are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Unproductive Strata for the drift/superficial deposits have low permeability that has negligible significance for water supply or river base flow – these are generally shallow / thin deposits (see also Chapter 5.5: Geology and Soils).

5.10.63 Therefore, the secondary B aquifer present within the study area is not considered to be at risk of pollution during the works or post works due to the nature of the aquifer and no further assessment on groundwater risks has been completed.

Abstractions and Discharges

5.10.64 NRW have no records of abstraction licences or discharge consents within 500m of the Scheme. Consultation with Gwynedd Council's Environmental Health Department revealed that one property within 500m of the Scheme receives a private water supply (Tŷ'n Lon) which is approximately 370m south of the A55(T).

5.10.65 Due to the location of the property and the nature/extent of the Scheme, it is not considered likely that this private water supply would be affected and therefore it has not been considered further within this assessment.

Existing Road Drainage

5.10.66 Existing drainage comprises a series of land drains, the highway filter drain system and a system of gullies. The existing highway filter drains comprise fairly large pipes, but flooding occurs sporadically on parts of the westbound carriageway from uncontrolled discharge emanating from adjacent land to the south of the highway.

Recorded Pollution Incidents to Controlled Waters

5.10.67 NRW have five pollution incidents on record from within the study area, summarised as follows:

- Event 274103. Date 26/10/04. Nominal grid reference: SH 63663 71364. Details: A tree caused a blockage in the stream. The tree was cut up and removed.
- Event 392315. Date 20/4/06. Nominal grid reference: SH 64140 72620. Details: 100 gallons of diesel lost from train onto railway ballast between Llandudno Junction and Llanfairpwll railway stations. There was no visible fuel found on the track by the rail inspector.
- Incident 872999. Date 6/4/11. Location: SH 63913 72886. Category 4 (i.e. no impact). Construction and demolition waste.
- Incident 897127. Date 27/6/11. Location: SH 63603 71532. Category 3 to land (i.e. minor). Fly-tipping of asbestos.
- Incident 1020627. Date 1/8/12. Location: SH 65562 72849. Category 3 to water (i.e. minor impact on water quality). Road traffic accident on A55(T).

Flood Risk

5.10.68 It is considered that the sources of flood risk associated with the operation of the Scheme are understood. The main sources of flood risk are runoff from the adjacent fields, insufficient highway drainage, below capacity culverts and lack of storage of the excess surface water. Each of the eight streams currently has potential to cause flooding to the A55(T) if a blockage either on the A55(T) culverts or culverts under the county road to the south (Roman Road) was to occur. In addition, there is flood risk from watercourses bursting their banks.

5.10.69 The main areas at risk from flooding have been identified through analysis of past flooding history (Wig Cottages and its access road and the A55(T) carriageway at flooding hotspots between Junction 12 and 13; this area is known to have been severely flooded at least twice in the past five years (2012 and 2015) resulting in partial or full road closure for up to 12 hours. These risks have been mitigated through the Scheme's design, which will ensure that the Scheme remains flood-free for a 1% (1 in 100) annual chance event including an allowance of +30% for climate change. The Scheme is also considered to remain flood-free for more extreme events up to a 0.1% (1 in 1000) annual chance event, but would increase flood depths within the Afon Wig flood plain by up to 0.20m and around Wig Cottages by up to 0.05m during such an event; mitigation is therefore proposed for the latter.

5.10.70 Part of the study area is within the floodplain of the Afon Wig and therefore there is a known level of flood risk to this area. TAN 15 (Technical Advice Note, Development and Flood Risk) advises

caution in respect of new developments in areas at high risk of flooding. The Development Advice Maps (DAMs) produced in conjunction with TAN15 illustrate those areas at high risk of flooding. From analysis of these DAMs it has been illustrated that the area of Wig Crossing Cottages does not fall within the high risk area. No section of the Scheme area falls within the DAMs areas at high risk.

Magnitude of Impacts and Significance of Effects (before mitigation)

5.10.71 This section considers the potential impacts of the Scheme on the water environment during both construction and operation. The potential effects set out in this section do not take into account proposed mitigation at this stage. Tables 5.10.14 and 5.10.15 summarise the potential effects during the construction and operational phases respectively.

Proposed Drainage Design

5.10.72 The proposed drainage design is explained in Chapter 2, Section 2.3, but specific issues relating to streams crossed by the Scheme, and therefore considered in this assessment, are summarised as follows:

Stream 1 would be used as at present and also to drain the new county road. Baffle weirs, battering of banks and brush matting to the downstream channel banks would be incorporated. Upstream of the A55(T) the existing trash screen will be replaced with an improved structure to allow safer access for routine maintenance and inspection.

Stream 2 would be used to discharge runoff from the new county road. The existing 1050mm diameter pipe culvert beneath the A55(T) would be extended to carry the stream beneath the new county road. A drain would be piped directly into the existing culvert to discharge runoff from the kerb and gully system.

Stream 3 would be used to discharge runoff from the new county road. The existing 1050mm diameter concrete culvert would be extended to the north to pass under the new county road. A new headwall would be constructed on the eastern side of the watercourse to discharge piped runoff from the kerb and gully system on the new county road.

Stream 4 would be used to discharge runoff from the kerb and gully system, which would discharge via a proposed pipe into an existing chamber on the line of the existing culvert.

Stream 4 would also be used, as at present, to carry runoff from the Scheme over a length of 300m by a filter drain in the northern verge, and by a system of surface water channels and carrier drains in the southern verge. The Scheme would drain into Stream 4, via both the proposed system of surface water channels and filter drains and by direct connection of the existing land drainage immediately east of Tai'r Meibion Farm into the existing culvert beneath the Scheme. The existing culvert would be extended to the north to accommodate the new county road and to the south to accommodate the increased overall width of the highway.

For most of the length of the Scheme surface water runoff from the fields on the southern side would be collected via the bund and channel system and directed into stream 4.

Stream 5 (Afon Wig) would be used, as at present, to discharge runoff from the Scheme for a 260m section via a filter drain in the northern verge, and by a system of surface water channels and filter drains in the southern verge. The existing culvert would be replaced by a much larger structure to accommodate 100 year plus climate change flows. In addition, runoff from the adjacent fields on the southern side of the Scheme would drain into Stream 5 via a bund and channel system.

Stream 6 would be used, as at present, to discharge runoff from the Scheme for a 740m section via the proposed filter drain in the northern verge, and by a system of surface water channels and filter drains in the southern verge. To the east and west of Stream 6, the filter drains and filter pipe

system would combine to outfall into a detention pond at the site of Wig Bach (Grid Reference: 263975, 372173, see Figure 2.5, Volume 1a) to prevent flooding from the large catchment area of rural runoff from the south of the Scheme. The existing culvert would be extended north and south. In addition, runoff from the adjacent fields on the southern side of the Scheme would drain into Stream 6 via a bund and channel system.

Stream 7 would be used, as at present, to discharge runoff from the Scheme for a 400m section, via the proposed filter drains in the northern verge, and by a system of surface water channels and filter drains in the southern verge. The filter drain to the west of Stream 7 would connect directly into the existing culvert. The filter drain to the east of Stream 7 would connect into an existing chamber. In addition, runoff from the adjacent fields on the southern side of the Scheme would drain into Stream 7 via a bund and channel system.

Stream 8 would be used, as at present, to discharge runoff from the Scheme over a 300m section via the proposed filter drain in the northern verge, and by a system of surface water channels and filter drains in the southern verge. The existing culvert would be upsized from a 300mm to a 1200mm diameter pipe and extended north beneath the NMU route. Stream 8 would also collect runoff from the fields on the southern side of the Scheme, via the proposed system of surface water channels and carrier drains.

There would be a new installation of a 450mm diameter pipe across the field between the A55(T) and Roman Road just west of The Old School, tying into Stream 8; land drains would also feed into this pipe.

Stream 8 will therefore receive increased water volumes once the proposed works have been completed; the current flows within the river are low. These increased water volumes will increase water velocities which will be managed through energy dissipation; the inclusion of a weir at the outfall will significantly reduce the velocity of the increased volumes. The lining of 200m of the stream will further reduce erosion rates that are currently occurring here and will stop any further erosion occurring from the increased water volume.

Sustainable Drainage Systems (SuDS)

- 5.10.73 The use of SuDS within the Scheme has been considered and assessed. Filter strips, filter drains, over the edge drainage and a detention pond have been incorporated into the proposed design. As the need to minimise land take limits the scope for the implementation of further SuDS, the use of over-sized pipes has been included for temporary storage of surface water runoff.
- 5.10.74 The detention pond at the site of Wig Bach would be used as a settling bay for some of the surface water runoff to allow for sediment separation and removal of hydrocarbons and other pollutants. During the detailed design stage, additional SuDS would be considered and implemented where possible.
- 5.10.75 The detention pond would typically comprise an inlet structure, fore bay, vegetative treatment for pollution control, detention storage, lined wet area, and outlet control structure. Together with flow control devices on the outfalls these would accommodate a reduced discharge rate which would discharge in to the nearest watercourse adjacent to the eastbound carriageway. The pond would be equipped with skim plates and flow controls which would operate on the same principles as oil separators (subject to agreement with NRW at detailed design). Emergency shut-off valves and bypasses would be provided upstream of critical discharge locations to enable the pond to be isolated from receiving watercourses in the event of an accidental spillage.
- 5.10.76 Treatment and management of runoff would be carried out as closely as possible to the source of the runoff to eliminate pollution entering the streams, where drainage discharges directly into the streams *i.e.* has not passed through the filter drains or attenuation pond.

Construction Period

5.10.77 The construction works for the Scheme have the potential to impact water quality in any of the receiving surface or groundwater receptors; this may be due to excavation (including dust from material handling – see Chapter 5.1: Air Quality), the deposition of soils, sediment, or other construction materials (see Chapter 5.6: Materials), spillage of fuels or other contaminating liquids, the mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site runoff. A Construction Environmental Management Plan (CEMP) will be required for the construction phase and Chapter 7 of this ES outlines the key contents of this.

Surface Water

5.10.78 There is potential for the Scheme to have an adverse effect on surface waters within the study area during the construction period through spillages of chemicals, cement and fuels into the watercourses. Increased siltation can occur during earthworks and in-stream works and can disrupt the natural environment of the watercourse (see Chapter 5.4: Nature Conservation).

5.10.79 In-stream works can have implications for a number of a watercourse's attributes. Pollution entering the watercourse as a result could have implications for water quality. Another effect of in-stream works (*e.g.* construction of culverts) relates to the potential for disturbance of in-stream habitats and associated communities due to the clearance of in-stream and bankside vegetation. Culverting can also affect flow rates, which could in turn affect the ecological composition of the specific watercourse (see also Chapter 5.4: Nature Conservation).

Hydromorphology and Hydrogeomorphology

5.10.80 Hydromorphology is a term used in river basin management to describe the hydrological (*e.g.* water flow, energy) and geomorphological (surface features) processes and attributes of rivers, lakes, estuaries and coastal waters. The Water Framework Directive (WFD) dictates that the ecology of surface waters is protected by correctly managing their hydrology and geomorphology. Changes to hydromorphology and hydrogeomorphology from road projects can be significant, with loss of drainage channels to culverting and increases to flow rates. Impacts on flow regime and physical habitat, which may result in a waterbody's deterioration of status under the Water Framework Directive or a failure to achieve the waterbody's objectives have therefore been considered.

5.10.81 During the construction period there is potential for changes to occur to the flow rates and capacity of the affected streams, which could have an adverse impact upon their natural hydromorphology and hydrogeomorphology. Any in-river works have the potential to change the hydromorphology of the streams and subsequently increase erosion (see also Erosion Prevention and Sediment Control Plan, Technical Appendix D, Volume 2).

Groundwater

5.10.82 Although there remains a potential for construction works to affect groundwater through storage of materials or accidental spillages, it has been confirmed by NRW that the secondary B aquifer that lies below the Scheme area is not at risk of pollution from the works (see also Chapter 5.5: Geology and Soils). Furthermore, any pollutants that do infiltrate the groundwater resource are considered likely to diminish over time through natural attenuation processes.

Fluvial flood risk

5.10.83 If work is undertaken within the Afon Wig floodplain and materials are stored within it this could increase flood risk resulting in a potentially minor adverse magnitude of impact. During high rainfall events the streams would become inundated with increased volumes of water, which would increase flood risk to the area during construction.

Pluvial flood risk

5.10.84 During intense and heavy rainfall events surface runoff onto the A55(T) at this location is significantly increased and there is significant risk of flooding from surface runoff from the fields to

the south of the Scheme area. Mitigation measures would therefore need to be implemented during construction to reduce flood risk from surface runoff during high rainfall events.

Flood risk from lakes and other waterbodies

5.10.85 There are no lakes or other known waterbodies within the study area that may increase flood risk during construction.

Table 5.10.10: Water receptors at risk from construction phase works

Catchment	Water feature	Grid Reference	Potential impact	Importance	Potential magnitude of impact
Ty'n Hendre	Stream 1	262171 371189	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Ty'n Hendre	Stream 2	371431 262493	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Ty'n Hendre	Stream 3	371621 262767	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Un-named	Stream 4	372037 263003	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Wig	Stream 5	371931 263439	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Un-named	Stream 6	372168 264005	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Un-named	Stream 7	372383 264508	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate
Un-named	Stream 8	372576 264963	-Increase in silt -Spillage to watercourse -Reduction in biodiversity -Erosion of river bed	High	Moderate

N/A	Groundwater	Extent of study area	-accidental spillages infiltrating into groundwater	Low	Negligible
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Operational Impacts

Drainage hierarchy

5.10.86 During operation road drainage can affect the water environment through discharge of sediments, pollutants and volume of water. The impact of road drainage on the water environment is partly determined by the way in which water is discharged from a road to the water environment; ideally, the pathway of water from the road to the environment should reflect natural hydrological processes. HD45/09 refers to the process as a preferred drainage hierarchy and suggests that this typically should consider discharge of road drainage by infiltration to ground before discharge to a surface watercourse or sewer.

5.10.87 The study area contains rocks of Ordovician Age consisting of mudstones and siltstones, which are generally impermeable below the uppermost weathered layers (see Chapter 5.5: Geology and Soils). Water flow through fractures and fissures within this rock is unimpeded and interconnected. The rock may be locally important in providing water sources, springs and local river base flow.

5.10.88 Based on previous ground investigations it is considered that:

- Generally, along the route of the Scheme, impermeable compacted cohesive rock and soil types would restrict the rate and amount of infiltration possible, and;
- Further land take would have other adverse impacts; therefore space required for infiltration is not possible.

Therefore, full infiltration drainage is not considered to be a viable option for the Scheme.

5.10.89 The route of the Scheme has been assessed in terms of eight drainage catchments based on its vertical alignment. All outfalls would discharge to watercourses, as at present, with a pond provided for attenuation only. Details of the proposed outfalls are provided in Table 5.10.11. Further details of the drainage design for each of these outfalls can be found in Technical Appendix D, Volume 2.

Table 5.10.11: Catchment Summary

Catchment	Stream	Grid Reference		Outfall Grid reference		Receiving water feature	Importance of attribute
		Eastings	Northings	Eastings	Northings		
Ty'n Hendre	1	262171	371189	262138	371229	Afon Ty'n Hendre (main river)	High
Ty'n Hendre	2	262493	371431	262473	371458	Afon Ty'n Hendre (main river)	High
Ty'n Hendre	3	262767	371621	262722	371633	Afon Ty'n Hendre (main river)	High
Un-named	4	263003	372037	263075	371969	Afon Tai'r Meibion (main river)	High
Wig	5	263439	371931	263428	371952	Afon Wig (main river)	High
Un-named	6	264005	372168	263989	372191	Un-named ordinary watercourse	High
Un-named	7	264508	372383	264494	372409	Un-named ordinary watercourse	High
Un-named	8	264963	372576	264947	372589	Un-named ordinary watercourse	High

Hydromorphology and Hydrogeomorphology

5.10.90 Currently all of the streams within the study area are culverted under the A55; therefore they have already been altered from their natural state, further extension of these culverts will be required to accommodate the extended hard surface area. The total length of the culvert extensions required is highlighted in Table 5.10.12 below. Lengthening culverts has the potential to impact upon the hydromorphology and hydrogeomorphology of the streams. Hydromorphology is a key contributor to Good Ecological Status (GES) and Good Ecological Potential (GEP) of streams following WFD guidelines. Where culvert extensions are required energy dissipation and flow reduction mitigation will be applied. Although increased culvert lengths on all the streams will permanently change the natural stream channel at these locations, further adverse effects on the hydromorphology and hydrogeomorphology of the streams is not considered likely to occur during operation.

Table 5.10.12 Total Culvert extension lengths for all of the streams

Stream	Culvert Extension North (km)	Culvert Extension South (km)	Total culvert extension length (km)	Total watercourse length (km)	% of watercourse with extended culvert
1	0.01000	No extension	0.01000	3.65	0.27
2	0.01146	No extension	0.01146	2.4	0.48
3	0.00880	No extension	0.00880	2.9	0.30
4	0.00656	0.00503	0.01157	1.3	0.89
5	0.001162	0.0053	0.00646	8.37	0.077
6	0.00723	0.0061	0.01333	2.19	0.61
7	0.01079	0.0147	0.02550	0.99	2.58
8	0.00536	0.0023	0.00766	0.95	0.806

5.10.91 Stream 8 currently has a high rate of erosion and increased discharge to the stream will increase water volumes within the channel, which could further increase erosion rates. It is therefore to be lined downstream of the A55(T) for 200m using a flexible geotextile matting; as far as the existing culvert under the farm access track. Weirs will be installed at the discharge outfall from the A55(T) to reduce the velocity of the water and further reduce erosion.

5.10.92 The proposed lining of Stream 8 has the potential to significantly alter the hydromorphology and hydrogeomorphology of the stream. However, the application of the lining will take into consideration the natural stream channel and replicate this as far as possible to ensure that the stream quality and flow regime is not adversely altered. The original materials from within the stream channel will be replaced on-top of the lining to further replicate the stream channel. The lining will also allow for natural vegetation to permeate through the material. The use of the geotextile lining will reduce erosion rates significantly and therefore improve the current circumstances.

5.10.93 The upsizing of the culverts at stream 5 and 8 will allow water to flow more easily through them with less constraint than at present. The increased culvert size will therefore reduce erosion rates as the velocity of the water within the upsized culverts will be reduced. Although surface water will be discharged from the highway directly to the streams, the use of energy dissipation measures on each of the streams (*e.g.* baffle weirs) will reduce the rate of flows downstream and hence reduce any additional erosion that could occur. The exact nature and design of the energy dissipation measures will be defined at the detailed design stage.

Flood Risk

Fluvial Flood Risk

5.10.94 Each of the eight streams currently has potential to cause flooding to the A55(T) if a blockage either on the A55(T) culverts or culverts under the Roman Road (Henffordd) was to occur. In addition, there is flood risk from streams bursting their banks.

- 5.10.95 All new or amended culverts, together with existing culverts that are to be retained, have been assessed to ensure that each would pass a 1% (1 in 100) chance flow including 30% for climate change. Checks have been made to ensure that there would be no adverse impact on flood risk to property up to a 0.1% (1 in 1000) chance event. Screens on streams 6 and 7 would be replaced with improved versions, while the new box culvert for stream 5 would require no screen.
- 5.10.96 Stream 8 will be lined using a geotextile material to significantly reduce erosion rates. Lining streams also has the potential to increase their discharge velocity rates. However, the inclusion of a weir at the outfall will reduce these increased rates. There are no properties at risk of flooding downstream of stream 8, therefore there is no increased flood risk following these works at this location. No further detailed assessment in relation to increased flood risk is required for the works proposed on Stream 8 as there is no at-risk property, people or infrastructure.
- 5.10.97 There is a requirement for the upsizing of the culvert on stream 5 (Afon Wig) and stream 8 as part of the works. The upsizing of the culverts will allow for a greater volume of water to flow through the culvert from the surrounding catchment. There are no downstream properties at risk in relation to stream 8; therefore, no further detailed assessment is required for that stream. However, the increased capacity of the culvert on stream 5 may increase flood risk downstream to Wig Crossing Cottages. Since it is essential that this upsizing does not cause any increased flood risk to these properties hydraulic flood modelling has been carried out, which confirmed that there would be isolated areas that show increase in flood risk to some properties during the 1 in 1000yr event, but a significant decrease during a 1 in 100yr+CC event; the full results can be found in the Flood Consequence Assessment (see Technical Report D, Volume 2). Mitigation of increased flood risk associated with Wig Crossing Cottages during the 1 in 1000yr event is therefore proposed as part of the scheme, with the detailed design aspects to be agreed with the property owners and NRW.

Pluvial Flood Risk

- 5.10.98 There is significant risk of pluvial flooding along the A55(T) from direct surface run off from the fields upstream of the A55(T). Runoff from these fields would be managed via a new bund and cut-off channel system and sufficient drainage to alleviate flood risk to the A55(T).

Increased Surface Runoff

- 5.10.99 Due to the increased hard standing area, there would be an increase in surface water runoff, which is therefore to be attenuated and controlled via the new drainage to levels similar to current or below.

Groundwater Flood Risk

- 5.10.100 No locations of known groundwater flooding have been identified. Based on the topography of the area, it is therefore unlikely to be a significant risk to the Scheme.

Flood Risk and Agricultural land

- 5.10.101 The potential for the improved drainage of the A55(T) to hydrologically change the fields to the north (downstream) due to a change in the drainage system has been considered. Through upsizing culverts at streams 5 and 8 there would be an increase of water that is able to reach downstream that would otherwise flood the A55(T).
- 5.10.102 Hydraulic modelling for stream 5 for a 1 in 100 year + 30% and 1 in 1000 year event indicates that the fields associated with Wig Crossing Cottages would see an increase of flood depths estimated up to 200mm during a 1 in 1000year event. However, the location of these fields is within the fluvial floodplain for the Afon Wig and therefore naturally it would be expected that such locations would experience times of increased wetness. No other fields are expected to receive an increase in flood levels as a result of the Scheme. The Flood Consequence Assessment (see Technical Appendix D, Volume 2) outlines the potential changes to flood risk for the area surrounding the Scheme in more detail.

Effects of Routine Runoff on Surface Waters

- 5.10.103 During the operational phase of the Scheme, the inclusion of 1m wide hard strips to each side of both two-lane carriageways and paving of the central reserve would result in an increased area (9,450m²) of hard surface, which represents an increase of 44.6%. The new county road/PMA/NMU route would also increase hard surface areas. An increase in the area of impermeable surfaces on a site is likely to affect the volumes of surface runoff. Surface runoff from impermeable surfaces such as roads may be contaminated by hydrocarbons, silt and other substances such as trace metals. Road-associated contaminants considered to have the greatest potential impact on receiving waters include suspended solids, Polycyclic Aromatic Hydrocarbons (PAHs), metals, pesticides, herbicides, de-icing agents and nutrients.
- 5.10.104 The incorporation of the revised drainage system for the Scheme creates very effective preferential pathways for the transport of pollutants to watercourses. Furthermore, the relatively low flow of the streams makes them more vulnerable to pollution as they have less volume to dilute harmful substances; stream 6 has a very low flow estimate of 1.7l/s; also used for Streams 7 and 8.
- 5.10.105 From the water sample results it was concluded that the concentration of hydrocarbons and zinc within the streams is currently below the toxicity threshold¹¹⁶. As the Scheme would not increase traffic capacity it is therefore expected that the level of hydrocarbons and zinc recorded in 2015 would not be increased post improvement and there would be no significant change to downstream receptors. However, a HAWRAT Method A assessment (Pollution impacts from routine runoff to surface waters), based on HD45/09, was carried out to establish whether toxicity thresholds would be exceeded.
- 5.10.106 Detailed calculations (see Table 5.10.13) have confirmed that there would be no impact of routine runoff to surface waters during the operation of the Scheme, as the change to predicted levels of dissolved copper or total zinc in the receiving watercourses is below the relevant thresholds. As a result, no additional pollution control measures are required for routine runoff. However, where possible surface water would be filtered and managed as close to source as possible to ensure that potential pollution is removed quickly and efficiently. The detention pond and filter strips would also allow pollution to be removed from surface runoff water before discharging to streams.

Table 5.10.13: Results of Method A Assessment of Effects of Routine Runoff (before mitigation)

Stream*	Catchment	Runoff Specific Thresholds (no mitigation)		EQS limit (µg/l) (no mitigation)		Suspended Solids (SS) test (Tier 1) (no mitigation)
		HAWRAT copper	HAWRAT zinc	HAWRAT copper concentration	HAWRAT zinc concentration	
4	Un-named	PASS	PASS	0.27	0.89	PASS
5	Wig	PASS	PASS	0.04	0.12	PASS
6	Un-named	PASS	PASS	0.31	1.00	PASS
7	Un-named	PASS	PASS	0.11	0.35	PASS
8	Un-named	PASS	PASS	0.17	0.56	PASS

* Streams 1, 2 and 3 have not been assessed using the Highways Agency Water Risk Assessment Tool (HAWRAT) as it is considered that the traffic volume on the new county road would be considerably lower than on the A55(T). The Q95 flows of streams 2 and 3 are not recorded by NRW; following visual inspection the stream 2 and 3 Q95 flows are considered to be similar to those of stream 1. Therefore, using the stream 1 Q95 flow of 1.6l/s for streams 2 and 3, and considering the low use of the road by traffic, it is concluded that the impact on streams 1, 2 and 3 would be negligible.

- 5.10.107 The cattle underpasses will require improved drainage systems to allow movement of livestock and agricultural machinery. The drainage will be directed away from watercourses as slurry from

¹¹⁶ Toxicity threshold guidance taken from The Private Water Supplies (Wales) Regulations 2010.

the underpasses may cause significant pollution to the streams; the slurry will build up over time as animal effluent mixes with rainwater to create a liquid mix. The drainage design for the cattle underpasses will therefore be confirmed during the detailed design stage, with agreement from NRW. The new farm accesses are considered not to affect the current effluent management requirements of the farms. The movement of livestock will not be altered significantly. Any changes at the detailed design stage will be assessed and evaluated in consultation with NRW.

5.10.108 As part of routine operational maintenance de-icing salts will be applied (as at present) and have the potential to enter the watercourses and affect the water quality. DMRB Volume 4, Section 2, Part 1 HA 103/06 recommends where the use of de-icing salt is likely to be very frequent and the dilution of runoff by receiving waters is low, flow should be diverted to infiltration facilities with groundwater protection or ponds.

5.10.109 In this case, the use of de-icing salt is not currently considered to be very frequent and is not expected to change significantly in the future. Furthermore, the proposed new drainage design would provide improved infiltration via SuDS in the form of grass filter strips and a detention pond before surface runoff enters downstream watercourses. In consideration of this, the current impact is assessed as being minor adverse and temporary, but likely to reduce to negligible adverse during the operational phase of the Scheme.

Pollution Impacts from Accidental Spillages

5.10.110 Pollution from accidental spillages during the operation of the Scheme is potentially the most damaging form of pollution to both surface and groundwater. The significance of the impact on water quality would depend on the nature of the spill, the concentration of contaminants released into the water and the speed at which the spillage enters the watercourse. A combination of dilution, dispersion, settlement and attenuation of contaminants determines the area affected by either routine discharge or accidental spillage.

5.10.111 The HAWRAT Method D assessment of pollution impacts from spillages on the A55(T) (*i.e.* the streams along the section subject to the highway improvement) confirms that the risk of a pollution incident from accidental spillages is <0.5% and is therefore below the acceptable risk threshold recommended by HD 45/09 for sensitive waters (100 years). As a result, there is no requirement for pollution mitigation measures to be incorporated into the Scheme design (although, as requested by NRW, these would be provided as an enhancement measure, particularly considering the sensitivity of the downstream protected sites).

5.10.112 Table 5.10.14 summarises the results of the Method D assessment of pollution impacts from spillages on the A55(T). See Technical Appendix D, Volume 2 for the full calculation results of potential pollution impacts from accidental spillages.

Table 5.10.14: Results of Method D Assessment of Pollution Impacts from Spillages (before mitigation)

Stream	Probability of a spillage	Predicted annual probability of a serious pollution incident	Spillage Prevention Required? (none required if probability is <1%)
4	0.00018	0.000081	No
5	0.00016	0.000072	No
6	0.00044	0.000198	No
7	0.00018	0.000081	No
8	0.00020	0.000090	No

5.10.113 Tables 5.10.15 and 5.10.16 summarise the potential construction and operational impacts of the Scheme on water features prior to mitigation.

Table 5.10.15: Summary of Potential Impacts on water features during Construction (before mitigation)

Potential Impacts	Feature	Attribute	Quality (WFD)	Importance	Magnitude	Significance
In-stream works leading to habitat loss/destruction/water pollution. Storage of materials on site and accidental spillages leading to water pollution.	Stream 1	Water Quality	Moderate	High	Minor Adverse	Moderate
	Stream 2	Water Quality	Moderate	High	Minor Adverse	Moderate
	Stream 3	Water Quality	Moderate	High	Minor Adverse	Moderate
	Stream 4	Water Quality	Moderate	High	Minor Adverse	Moderate
	Stream 5	Water Quality	Moderate	High	Minor Adverse	Moderate
	Stream 6	Water Quality	Good	High	Minor Adverse	Moderate
	Stream 7	Water Quality	Good	High	Minor Adverse	Moderate
	Stream 8	Water Quality	Good	High	Minor Adverse	Moderate
	Groundwater	Vulnerability	Sections of the Scheme and the agricultural access track are underlain by a minor aquifer.	Low	Negligible	Neutral
Hydromorphology and hydrogeomorphology	Vulnerability	Stream quality ranges from Moderate to Good. Changes to hydromorphology/hydrogeomorphology have the potential to reduce WFD quality status.	High	Minor Adverse	Moderate	

Table 5.10.16: Summary of Potential Impacts on water features during Operation (before mitigation)

Potential Impacts	Feature	Attribute	Quality (WFD) (where applicable)	Importance	Magnitude	Significance
Risk of accidental spillages leading to water pollution.	Stream 1	Water Quality	Moderate	High	Negligible	Neutral
	Stream 2	Water Quality	Moderate	High	Negligible	Neutral
	Stream 3	Water Quality	Moderate	High	Negligible	Neutral
	Stream 4	Water Quality	Moderate	High	Negligible	Neutral
Increase in area of impermeable surfaces, increased erosion rates and increased sediment	Stream 5	Water Quality	Moderate	High	Negligible	Neutral
	Stream 6	Water Quality	Good	High	Negligible	Neutral
	Stream 7	Water Quality	Good	High	Negligible	Neutral
	Stream 8	Water Quality	Good	High	Negligible	Neutral

Potential Impacts	Feature	Attribute	Quality (WFD) (where applicable)	Importance	Magnitude	Significance
transportation with potential to alter hydromorphology/ hydrogeomorphology. Revised drainage system creating preferential pathways for the transport of pollutants.	Groundwater	Vulnerability	Sections of the Scheme and the agricultural access track are underlain by a minor aquifer.	Low	Negligible	Neutral
	Hydromorphology and hydrogeomorphology	Vulnerability	Stream quality ranges from Moderate to Good. Changes to hydromorphology/ hydrogeomorphology have the potential to reduce WFD quality status.	High	Negligible	Neutral

Mitigation and Design Measures

Construction Phase

Generic mitigation measures

- 5.10.113 Prior to construction a Construction Environmental Management Plan (CEMP) would be compiled to provide targeted guidance throughout the construction period (see Chapter 7). This would detail both generic and specific instructions to enable construction to be undertaken with minimal impact on the water environment and ensure appropriate consents are obtained prior to works commencing.
- 5.10.114 Consultation with NRW and Gwynedd Council as LLFA would also occur prior to undertaking any works with the potential to adversely affect water attributes.
- 5.10.115 The risk of pollution during construction would be reduced by the adoption of good working practices and strict adherence to the Environment Agency PPGs (2011 – 2016), Guidance for Pollution Prevention 5¹¹⁷ and CIRIA guidance.
- 5.10.116 The key guidelines with regard to the construction of the Scheme and water features are:
- PPG 1: Understanding your environmental responsibilities - good environmental practice
 - PPG 2: Above ground oil storage tanks
 - PPG 3: Use and design of oil separators in surface water drainage systems
 - PPG4: Treatment and disposal of sewage where no foul sewer is available
 - GPP 5: Works and maintenance in or near water
 - PPG 6: Working at Demolition and Construction Sites
 - PPG 22: Dealing with spills
 - Control of pollution from highway drainage discharges (CIRIA report 142)
 - Control of water pollution from construction sites (CIRIA C532)
 - Containment systems for the prevention of pollution (CIRIA C736)
 - The SuDS Manual (CIRIA C753)
- 5.10.117 Additional good working practice has been collated from HD 45/09 CIRIA. Generic prevention and mitigation measures that would be applied prior to and during construction, as part of the CEMP, include:
- Provision of adequate temporary storage to contain surface runoff during the construction period, particularly when there are large areas of exposed earthworks as these lead to substantial increases in surface flows during intense rainstorms and can carry silt to receiving watercourses.
 - On-site availability of oil spill clean-up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak.
 - Use of drip trays under mobile plant.
 - Sediment-trapping matting installed downstream of any construction activities adjacent to or over watercourses.
 - Preparation of incident response plans, prior to construction, and present on site throughout construction to inform sub-contractors of required actions in the event of a pollution incident.
 - Timing of works close to watercourses so that they do not interfere with spawning fish.
 - The use of construction materials on site free from contaminated material to avoid any potential contamination of the watercourse.
 - Ensuring that wet concrete does not come into contact with river or groundwater.

¹¹⁷ Guidance for Pollution Prevention, Works and maintenance in or near water: GPP 5, NIEA/SEPA/NRW, January 2017.

- Testing of made soils and soils that would be reworked to identify any soil contamination.

5.10.118 Sediment and erosion control and monitoring measures would be implemented, following consultation with NRW, to ensure that increased siltation and erosion does not occur during construction (see also Chapter 5.4: Nature Conservation).

5.10.119 During construction an incident response plan would be in place to deal with any issues as soon as they occur and to ensure that works are undertaken with the utmost care where they have potential to lead to contamination of any watercourse. Emergency action planning would include measures to be taken to prevent pollution caused by severe weather.

5.10.120 Wherever practicable, grey water systems would be used at site compounds to reduce runoff from site, improve water efficiency and lessen the potential for polluting discharges to surface watercourses.

Surface Water

5.10.121 Good working practices would include, insofar as is practicable, the implementation of the PPGs and the CIRIA Pollution Prevention guidelines¹¹⁸. Measures to avoid the contamination of surface waters during construction would be incorporated into the construction programme and method statements, and would be agreed with NRW prior to the commencement of works (see also Chapter 5.4: Nature Conservation). The need to prepare and enforce appropriate working practices during construction would be included in the CEMP. This would include the requirement for appropriate training of site staff on water environment issues. An agreed contingency plan to deal with emergencies would also be established.

5.10.122 By employing the best practice techniques listed below, the risks of pollutants reaching surface water features would be minimised to a level where any events that did occur would be contained and limited in scale:

- The use of concrete would be monitored carefully to ensure no accidental discharge into any watercourse;
- Mixer washings and excess concrete would not be discharged to water;
- All fuel, oils or chemicals stored on site would be located as far as is reasonably possible, and in no case less than 10m from any water body;
- Stores would be surrounded by an effective and impervious bund capable of holding the full contents of the store plus 10%. Protocol for the storage of fuel, equipment and construction materials, so as to minimise the risk of water pollution, is provided within PPG2;
- Dust suppression measures would be required in order to prevent entry of suspended solids into nearby water bodies, particularly in dry weather conditions (see Chapter 5.1: Air Quality);
- No plant would be used in-stream without prior consent from NRW. Plant operators and contractors would check vehicles and mobile plant on a daily basis for fuel and oil leaks and suitable maintenance would be promptly carried out, and;
- Plant and wheel washing facilities would be sited appropriately. To prevent indiscriminate washing out of the mobile plant, designated wash-out bays would be employed on site. This would avoid cementitious materials from being washed out directly onto the ground. Once full, the wash out sumps would be pumped into a tanker for disposal off-site at a licensed disposal point. No wash waters would be discharged to surface waters. Refuelling of construction equipment would only occur at locations remote from surface water features.

¹¹⁸ Control of pollution from highway drainage discharges (CIRIA report 142), Control of water pollution from construction sites (CIRIA C532), Containment systems for the prevention of pollution (CIRIA C736)

5.10.123 Regular monitoring of the surface water quality will also be carried out throughout the construction period to check for any changes to the water quality. The Erosion Prevention and Sediment Control Plan (see Technical Appendix D, Volume 2) also outlines the mitigation and prevention measures that will be implemented to ensure that there is no adverse impact to surface water quality.

Groundwater

5.10.124 Although there would be no direct discharges of surface water runoff to ground, precautionary measures would be taken during construction to minimise the potential for contaminants to reach any perched groundwater that may be present in both the minor aquifer and non-aquifer.

5.10.125 Best practice techniques, as outlined in the PPGs, would be employed throughout the construction process to minimise the risk of spillages. Appropriate phasing and scheduling of construction activities would play a key role in mitigating potential impacts. With best practice techniques employed, the potential for contamination of any underlying groundwater would be minimised. Measures to avoid the contamination of groundwater during both construction and operation would be agreed with NRW prior to the commencement of works.

Hydromorphology and Hydrogeomorphology

5.10.126 During the construction period there is potential for changes to occur to the flow rates and capacity of the streams, which could have an adverse impact upon their natural hydromorphology and hydrogeomorphology. Any in-river works have the potential to change the hydromorphology of the streams and subsequently increase erosion. This risk will be reduced using best working practices and reducing in-stream works. In-stream works will also not be permitted under high flow conditions.

Flood Risk

5.10.127 To ensure that flood risk is not increased during construction suitable mitigation measures will be adopted. There will be no storage of materials and vehicles within the floodplain or within areas known to have flooded in the past unless agreed with the overseeing organisation. In-stream works will not occur during times of increased rainfall and high flows. Increased runoff caused by compound or site areas will be restricted and attenuated to reduce increased runoff from increased impermeable surfaces into the watercourses.

5.10.128 The significance of effect of construction on surface water quality with specific mitigation is presented in Table 5.10.17. The potential effects of construction on groundwater quality with mitigation are presented in Table 5.10.18 and the potential effects of construction on flood risk with mitigation are presented in Table 5.10.19.

Table 5.10.17: Potential effects of construction on surface water features (with mitigation)

Stream	Grid Reference	Importance	Potential effects	Magnitude of impact before mitigation	Significance before mitigation	Example of proposed mitigation	Magnitude of impact after mitigation	Significance after mitigation
Construction of upsized culverts								
Streams 5 and 8	Various	High	<ul style="list-style-type: none"> Increased suspended sediment affecting surface waterbodies Change to hydromorphology/hydrogeomorphology of the streams due to instream works 	Minor adverse	Moderate	<ul style="list-style-type: none"> Sediment Erosion Management Plan controls Use precast units where practicable, to minimise the use of wet concrete Application of PPG 	Negligible	Neutral
Lining of stream channel								
Stream 8	264976, 372569	High	<ul style="list-style-type: none"> Changes to hydromorphological and hydrogeomorphological properties of the stream. Loss of construction materials into stream 	Minor adverse	Moderate	<ul style="list-style-type: none"> Use of pre-made material that does not require the use of liquid materials within the stream Temporary diversion of stream to allow for dry conditions to lay the lining material. No in-stream works during periods of heavy rainfall. 	Negligible	Neutral
Culvert extensions and / or replacements								
All eight streams (1-8)	Various	High	<ul style="list-style-type: none"> Increased suspended sediment affecting surface water bodies Change to hydromorphology/hydrogeomorphology of streams Release of hydrocarbons 	Minor adverse	Moderate	<ul style="list-style-type: none"> Sediment Erosion Management Plan controls Use precast units where practicable, to minimise the use of wet concrete Application of PPG 	Negligible	Neutral

			to surface water					
			<ul style="list-style-type: none"> • Damage to bed and banks of water course 					
Disposal of surface water runoff from compounds								
All streams	Various	High	<ul style="list-style-type: none"> • Changes in chemical balance of water quality 	Minor adverse	Medium	<ul style="list-style-type: none"> • The principle contractor would provide a method statement of control of contamination and pollutants 	Negligible	Neutral
Dust caused by construction works								
All streams	Various	High	<ul style="list-style-type: none"> • Changes in chemical balance of water quality 	Minor adverse	Medium	<ul style="list-style-type: none"> • Sediment Erosion Management Plan controls • Suppression of dust using water sprinklers, from waters gained from abstraction and bowsers • Use of permanent storage area for water storage where required (detention pond at site of Wig Bach - Grid Ref: 263975, 372173) 	Negligible	Neutral

Table 5.10.18: Potential effects of construction on groundwater quality (with mitigation)

Water feature	Importance	Magnitude of impact before mitigation	Significance before mitigation	Mitigation	Magnitude of impact after mitigation	Significance after mitigation
Temporary storage of construction material						
Groundwater	Low	Negligible	Neutral	Areas which may generate contaminated water would be banded and have water discharged to self-contained units with	Negligible	Neutral

				treatment facilities. There would be no discharge to groundwater		
Groundwater abstraction						
Groundwater	Low	Negligible	Neutral	If insufficient water is available to supply requirements at site compounds any abstraction from groundwater would first require licence from NRW	Negligible	Neutral
Storage of material from excavations						
Groundwater	Low	Negligible	Neutral	Tests would be undertaken to ensure contaminated material is identified, isolated and reworked or removed to special landfill to avoid any leachate problems	Negligible	Neutral
Cutting below groundwater table						
Groundwater	Low	Negligible	Neutral	Consultation with NRW would determine if an abstraction licence is required for dewatering	Negligible	Neutral

Table 5.10.19: Potential effects of construction on flood risk (with mitigation)

Stream	Grid Reference	Importance	Potential effects	Magnitude of impact	Significance before mitigation	Example of proposed mitigation	Magnitude of impact after mitigation	Significance
Increased compound runoff to surface water								
Downstream of all watercourses	Various	High	<ul style="list-style-type: none"> Increased runoff downstream of new impermeable area would result in 	Minor adverse	Moderate	<ul style="list-style-type: none"> Wherever possible use the proposed operational mitigation to provide attenuation 	Negligible	Neutral

			increased volumes of water within the stream(s).			<ul style="list-style-type: none"> Capture and restrict additional runoff to greenfield runoff rates 		
Storage of materials in floodplain								
Fluvial flood plain (Afon Wig)	263434, 371988	High	<ul style="list-style-type: none"> Reduction in floodplain storage increases flood risk 	Minor adverse	Moderate	<ul style="list-style-type: none"> Avoid locations of storage in floodplains 	Negligible	Neutral
Work in watercourses								
All watercourses where construction work is to be undertaken	Various	High	<ul style="list-style-type: none"> Flood risk 	Minor adverse	Moderate	<ul style="list-style-type: none"> Ensure daily weather alerts obtained and retain open liaison with NRW for flood alerts Design any temporary works to avoid increasing flood risk Obtain temporary Land Drainage Consents for all works in and within 7m of any watercourses and on floodplains Consult with Lead Local Flood Authority (Gwynedd Council) 	Negligible	Neutral

Operational Mitigation

Surface Water

- 5.10.129 Surface water runoff from the highway would be managed by the improved drainage network. The use of SuDS in the form of filter drains, filter strips, over the edge drainage and a detention pond would be combined with over-sized pipes to allow efficient removal of excess water from the carriageway.
- 5.10.130 In terms of spillage risk, Method D tests undertaken show that all proposed discharges have a lower serious spillage risk than the threshold of 1 in 200 years. Separate oil interceptors are therefore not proposed. However, although the pollution risk is below the applicable threshold for requiring pollution control measures to be provided, pollution control points would still be preferred by NRW and would therefore be installed at the outfalls of each watercourse, providing an opportunity for an enhancement measure as part of the scheme.
- 5.10.131 Subject to agreement with NRW at the detailed design stage, such pollution control measures would typically include a chamber and isolation valve that would cut off flows from the highway, and can be remotely triggered to close in a few seconds. It is expected that the unit would be stand-alone, with solar and battery power operation so that it would not be vulnerable to power outages. The device would effectively protect downstream areas from fuel chemicals or milk spillages. Access to these locations is expected to be available via the NMU route and the new county road and would be clearly sign-posted. Specific access locations would be identified during the detailed design stage.
- 5.10.132 There would be a detention pond constructed at the site of Wig Bach (Grid Reference: 263972 372181) near to stream 6 as part of the scheme design (see Figure 2.5, Volume 1a). Ponds provide surface attenuation of storm water runoff to aid in the control of surface water discharge. Ponds also allow for some water quality treatment, primarily settlement of solids and uptake of heavy metals through plants.
- 5.10.133 The proposed detention pond would be equipped with skim plates and flow controls which would operate on the same principles as oil separators (subject to agreement with NRW). Emergency shut-off valves and bypasses would be provided upstream of critical discharge locations to enable the pond to be isolated from receiving watercourses in the event of an accidental spillage.

Hydromorphology and Hydrogeomorphology

- 5.10.134 The increase in drainage discharge to streams will increase flow volumes and increased culvert size and length will increase flow rates; therefore energy dissipation measures will be incorporated to mitigate these changes at each stream, such as baffle weirs to dissipate energy, river training walls to ensure the river geometry is retained and weirs. The inclusion of the detention pond, filter strips and the flood bund will help to reduce discharge rates to ensure that flow rates are not increased from current flow rates. Refer to the Erosion Prevention and Sediment Control Plan, Technical Appendix D, Volume 2 for further details.
- 5.10.135 The hydromorphology and hydrogeomorphology will be altered within Stream 8 as there will be a 200m stretch of the stream lined using a geotextile material as an erosion reduction and prevention measure. The lining material will be a flexible geotextile that will replicate the natural stream bed. To mitigate against significantly altering the characteristics of the stream, the river bed will be replicated to ensure that the WFD classification of the stream is not negatively altered through significant changes to the hydromorphology and hydrogeomorphology. The use of the natural stream bed material on top of the lining will further ensure the stream hydromorphology and hydrogeomorphology is not adversely altered, ensuring that channel roughness is replicated. Refer to the Erosion Prevention and Sediment Control Plan, Technical Appendix D, Volume 2 for further details.

Winter maintenance

- 5.10.136 During the operation of the Scheme it would be ensured that the maintenance contractors comply with current Environment Agency guidance and specifications as detailed in PPG10: Guidelines for storage of salt. It would be ensured that the use of de-icing salts would follow accepted practice and methodologies.

Flood Risk

Fluvial Flood Risk

- 5.10.137 The increased capacity of the culvert on stream 5 may increase flood risk downstream to Wig Crossing Cottages. Since it is essential that this upsizing does not cause any increased flood risk to these properties a full hydraulic assessment was carried out using flood modelling software. The modelling confirmed that there would be an increase in flood risk to the Wig Crossing Cottages during the 1 in 1000yr event (due to increased flow being conveyed to the downstream railway culvert), but a significant decrease during a 1 in 100yr+CC event; the full results can be found in the Flood Consequence Assessment (see Technical Report D, Volume 2).
- 5.10.138 Mitigation of increased flood risk associated with Wig Crossing Cottages during the 1 in 1000yr event is therefore proposed. Such mitigation would include a wall/bund (up to 1m high) along the Wig Crossing Cottages' eastern and southern boundaries and increased outfall points surrounding the properties; with the detailed design aspects to be agreed with the property owners and NRW. The model outputs illustrate that the upsizing of the culvert combined with these mitigation measures and the bund/channel along the southern side of the A55(T) carriageway upstream, significantly reduces the overall flood risk to Wig Crossing Cottages. The final location and height of the wall will be determined at the detailed design stage and with agreement from NRW. The levels of the wall are outlined in Appendix Z of the Flood Consequence Assessment (see Technical Appendix D, Volume 2).
- 5.10.139 However, following concerns raised by NRW and the residents of Wig Crossing Cottages in relation to the potential for surface water to pool behind the proposed wall, further drainage has been incorporated into the Scheme at this location to ensure that Wig Crossing Cottages are not at increased risk of surface water flooding.
- 5.10.140 Using the methodology and guidance outlined in The SuDS Manual (CIRIA C753) an assessment of the greenfield runoff from the surface water run off catchment area to the west of Wig Crossing Cottages has been carried out. The Revitalised Flood Hydrograph Model (ReFH2) methodology along with the use of the Plot Scale enabled efficient adjustment of the catchment area and the relevant catchment descriptors to allow a realistic estimate of the greenfield runoff to be calculated.
- 5.10.141 The initial catchment area was derived using LiDAR data provided by Welsh Government and the use of watershed analysis within GIS software to derive the specific catchment areas using specific outfall locations. Following both the ReFH2 plot scale assessment and the watershed analysis assessment, using the tables produced by HR Wallingford for the size of culverts in relation to runoff rates, the size of the culverts was calculated. Therefore an additional outfall from the railway embankment of a minimum 300mm diameter to remove surface water is proposed, along with a minimum 300mm diameter pipe incorporated within the surface water drainage to the south of Wig Crossing Cottages draining into the Afon Wig (Stream 5) from the Wig Crossing Cottages access track. The increased outfalls and drainage of surface water will ensure that Wig Crossing Cottages will not be at increased risk of surface water pooling behind the proposed mitigation wall.
- 5.10.142 No mitigation measures are proposed in regard to the predicted increased flood depths (up to 200mm) of the fields adjacent to Wig Crossing Cottages during a 1 in 1000year event as the acquisition of land in order to provide attenuation measures for such infrequent events would

have greater disadvantage in terms of sterilising agricultural land, than it would benefit in terms of reduced depth of flooding in a relatively small area of land.

5.10.143 Measures to manage the risk of blockage of culverts have been incorporated into the Scheme. These include improved trash screen arrangements incorporating safe access to facilitate regular maintenance and clearing.

Pluvial Flood Risk

5.10.144 To reduce pluvial flood risk a new bund would be constructed along the westbound carriageway from Tai'r Meibion (NGR: 263051, 371736) to east of stream 8 (NGR: 265087, 372605) combined with a channel to drain any excess water.

Increased Surface Water Runoff

5.10.145 Attenuation facilities would be provided to ensure that surface water runoff from the highway is restricted to existing or below existing runoff. Storage would be provided to contain the volume of a 1% (1 in 100) flood event, plus an allowance of 30% for climate change.

5.10.146 Runoff from the highway would be restricted using controls such as orifice plates or hydro brakes and attenuation would be provided by a pond. Suitable access provision would be provided to all attenuation facilities to allow for future maintenance. Further details can be found in the Flood Consequence Assessment in Technical Appendix D, Volume 2.

Proposed Water Framework Directive (WFD) compliance mitigation and enhancement measures

5.10.147 Compliance with the WFD has been considered within this assessment (see Technical Appendix D, Volume 2 for further details). A number of mitigation measures have been considered for each element of the Scheme and are summarised below:

- To lessen the impact to the hydromorphology/ hydrogeomorphology and aquatic ecology, a box culvert instead of a pipe culvert would be used to upsize Stream 5. The structure would also include a weir at the upstream cascades, with potential benefit for fish, while a baffle weir will be included downstream to reduce the velocity of the flow, allowing the passage of animals and to aid the natural build-up of sediments.
- The new culvert for the Afon Wig (stream 5) would incorporate a raised mammal ledge/shelf on each side (see Chapter 5.4: Nature Conservation).
- All culverts would have erosion control measures downstream of them. The exact designs at the transition points between the natural and artificial channels would be managed with respect to the WFD throughout the detailed design process of the Scheme.

5.10.148 Enhancement within WFD compliance assessments can be used as a form of mitigation to offset adverse impacts. Liaison with NRW has been undertaken as part of the Scheme design process, and agreement with NRW is required at the detailed design stage on which measures are essential to include within the Scheme to ensure compliance with the WFD.

5.10.149 The installation of in-river structures such as road culverts can pose limitations upon the ability of migratory fish (and mammals) to move freely towards upstream reaches of a watercourse under particular flow conditions, this will have a consequential impact upon the status of fish species within a watercourse (and movement of mammals). Measures to help avoid such problems would be considered during detailed culvert design and agreed with NRW, and informed by technical design guidance published by the Environment Agency (EA) and the Scottish Environmental Protection Agency (SEPA). Such design measures are discussed in Chapter 5.4: Ecology and Nature Conservation.

Residual Environmental Effects (following mitigation)

Construction Period

- 5.10.150 Providing adherence to best practice guidance and the adoption of good working practices and strict adherence to the PPGs and NRW/Gwynedd Council permitting conditions, the magnitude of impact during construction would be negligible with neutral significance.

Operational Phase

- 5.10.151 Water quality tests have been undertaken for four catchments consisting of eight streams. The tests show that all discharges would comply with the EQS for both copper and zinc and would meet and pass the Runoff Specific Thresholds for both copper and zinc. Discharge from all catchments would pass the Tier 1 test from Method A - Assessment of Pollution Impacts from Routine Runoff to Surface Waters. However, pollution control measures would be provided at downstream outfalls to protect downstream areas in the event of an accidental spillage on the highway.
- 5.10.152 De-icing salt has a low environmental impact when used responsibly and sodium chloride is not classified as dangerous to the environment. The potential operational impact of salt on water quality (as at present) would be temporary, minor adverse and of moderate significance.
- 5.10.153 The FCA identified some areas of existing fluvial and pluvial flood risk, including Wig crossing Cottages. Mitigation measures are proposed to protect Wig Crossing Cottages from an increase in flood levels associated with a 1 in 1000 year event. Design measures would ensure that the Scheme would remain flood-free for a 1% + climate change (1 in 100 + climate change) annual chance event including an allowance for climate change from fluvial flood risk. Pluvial flood risk from nearby catchments is mitigated using a cut-off system designed to a 1% + CC (1 in 100 + CC) annual chance event. With mitigation, the Scheme is considered to have no significant impacts elsewhere in extreme events up to a 0.1% (1 in 1000) annual chance event. Updated modelling and assessment presented in the FCA concludes that there would be no significant risk of flooding from the Scheme incorporating mitigation.
- 5.10.154 The lining of stream 8 will have a minor impact on the hydromorphology and hydrogeomorphology of the stream. However, the lining will reduce erosion rates and will replicate the current river bed and is therefore predicted to improve the current situation of the stream.
- 5.10.155 The WFD compliance assessment concludes at a waterbody scale that the impacts are considered unlikely to be significant.
- 5.10.156 Table 5.10.20 summarises the impacts of the Scheme on all watercourses within the study area during construction and operation. The overall significance of the impact on the water environment is considered to be **neutral**.

Table 5.10.20: Summary of residual effects to watercourses during construction and operation of the Scheme

Receptor(s)	Description of effect	Magnitude of impact prior to mitigation	Magnitude of impact following mitigation	Significance of impact following mitigation	Notes/comments
Construction Impacts					
All streams	Culvert extensions -increase in silt -spillage to watercourse -reduction in biodiversity -erosion of river bed -change to hydromorphology/ hydrogeomorphology	Minor	Negligible	Neutral	Providing adherence to best practice guidance and the adoption of good working practices and strict adherence to the PPGs/CIRIA Pollution Prevention guidance, the magnitude of impact during construction would be negligible with neutral significance
Stream 5 and 8	New culvert/ upsizing -increase in silt -spillage to watercourse -reduction in biodiversity- change to hydromorphology/ hydrogeomorphology	Minor	Negligible	Neutral	
Surface water or groundwater	Compound construction -increased flood risk -spillages	Minor/ Negligible	Negligible	Neutral	
Groundwater	Cuttings into ground -discharge of polluted groundwater to surface water -loss of perched water table -loss of local abstraction	Negligible	Negligible	Neutral	
Operational Impacts					
All Streams	Increased culvert length - increased water velocity - loss of natural stream bed - change to hydromorphology/ hydrogeomorphology	Negligible	Negligible	Neutral	Design measures (<i>i.e.</i> energy dissipation) to prevent flooding downstream of the A55(T) would reduce the risk of flooding to properties downstream of culverts as flow rates will be reduced. The energy dissipation measures will also reduce erosion rates.
Streams 5 and 8	Increased culvert capacity -increased water volumes within the stream -change to hydromorphology/	Negligible	Negligible	Neutral	Design measures (<i>i.e.</i> energy dissipation and localised bank raising) to ensure that properties are protected against flooding from

	<p>hydrogeomorphology</p> <ul style="list-style-type: none"> -erosion to river bed (positive effect to stream 8 through partial lining to reduce current erosion rates) -increased flood risk to Wig Crossing Cottages during a 1 in 1000 year event. 				the increased culvert capacity.
Surface water	Improved drainage from carriageway (positive)	Negligible	Negligible	Neutral	<p>Improved drainage would ensure that surface water is removed from the carriageway more efficiently than at present.</p> <p>Design measures in the form of oversized pipes, increased culvert length and increased culvert size at some locations. Attenuation within the pond would reduce flood and pollution risk.</p>

Summary

- 5.10.149 Using the DMRB guidance, the assessment has followed the steps required to ensure that all possible incidences and parameters are assessed for risk to the water environment. The assessment techniques follow the associated effects of discharges to waterbodies from the development or improvement of trunk roads and motorways, and can be applied wherever surface water or groundwater resources are affected by road runoff.
- 5.10.150 The current ecological and chemical status of the streams has been established and is estimated to remain the same during and post works. The assessment of the water environment within the study area has ensured that all factors of pollution sources have been taken into consideration and suitable mitigation measures recommended.
- 5.10.151 The assessment findings illustrate that:
- Accidental spillages during construction and operation have been assessed and the probability of such accidents polluting the streams is low.
 - Increased pollution to all streams and waterbodies within the Scheme would not occur, with the use of pollution prevention controls during the construction period.
 - WFD status would not be degraded throughout construction of the Scheme or during its operation.
 - Increased flood risk to property within the Scheme area would not occur due to mitigation and improved drainage.
 - Discharge of surface water to streams would be reduced to pre-scheme flow velocities using flow control devices and attenuation in the form of a pond.
- 5.10.152 The Scheme is estimated to have no significant effect on the water environment within the study area, following the application of mitigation measures during the construction phase. Mitigation measures and best practice guidance have been proposed for works in those areas that are seen to be of higher risk or more sensitive. Suitable mitigation is outlined to reduce the potential for pollution to reach the watercourses.
- 5.10.153 Following detailed assessment, during operation it has been concluded that the residual impacts of the scheme are negligible and the proposed design measures provide sufficient protection to the environment and assets within the study area of the Scheme. Continued monitoring and maintenance of the pollution control points, the cut-off channel, highway drainage and inspection of the detention pond will ensure that risks of pollution during operation remain limited.
- 5.10.154 Increased flood risk to property following upsizing of culverts has been fully assessed and mitigation measures proposed to ensure that risk to people and property is not increased post works.
- 5.10.155 Considering the above, it is considered that there are no operational cumulative effects within the study area in regards to flood risk and pollution. Potential construction phase-related cumulative effects have been identified and reported in Chapter 6. The Scheme is not expected to conflict with the objectives, policies and plans relating to road drainage and the water environment identified in the Regulatory/Policy Framework section of this chapter and would contribute to achieving Wales Transport Strategy Outcome 13 by improving resilience to flood risk along this section of highway.

Chapter 6.0: Assessment of Cumulative Effects

Introduction

- 6.1 This chapter summarises the assessment of cumulative effects associated with the Scheme. Cumulative impacts result from multiple actions on receptors and resources and over time and are generally additive or interactive (synergistic) in nature. Cumulative impacts can also be considered as impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project¹¹⁹.
- 6.2 There can be a considerable level of uncertainty associated with the prediction of cumulative effects and professional judgment is required when considering the influence of other projects on particular receptors and the associated likelihood of significant cumulative effects occurring. However, the method explained in the following section has been adopted in order to reduce such uncertainty and provide objectivity and clarity to the assessment of the potential significant cumulative effects associated with the Scheme.

Method

- 6.3 Cumulative effects have been considered using the guidance provided in the DMRB, Volume 11, Section 2, Part 5, HA205/08 and Part 6, HD48/08. In accordance with this guidance cumulative effects upon single resources/receptors as a result of the Scheme and multiple effects from other projects in the vicinity have been considered.
- 6.4 In terms of which types of project should be assessed, the HA205/08 guidance refers to the term 'reasonably foreseeable', and interprets this to include other projects that are 'committed'. These should include (but not necessarily be limited to):
- Trunk road and motorway projects which have been confirmed (*i.e.* gone through the statutory processes).
 - Development projects with valid planning permissions as granted by the Local Planning Authority, and for which formal EIA is a requirement or for which non-statutory environmental impact assessment has been undertaken.
- 6.5 The HA205/08 guidance recognises that there are principally two types of cumulative impact to consider in environmental impact assessment. These are:
- 1) Incremental impacts from a single project (*i.e.* the combined action of a number of environmental topic-specific impacts upon a single receptor/resource), and;
 - 2) Multiple impacts from different projects (in combination with the project being assessed).
- These have therefore been considered within this assessment.
- 6.6 The study area for the cumulative effects assessment varies depending on each environmental topic. Incremental impacts are those occurring within the zone of influence of the Scheme. Multiple impacts from other projects relate to the Scheme and other projects within north-west Wales considered to have potential to generate significant cumulative environmental impacts, particularly any developments located along the A55(T) corridor from Chester to Holyhead; and on any major routes located west of the Scheme which could generate increased construction traffic along this section of the A55(T).
- 6.7 The HA205/08 guidance explains that other projects to be considered in the assessment of cumulative effects should be determined in consultation with the Local Planning Authority and

¹¹⁹ Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interaction, European Commission, May 1999.

other statutory bodies and confirmed with the Overseeing Organisation on a project-by-project basis.

6.8 The following organisations were consulted with regard to their knowledge of potential projects/schemes that are either committed or likely to be developed in the future and could generate cumulative impacts in combination with the Scheme:

- North Wales local authorities through which the A55(T) passes (*i.e.* Conwy, Denbighshire, Flintshire, Gwynedd and Isle of Anglesey),
- Natural Resources Wales (NRW),
- North and Mid Wales Trunk Road Agent (NMWTRA), and;
- Snowdonia National Park Authority (SNPA).

6.9 Responses were received from Conwy County Borough Council, Gwynedd Council and NMWTRA and were used to inform this assessment. The main points raised were:

- NMWTRA identified that close liaison and co-ordination would be required regarding their delivery of routine maintenance projects during the construction phase of the Scheme.
- NMWTRA also identified the following major projects that could affect the programming/delivery of the Scheme:
 - A55 Junctions 15 and 16 Improvements;
 - Improvements to the A55 crossing of the Menai Strait;
 - A487 Caernarfon and Bontnewydd bypass;
 - A55 J11 Llandygai to J1 Holyhead – possible major maintenance, and;
 - Nuclear power station at Wylfa, Anglesey.

6.10 In accordance with HA205/08 the following factors have been considered in determining the significance of cumulative effects:

- Which receptors/resources are affected?
- How will the activity or activities affect the condition of the receptor/resource?
- What are the probabilities of such effects occurring?
- What ability does the receptor/resource have to absorb further effects before change becomes irreversible?

6.11 The magnitude of cumulative impacts is based on their corresponding magnitude in the relevant topic assessment chapters, before mitigation is considered. For cumulative effects between two projects the worst-case magnitude has been applied. The significance of cumulative effects, following mitigation, has been determined using the guidance provided in Table 6.1 (taken from Table 2.6: HA205/08) and professional judgement.

Table 6.1: Assigning significance of cumulative effects

Significance	Criteria
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issues.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of

	the resource to absorb such change.
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Cumulative (incremental) impacts from a single project

- 6.12 Incremental cumulative impacts associated with the Scheme have been assessed in consideration of the guidance provided in HA205/08 and are presented in Table 6.2 (based on Table 3.2: HD48/08). This approach enables the quantification of various environmental impacts upon a single receptor. Most of the incremental cumulative effects would occur during the construction period.
- 6.13 Up to moderate adverse cumulative effects could affect human receptors within the scheme corridor as a result of temporary impacts related to the generation of dust, noise, vibration and views during the construction phase. Moderate adverse residual cumulative effects could also affect all travellers within the scheme corridor while temporary traffic management is in place. The permanent loss of agricultural land and soils (including 2.8ha of Sub-grade 3a land) would also result in a residual moderate adverse cumulative effect.
- 6.14 A minor adverse residual cumulative effect could affect No's 1 and 2 Bryn Meddyg during the operational phase as a result of the increased carriageway level opposite the properties leading to slight adverse impacts on views and a marginal increase in noise and airborne vibration levels.
- 6.15 Minor adverse residual cumulative effects could occur to natural connectivity features and the Roman Road hedgerow during the construction phase and following site clearance. However, these would reduce to not be significant in the medium – long term as mitigation planting/landscaping and translocated hedgerows become established.

Table 6.2: Summary of Predicted Incremental Cumulative Effects within the Scheme (based on Table 3.2: HD48/08)

Transportation Impact of Scheme	Incremental Cumulative Impact	Spatial Extent	Magnitude	Timing/Duration	Mitigation/Enhancement	Uncertainty of Impact occurring	Significance of Effect (based on Table 2.6: HA205/08)
<i>Transportation measure: Highways Improvement and associated access provisions</i>							
Receptor/s: Humans, particularly local residents within the scheme corridor (see Chapters 5.1, 5.3, 5.6 & 5.7)							
Generation of dust and PM ₁₀ resulting in loss of amenity and/or adverse impacts on human health at nearby sensitive locations.	Construction activities contributing to nuisance at affected residential and amenity receptors	Local (within and adjacent to construction footprint)	High – Low risk depending on construction activity	Temporary (short term) during construction period	Employment of construction best practice in accordance with IAQM guidance, delivered via the CEMP	Low	Up to Moderate adverse
Temporary adverse impacts on local residents and receptors from construction noise and vibration.			Varying depending on construction activity and location of receptor	Temporary (short term) during construction period	The contractor would be required to prepare a CEMP, for agreement with the Local Authority Environmental Officers, which would include measures to manage construction noise and vibration		
Slight to moderate adverse impacts on visual receptors during the construction period due to visibility of construction plant and associated works.			Slight to moderate adverse depending on receptor location	Temporary (short – medium term) during construction period and while replacement landscape features establish	Restoration/retention of hedgerow patterns through new planting and, in selected locations, translocation of existing hedgerows, and their associated maintenance and aftercare.		
Mismanagement of waste materials leading to detrimental impacts on air quality and			Moderate adverse	Temporary (short term) during construction period	Best practice construction site methods during selection and management of haul routes and temporary storage/processing of materials to prevent impacts on		

increased noise resulting in a moderate adverse impact.					environmental and human receptors, delivered via the CEMP.		
Receptor/s: No's 1 & 2 Bryn Meddyg							
Slight adverse visual impact due to increased carriageway level	Reduced enjoyment of two properties during the operational phase	Local: No's 1 and 2 Bryn Meddyg	Slight adverse	Operational phase (long term)	A combination of a screen fence and the planting of scrub and trees would limit visibility to the west of No. 1 and within acute views from the front of No. 2.	Low	Minor adverse
Marginal increase in noise levels (+ 0.1 – 0.2dB) and airborne vibration (+2%)			Negligible adverse		Full low-noise road surfacing to both carriageways forms part of the Scheme works and has been accounted for in the noise assessment calculations.	Low	
Receptor/s: All Travellers (see Chapter 5.8)							
Disruption to usual traffic flows and potential delays brought about by traffic management resulting in a moderate adverse effect.	Disruption to all travel through the study area due to traffic management during the construction period	Users of the A55(T) and surrounding transport network	Moderate adverse	Construction Phase Short term	Sensitive traffic management and clear signage.	Low	Moderate adverse
Temporary traffic management during the works affecting the movement of pedestrians, cyclists and equestrians in the area resulting in a moderate adverse effect.			Moderate adverse		Sensitive traffic management and clear signage for NMU's. Provision of temporary alternative routes (including for Roman Road / Henffordd) during construction.	Low	

Receptor/s: Natural connectivity features including habitats and watercourses (see Chapters 5.3, 5.4 and 5.10)							
Loss and degradation of habitat features from the start of the construction phase, including up to 4.8km of hedgerows, resulting in a moderate adverse impact	Loss and degradation of ecological, landscape and water connectivity features during the construction period	Habitat connectivity features within the footprint of the works and biodiversity that uses them.	Moderate adverse	From construction phase to at least 15 years after scheme opening Short – long term	Restoration/retention of hedgerow patterns through new planting and, in selected locations, translocation of existing hedgerows, and their associated maintenance and aftercare.	Low	Minor adverse to Not Significant
Loss and degradation of landscape features from the start of the construction phase, including up to 4.8km of hedgerows, resulting in slight to moderate adverse impacts		Landscape connectivity features within the footprint of the works and views of them.	Slight to moderate adverse	From construction phase to at least 15 years after scheme opening Short – long term	Restoration/retention of hedgerow patterns through new planting and, in selected locations, translocation of existing hedgerows, and their associated maintenance and aftercare.	Low	
Pollution and disturbance of watercourses that flow through the site during the construction phase resulting in a minor adverse impact		Eight watercourses that flow through the scheme and downstream receptors, including a SAC, SPA, SSSI and LNR in the Menai Strait	Minor adverse	Construction phase Short term	Temporary working areas including compounds, storage areas and haul roads positioned to avoid sensitive ecological receptors Adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidelines (PPGs), and CIRIA guidance, delivered via the CEMP.	Low	

Receptor/s: 860m of Roman Road (Henffordd) hedgerow (see Chapters 5.2, 5.3 and 5.4)							
Widening of Roman Road (Henffordd) leading to the removal of 860m of historic hedgerow, resulting in a major adverse impact	Combined disturbance/disruption of a historic and ecologically valuable feature	Local: 860m section of hedgerow along the north-eastern side of Roman Road (Henffordd) and associated biodiversity	Major adverse	From construction phase to at least 15 years after scheme opening Short – long term	Detailed recording and translocating/re-instating the original boundary feature on its new alignment wherever possible, and its associated maintenance and aftercare.	None	Minor adverse to Not Significant
Widening of Roman Road (Henffordd) leading to the removal of 860m of ecologically valuable old hedgerow, resulting in a moderate adverse impact			Moderate adverse	From construction phase to at least 15 years after scheme opening Short – long term	Translocating/re-instating the original hedgerow and associated ground features on its new alignment wherever possible, and its associated maintenance and aftercare.	None	
Receptor/s: Soils (see Chapters 5.5, 5.6 and 5.9)							
Permanent loss of soils resulting in a moderate adverse impact	Loss of soil resources due to the land take for the scheme	Soils and agricultural land within the permanent footprint of the scheme	Moderate	Permanent from construction phase Long term	No further mitigation beyond initial outline design considerations to reduce land take	None	Moderate adverse
Permanent loss of 2.8ha of Sub-grade 3a and 2.9ha of Sub-grade 3b agricultural land resulting in a low adverse impact			Low	Permanent from construction phase Long term	No further mitigation beyond initial outline design considerations to reduce land take	None	

Cumulative (multiple) impacts from different projects

Trunk Road and Motorway Projects which have been confirmed

- 6.16 Planned trunk road projects in North Wales are included in the Welsh Government's National Transport Finance Plan 2015. Such projects that are currently identified in statutory plans and/or are undergoing some form of environmental assessment and considered potentially likely to result in significant cumulative effects with the Scheme are identified in Table 6.3.
- 6.17 Of these projects, only the A487 Caernarfon and Bontnewydd bypass has currently progressed sufficiently through the statutory processes (*i.e.* publication of draft Orders and ES) to be considered as a 'confirmed project' (subject to statutory approvals), as defined by the HA205/08 guidance; the potential significant cumulative effects with this project have therefore been considered in this chapter. If the Scheme were to receive statutory approval it is expected that the EIA for the other projects listed in Table 6.3 would need to consider any significant cumulative effects associated with it.

Table 6.3: Planned trunk road and major infrastructure projects in North Wales

Project/plan	Transport/development plan reference	Draft programme (per NTFP 2015)
A487 Caernarfon and Bontnewydd bypass	National Transport Finance Plan. Scheme (ref. R17).	Commencing late 2016 and completed by 2019
A55(T) Junctions 15 and 16 Improvements	National Transport Finance Plan. Scheme (ref. R18).	Commencing March 2018 and completed by March 2020.
Improvements to the A55(T) crossing of the Menai	National Transport Finance Plan. Scheme (ref. R19/R27c).	Commencing 2017/18 and continuing beyond 2020

A487 Caernarfon and Bontnewydd bypass

- 6.18 The Welsh Government is proposing to build a bypass from the Goat roundabout on the A499/A487 junction to the Plas Menai roundabout, around Llanwnda, Dinas, Bontnewydd and Caernarfon in Gwynedd¹²⁰. Subject to the outcome of a Public Inquiry currently scheduled for June 2017, the work is currently expected to commence in autumn 2017 and be completed in late 2019 and would therefore overlap with the construction of the Scheme, which is located approximately 12.7km to the north-east.
- 6.19 The scheme is being developed to meet 5 objectives:
- reduce journey times between Llanwnda and Plas Menai;
 - reduce journey times between Llanwnda and Caernarfon;
 - reduce the number of vehicles passing through residential communities including Llanwnda, Dinas, Bontnewydd and Caernarfon;
 - reduce accidents on the A487, and;
 - improve the resilience of the network by increasing the amount and/or capacity of alternative routes.
- 6.20 It is proposed to build 9.8km of 2+1 carriageway (2 lanes in one direction, 1 in the other, switching from one side to another) between the Goat roundabout and Plas Menai

¹²⁰ <http://gov.wales/topics/transport/roads/schemes/a487/caernarfon-bontnewydd-bypass/?lang=en>

roundabout. The scheme will also involve constructing 22 structures including culverts and 7 bridges and improving the existing A487 to improve existing junctions.

6.21 Environmental Impact Assessment has been completed for this project and the findings published in an Environmental Statement in August 2016. The ES has been used to determine whether significant cumulative effects with the Scheme are likely. Potential significant cumulative impacts with the Scheme have been identified for cultural heritage, ecological, soils, materials and all travellers receptors. Table 6.4 summarises the potential cumulative effects between the A487 Caernarfon and Bontnewydd Bypass and the Scheme.

6.22 Potential residual significant cumulative effects have been identified between the two schemes for the following receptors:

- Cultural Heritage: the potential loss of parts of the Caernarfon – Caerhun Roman Road historical feature would result in a moderate adverse cumulative effect. However, it should be noted that the location of this feature in relation to the Scheme is currently uncertain and it may not be affected by it. Nevertheless, it has been considered in this assessment in order to represent the worst-case scenario.
- Ecological features: the loss of natural habitats (including trees, hedgerows and broadleaved woodland) would result in cumulative residual adverse effects of moderate – minor significance in the short term until replacement habitats establish in the medium – long term, by which time they would reduce to not significant. Potential long term beneficial cumulative effects could be realised by an increase in natural habitats created with each scheme.
- Soils: the large area of agricultural land taken by the A487 Caernarfon and Bontnewydd bypass (56ha including 13.8ha of Grade 2 land and 13.2ha of Sub-grade 3a land), coupled with the additional requirement for land of a similar quality within the Scheme (2.8ha of Sub-grade 3a land) would result in a major adverse residual cumulative effect on this resource in north-west Wales.
- Materials: the combined requirement of fill for both the Scheme (approximately 19,305m³) and the A487 Caernarfon and Bontnewydd bypass (24,461m³) would result in a residual moderate adverse cumulative effect on local fill material aggregate resources and road links between them and the projects. Measures would be considered to minimise the need for fill materials (including the potential re-use of surplus site-won materials) within the schemes, but the extent of this benefit is not currently confirmed. Another moderate adverse residual cumulative effect would remain from the amount of surplus material estimated to be generated from both schemes (181,686m³), which again could be reduced following further consideration at the detailed design and construction stages.
- All Travellers: Users of the road network between both schemes could receive a temporary residual moderate adverse cumulative effect during the construction phases as a result of traffic management measures implemented. However, on completion of both schemes a cumulative moderate beneficial effect could be realised for this receptor due to a reduction in driver stress.

Table 6.4: Cumulative Effects between the Scheme and the A487 Caernarfon and Bontnewydd Bypass (based on Table 3.2: HD48/08)

Transportation Impact of Scheme	Cumulative Impact with additional project/s	Spatial Extent	Magnitude	Timing/Duration	Mitigation/Enhancement	Uncertainty of Impact occurring	Significance of Cumulative Effect (based on Table 2.6: HA205/08)
<i>Transportation measure: Highways improvement and associated access provisions</i>							
Cultural Heritage (see Chapter 5.2)							
Potential adverse impact on Roman Road segments, part of RR67c Caerhun-Caernarfon route	Additional adverse impact on a short stretch of Roman Road, also part of Caerhun – Caernarfon route	Caerhun – Caernarfon Roman Road	Major adverse	Immediate and permanent during construction phases onwards	Watching brief and subsequent appropriate recording of any remains encountered.	Moderate (exact location not confirmed)	Moderate adverse
Ecological Receptors (see Chapter 5.4)							
Degradation of habitats associated with rivers and streams, otter foraging habitat and reptiles/amphibians arising from siltation and pollution incidents that are not properly managed	Additional degradation of habitats during the construction phase	Rivers and streams within the footprint and downstream of the two schemes	Up to minor adverse	Temporary for duration of construction phases and depending on works programming	<ul style="list-style-type: none"> Implementing PPG and CIRIA pollution prevention measures when working in/near to watercourses. Controlling dust generation Statutory drainage consents and associated mitigation for working in watercourses, expected to include fish rescues where required Toolbox talks to site personnel Direct lighting of watercourses that could support migratory fish to be avoided where possible, particularly during spawning season. All construction lighting in vicinity of watercourses to be shielded and directed 	Low	Not significant

					<p>away from watercourses</p> <ul style="list-style-type: none"> All site compounds, welfare units and generators to be located at least 30m away from watercourses 		
Loss of approximately 0.23ha of mature broad-leaved woodland	Additional loss of approximately 2.96ha of mature broad-leaved woodland	Mature broadleaved woodland within the County	Minor adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> Tree protection measures in accordance with BS5837:2012. Planting 1.87ha of native broad-leaved woodland and 13.02ha of broadleaved plantation woodland 	Low	Minor adverse to Not significant
Loss of trees and hedgerows during site clearance	Additional loss of trees and hedgerows	Trees and hedgerows within the County	Moderate adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> Translocation/replanting of hedgerows (including an additional 22.6km) Planting 0.26ha of scattered trees Small groups of young native trees managed as standards within new/translocated hedgerows Placing three large mature oaks that would be removed in close proximity to retained large mature/veteran trees Loss of 3 large mature oaks to be compensated by planting of suitable trees (approximately 11 standard trees after thinning) 	None	Moderate adverse to Not significant
Loss of open watercourse (including potential stream habitat for fish)	Additional loss of open watercourse (including potential stream habitat for fish)	Open watercourses within the County	Minor adverse	Immediate and permanent during construction phases onwards	<ul style="list-style-type: none"> Improvement of 200m of stream due to reduction in erosion and measures to improve access for aquatic species Energy dissipation measures installed at the discharge 	Low	Not significant

					<p>outfall of watercourses to reduce erosion, minimising habitat lost</p> <ul style="list-style-type: none"> • Improvements to fish passage through certain culverts 		
Loss of bat foraging habitat and linear features used by bats for navigation	Additional loss of bat foraging habitat and linear features used by bats for navigation	County bat population	Moderate adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows (including an additional 22.6km) • Planting 0.26ha of scattered trees • Planting 1.87ha of native broad-leaved woodland and 13.02ha of broadleaved plantation woodland • Temporary navigational features installed • Retention of existing safe commuting routes • Provision of structures for safe crossing locations 	Low	Moderate adverse to Not significant
Potential loss/disturbance of bat roosts during construction	Additional potential loss/disturbance of bat roosts during construction	County bat population	Minor adverse	Temporary for duration of construction phases and depending on works programming	<ul style="list-style-type: none"> • Pre-construction survey of all mature trees to be removed • Adherence to conditions of EPS licence, if required • Site facilities located 150m away from roosts • No night-time working or non-directional lighting in the vicinity of roosts. • Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker • Tree bat boxes erected within suitable habitat. • Replacement tree stock 	Moderate	Not significant

					planted.		
Temporary disturbance to otters	Additional disturbance to otters	County otter population	Minor adverse	Short term and temporary during the construction phases only	<ul style="list-style-type: none"> • Pre-construction survey to check for resting places • Location of site facilities at least 30m away from any watercourse • Minimal lighting in vicinity of watercourses and all construction lighting directed away from watercourses 	Low	Not significant
Loss of badger sett	Additional loss of badger setts	County badger population	Up to Moderate adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> • Pre-construction survey • Adherence to licence conditions • Provision of an artificial sett 6 months in advance of sett closure • Sett closure according to standard guidelines • Sett destruction and all licensed works within the vicinity to be undertaken between July and November 	None	Moderate adverse to Not significant
Disturbance to badgers in setts to be destroyed and retained setts close to the scheme	Additional disturbance to badger setts	County badger population	Moderate adverse	Immediate and permanent following site clearance for setts to be destroyed. Short term and temporary during the construction phases for setts disturbed.	<p>As above and:</p> <ul style="list-style-type: none"> • Construction lighting minimised in vicinity • Site compounds, welfare units and generators positioned at least 50m away from active setts 	None	Not significant
Mortality of animals during construction	Additional mortality of animals during construction	County wildlife	Moderate adverse	Short term and temporary during the construction phases only	<ul style="list-style-type: none"> • Pre-construction surveys • Covering any excavations or providing an egress for trapped animals • Location of site facilities at least 50m away from active setts 	Moderate	Not significant

					<ul style="list-style-type: none"> • Ecological Watching Brief during translocation/removal of hedgerows, clearance of woodland and scrub and topsoil stripping • Translocation of reptiles/amphibians to a suitable receptor site 		
Mortality of animals during operation	Additional mortality of animals during operation	County wildlife	Minor adverse	Immediate and permanent from operational phases onwards	<ul style="list-style-type: none"> • Provision of holes up to 200mm diameter in concrete central reserve. • Mammal ledges/shelves within new culverts. • Dry pipes. • Otter/badger-resistant guide fencing. • Grass cutting height of no less than 50mm to minimise the risk of reptiles being harmed. 	Low	Not significant
Loss of wildlife foraging habitat	Additional loss of wildlife foraging habitat	Wildlife foraging habitat within the County	Minor adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows (including an additional 22.6km) • Planting of native broad-leaved woodland, scrub and scattered trees to provide a larger area than the area lost • Species-rich grassland provided on road verges, embankments and cuttings (extent to be determined at detailed design stage) 	None	Minor adverse to Not significant
Destruction of active bird nests and/or disturbance of nesting birds during site clearance	Additional destruction of active bird nests and/or disturbance of nesting birds during site	County breeding bird population	Moderate adverse	Immediate and permanent during site clearance	Vegetation removal outside breeding bird season, or ecologist check for active nests immediately prior to removal	Moderate	Not significant

	clearance						
Loss of bird nesting habitat	Additional loss of bird nesting habitat	County bird population	Minor adverse	Immediate and permanent following site clearance.	<ul style="list-style-type: none"> • Translocation/replanting of hedgerow (including an additional 22.6km) • Planting of native broad-leaved woodland, scrub and scattered trees to provide a larger area than the area lost 	None	Minor adverse to Not significant
Potential disturbance of the nest site of a Schedule 1 bird (Red Kite)	Additional potential disturbance of the nest site of a Schedule 1 bird (Red Kite)	County Red Kite population	Moderate adverse	Short term and temporary during the construction phases only	<ul style="list-style-type: none"> • Preconstruction check for red kite nests in the vicinity of the works in the April prior to any scheduled works. • If any active red kite nests are found that could be disturbed, works to be programmed to avoid the area during the nesting period. 	High	Not significant
Increased risk of Barn Owl road traffic mortality	Additional increased risk of Barn Owl road traffic mortality	County Barn owl population	Minor adverse	Long term and permanent during operational phases.	<ul style="list-style-type: none"> • Replanting, translocation or retention of hedgerows • Planting of woodland, scrub and scattered trees in a number of locations which would provide a greater length of wooded or tree-lined carriageway than exists • Consideration of proximity of species-rich grassland to the carriageway during detailed design 	High	Minor adverse to Not significant
Loss of reptile and amphibian habitat	Additional loss of reptile and amphibian habitat	County reptile/amphibian populations	Minor adverse	Immediate and permanent following site clearance.	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows including an additional 22.6km • Planting of native broad-leaved woodland, scrub and scattered trees to provide a larger area than the area lost 	Low	Minor adverse to Not significant

Soils (see Chapters 5.5 and 5.9)							
Loss of 5.7ha of Grade 3 agricultural soils, including 2.8ha of Sub-grade 3a land.	Additional loss of 56ha of agricultural soils including 13.8ha of Grade 2 land and 13.2ha of Sub-grade 3a land	Agricultural soils in north-west Wales	Major adverse	Immediate and permanent following site clearance.	None following initial design considerations to minimise agricultural land take	None	Major adverse
Materials (see Chapters 5.6)							
Approximately 19,305m ³ of fill material required	Additional 24,461m ³ of fill material required	Local fill material aggregate resources and road links between them and the projects	Moderate adverse	Immediate and permanent following site clearance.	Efficient detailed design to reduce requirements for imported materials. Minimise volume of imported material by allowing re-use of site-won material. Adequate separation, processing, and storage of site-won materials to maximise potential for their re-use. Use local suppliers and waste receptor sites to reduce residual traffic-related impacts	Low	Moderate adverse
Approximately 21,676m ³ of surplus earthworks material potentially exported as waste	Additional 160,010m ³ of unsuitable fill material to be exported	Local waste management facilities	Moderate adverse	Immediate and permanent following site clearance.	Early estimation of waste stream and developing of treatment options based on waste hierarchy Investigation as to whether surplus earthworks could be suitable for processing for use as fill.	Low	Moderate adverse
All Travellers (see Chapter 5.8)							
Temporary disruption to	Additional	Users of the road	Moderate	Temporary and short	Good site working practices	Low	Moderate

normal traffic flows and increased driver stress along this section of the A55 and Roman Road (Henffordd)	temporary disruption to normal traffic flows and increased driver stress through the Caernarfon to Bontnewydd area	network between both schemes	adverse	term during the construction phase	including clear signage and consideration of the effects on all travellers when designing traffic management measures		adverse
Reduction in driver stress	Additional reduction in driver stress	Users of the road network between both schemes	Moderate beneficial	Permanent and long term from completion of the schemes	Not required (beneficial impact)	Low	Moderate beneficial

Development projects with valid planning permissions as granted by the Local Planning Authority, and for which formal EIA is a requirement or for which non-statutory environmental impact assessment has been undertaken

- 6.23 Gwynedd Council provided details of several projects within the immediate area which had received planning permission between 2008 and 2012. A review of Gwynedd Council's planning web site identified several more planning applications for both the Abergwyngregyn and Llanllechid communities since 2012. The small scale and location of the majority of these proposals leads to them being considered unlikely to generate significant cumulative effects in combination with the Scheme; the majority involve domestic alterations, construction of single dwellings or small scale services installations which do not require a formal or non-statutory EIA.
- 6.24 The Tal-y-Bont flood alleviation scheme is located approximately 1.5km south-west of the Scheme and, while it does not require planning permission or formal EIA, non-statutory environmental assessment has been completed. Due to the location, nature and scale of the work it is considered that it has potential to generate cumulative effects with the Scheme and has therefore been considered within this assessment (see Table 6.5).
- 6.25 The scheme was completed in autumn 2016 and involved the construction of a weir structure on the western bank of an un-named watercourse at Grid Reference SH 60882 70173, which has been designed to divert peak flows above approximately 2m³/s from the watercourse. The water which flows over the weir during times of heavy flow will be culverted to the west for approximately 200m prior to entering an open channel with a base width of 2.2m for approximately 260m. From this channel the flow will enter a second culvert structure which extends for 160m through agricultural land before discharging onto the eastern river bank via a new stepped spillway, directly upstream of the A55(T) at Grid Reference SH 60247, 70088.
- 6.26 Following a review of the Tal-y-Bont FAS Assessment of Significant Effects report (YGC, 2016) potential cumulative impacts with the Scheme were identified for cultural heritage, ecological and water environment receptors, along with proposed mitigation measures. Table 6.5 summarises the potential cumulative effects between the Tal-y-Bont FAS and Scheme.
- 6.27 The loss of local natural habitat and landscape features (including trees, hedgerows and broadleaved woodland) would result in cumulative residual adverse effects of moderate – minor significance in the short term until replacement habitats establish in the medium – long term, by which time they would reduce to not significant. Potential long term beneficial effects could be realised by an increase in natural habitats created with the Scheme.

Table 6.5: Cumulative Effects between the Scheme and the Tal y Bont FAS (based on Table 3.2: HD48/08)

Transportation Impact of Scheme	Cumulative Impact with additional project/s	Spatial Extent	Magnitude	Timing/Duration	Mitigation/Enhancement	Uncertainty of Impact occurring	Significance of Cumulative Effect (based on Table 2.6: HA205/08)
<i>Transportation measure: Highways improvement and associated access provisions</i>							
Cultural Heritage (see Chapter 5.2)							
Adverse impact on the setting of the Dyffryn Ogwen Landscape of Outstanding Historical Importance	Additional detracting of the setting of the Dyffryn Ogwen LOHI.	Dyffryn Ogwen LOHI	Moderate adverse	Immediate and permanent following site clearance and commencement of construction.	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows (including an additional 22.9km) • Clawdd reinstatement. 	Low	Moderate adverse to Not significant
Ecological Receptors (see Chapter 5.4)							
Loss of trees and hedgerows during site clearance	Additional loss of trees and hedgerows	Trees and hedgerows within the locality	Moderate adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows (including an additional 22.6km) • Planting 0.26ha of scattered trees • Small groups of young native trees managed as standards within new/translocated hedgerows • Placing three large mature oaks that would be removed in close proximity to retained large mature/veteran trees • Loss of 3 large mature oaks to be compensated by planting of suitable trees (approximately 11 standard trees after thinning) 	None	Moderate adverse to Not significant
Disturbance to the local otter population	Additional disturbance to the local otter population in combination with the	Local otter population	Minor adverse	Short term and temporary during the construction period only.	<ul style="list-style-type: none"> • Pre-construction survey to check for resting places • Location of site facilities at least 30m away from any 	Low	Not significant

	Tal-y-Bont FAS.				<p>watercourse</p> <ul style="list-style-type: none"> • Minimal lighting in vicinity of watercourses and all construction lighting directed away from watercourses 		
Loss of bat foraging habitat and linear features used by bats for navigation	Additional loss of bat foraging habitat and linear features used by bats for navigation in combination with the Tal-y-Bont FAS.	Local bat population	Moderate adverse	Immediate and permanent following site clearance.	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows (including an additional 22.6km) • Planting 0.26ha of scattered trees • Planting 0.26ha of native broad-leaved woodland • Temporary navigational features installed • Retention of existing safe commuting routes 	Low	Moderate adverse to Not significant
Loss of at least 8 mature trees with bat roosting potential	Additional loss of 4 trees with bat roosting potential.	Local bat population	Minor adverse	Immediate and permanent following site clearance.	<ul style="list-style-type: none"> • Pre-construction survey of all mature trees to be removed • Adherence to conditions of EPS licence, if required • Site facilities located 150m away from roosts • No night-time working or non-directional lighting in the vicinity of roosts. • Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker • Tree bat boxes erected within suitable habitat. • Replacement tree stock planted. 	Low	Minor adverse to Not significant
Mortality of animals during construction	Additional mortality of animals during construction	Local wildlife	Moderate adverse	Short term and temporary during the construction phases only	<ul style="list-style-type: none"> • Pre-construction surveys • Covering any excavations or providing an egress for trapped animals 	Moderate	Not significant

					<ul style="list-style-type: none"> • Location of site facilities at least 50m away from active setts • Ecological Watching Brief during translocation/removal of hedgerows, clearance of woodland and scrub and topsoil stripping • Translocation of reptiles/amphibians to a suitable receptor site 		
Loss of wildlife foraging habitat	Additional loss of wildlife foraging habitat	Wildlife foraging habitat within the locality	Minor adverse	Immediate and permanent following site clearance	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows (including an additional 22.6km) • Planting of native broad-leaved woodland, scrub and scattered trees to provide a larger area than the area lost • Species-rich grassland provided on road verges, embankments and cuttings (extent to be determined at detailed design stage) 	None	Minor adverse to Not significant
Inhibited/obstructed passage for fish and eels due to in-channel works and changes to drainage features	Additional inhibited/obstructed passage for fish and eels within the local watercourses in combination with the Tal-y-Bont FAS.	Local fish/eel population	Minor adverse	Short term and temporary during the construction period, but possibly permanent if unsympathetic changes are made.	<ul style="list-style-type: none"> • Direct lighting of watercourses that could support migratory fish to be avoided where possible, particularly during spawning season. • All construction lighting in vicinity of watercourses to be shielded and directed away from watercourses • All site compounds, welfare units and generators to be located at least 30m away 	Low	Not significant

					<p>from watercourses</p> <ul style="list-style-type: none"> • Implementing PPG and CIRIA pollution prevention measures when working in/near to watercourses. • Statutory drainage consents and associated mitigation for working in watercourses, expected to include fish rescues where required • Toolbox talks to site personnel 		
Destruction of active bird nests and/or disturbance of nesting birds during site clearance	Additional destruction of active bird nests and/or disturbance of nesting birds during site clearance	Local breeding bird population	Moderate adverse	Immediate and permanent during site clearance	Vegetation removal outside breeding bird season, or ecologist check for active nests immediately prior to removal	Moderate	Not significant
Loss of bird nesting habitat due to hedgerow removal	Additional loss of hedgerow habitat and loss of potential bird nesting sites in combination with the Tal-y-Bont FAS.	Local bird population	Minor adverse	Immediate and permanent following site clearance.	<ul style="list-style-type: none"> • Translocation/replanting of hedgerow (including an additional 22.6km) • Planting of native broad-leaved woodland, scrub and scattered trees to provide a larger area than the area lost 	None	Minor adverse to Not significant
Loss of reptile and amphibian habitat	Additional loss of reptile and amphibian habitat	Local reptile/amphibian populations	Minor adverse	Immediate and permanent following site clearance.	<ul style="list-style-type: none"> • Translocation/replanting of hedgerows including an additional 22.6km • Planting of native broad-leaved woodland, scrub and scattered trees to provide a larger area than the area lost 	Low	Minor adverse to Not significant
Water Environment receptors (see Chapter 5.10)							
Contaminated watercourses during construction activities	Additional contamination to watercourses that flow into the Menai Strait.	Local	Minor negative	Short term and temporary during the construction period only.	<ul style="list-style-type: none"> • All site compounds, welfare units and generators to be located at least 30m away from watercourses 	Low	Not significant

					<ul style="list-style-type: none">• Implementing PPG and CIRIA pollution prevention measures when working in/near to watercourses.• Statutory drainage consents and associated mitigation for working in watercourses, expected to include fish rescues where required• Toolbox talks to site personnel		
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Summary

- 6.28 This chapter has considered the cumulative effects of the Scheme, both as incremental impacts within the scheme and also as multiple impacts associated with other committed projects.
- 6.29 Incremental impacts would occur during the construction phase of the Scheme and mitigation measures are proposed to avoid and reduce these where possible. The resulting significant cumulative effects range from minor to moderate adverse, and are summarised as follows:
- Construction activities contributing to nuisance at affected residential and amenity receptors (moderate adverse);
 - Disruption to all travel through the study area due to traffic management during the construction period (moderate adverse);
 - Reduction in enjoyment of No's 1 & 2 Bryn Meddyg during the operational phase due to small changes in views and noise/airborne vibration levels (minor adverse);
 - Loss and degradation of ecological, landscape and water connectivity features during the construction period (minor adverse);
 - Combined disturbance/disruption of a historic and ecologically valuable feature; hedgerow along Roman Road (Henffordd) (minor adverse), and;
 - Loss of soil resources due to the land take for the scheme (minor adverse).
- 6.30 Cumulative impacts with other projects have also been considered and reported in this chapter (see Tables 6.4 and 6.5) and, after mitigation, range from minor to major adverse. In combination with the A487 Caernarfon and Bontnewydd bypass scheme the Scheme is predicted to contribute to the following significant cumulative effects of minor adverse magnitude or above:
- Additional adverse impact on Roman Road, part of Caerhun – Caernarfon route (moderate adverse);
 - Additional habitat loss and disturbance to wildlife (moderate adverse to not significant as mitigation planting establishes);
 - Additional loss of agricultural soils including Sub-grade 3a land (major adverse);
 - Additional fill material required from local sources (moderate adverse);
 - Surplus fill material generated (moderate adverse);
 - Additional temporary disruption to normal traffic flows and increased driver stress (moderate adverse), and;
 - Additional reduction in driver stress on completion of both schemes (moderate beneficial).
- 6.31 In combination with the Tal y Bont Flood Alleviation Scheme (see Table 6.5) the Scheme is predicted to contribute to the following significant cumulative effects:
- Additional loss of habitat and historic landscape features and disturbance to wildlife (moderate adverse to not significant as mitigation planting establishes).

Chapter 7.0: Environmental Management

This chapter explains how the proposed mitigation measures to address the Scheme's predicted significant effects and how the principles of sustainable development and good practice will be delivered during the construction phase of the Scheme. It also summarises the method used to compile the Environmental Masterplans.

7.1 Environmental Management Plan

7.1.1 In accordance with modern standard practice for major development works, an Environmental Management Plan (EMP) would be developed and maintained for the Scheme. An EMP provides the framework for recording environmental risks, commitments and other environmental constraints and clearly identifies the structures and processes that will be used to manage and control these aspects. The EMP also seeks to ensure compliance with relevant environmental legislation, government policy objectives and scheme-specific environmental objectives and principles. It also provides the mechanism for monitoring, reviewing, auditing and managing environmental performance, compliance and change throughout the road project's life cycle.

7.1.2 In the early stages of a project the EMP will be in outline only. It will later be refined and expanded into a Construction Environmental Management Plan (CEMP) as more information becomes available and there is more certainty in terms of the road project's layout, construction methods, programme and the likely environmental effects. Towards the end of the construction period the CEMP will be refined into a CEMP (Aftercare) (CEMPA) to cover the period between construction and handover. The CEMPA will progress into a Handover Environmental Management Plan (HEMP) which will contain essential environmental information needed by the body responsible for the future maintenance and operation of the asset.

7.1.3 The indicative contents of a CEMP are as follows:

- Introduction & background: giving a brief summary of the project, any relevant strategy or programme context and the purpose of the CEMP;
- Project team roles and responsibilities: particularly important where there are multiple organisations involved in a project, *e.g.* several sub-contractors. This section should also detail where queries should be directed within the team (including contact details), and escalated up to technical specialists as required. It should also make the lines of communication clear;
- Induction, training and briefing procedures for construction staff: detailing procedures to ensure construction staff receive an adequate introduction to the environmental aspects of the project, a site induction and training (if this information is contained in other documents, an appropriate cross reference should be provided, rather than replication of information);
- Environmental Objectives and Principles to be achieved throughout the road project's lifecycle;
- Proposed mitigation measures and commitments to be addressed throughout the project's development;
- Change management process and procedure for assessing changes to the agreed design against environmental commitments and requirements and agreed during the consents process. This should include a mechanism for liaising with the Overseeing Organisation;
- Environmental Commitments Register (ECR): the environmental mitigation measures and promises made in the ES, SIAA and public inquiry (if applicable);
- Consents, commitments and permissions: this should provide a record of the consents and permissions from Statutory Bodies and other stakeholders and any commitments made to them;

- Method Statements to be implemented during the construction process;
- Protection of sensitive areas: detailing how sensitive areas within, adjacent to, and off the site are to be protected during the design, construction and maintenance of works;
- Environmental risk assessments: detailing the environmental risks associated with all activities on the project, the mitigation measures to remove or reduce the risks and assigned responsibilities for the risks;
- Environmentally significant changes: detailing procedures to be followed if any significant changes are encountered once a project commences and the grounds which would result in a change to the CEMP, *e.g.* the use of alternative construction methods or design. This should also detail who has responsibility for overseeing and assessing the environmental and compliance implications of changes and managing any changes to existing agreements or commitments, particularly those agreed in the consents process;
- Environmental monitoring and evaluation requirements: setting out what monitoring needs to be undertaken against the project's environmental objectives, principles and relevant environmental actions and commitments, by who and the associated reporting requirements;
- Procedures for monitoring and reviewing compliance with the CEMP: *e.g.* daily/weekly/monthly inspection/audit reports and procedures for rectification of failings;
- Summary of procedures to be followed in the event of an environmental emergency or breaching of EMP measures, and;
- Annexes: there should be a number of annexes (or cross references to other documents where relevant information is held) including:
 - Site Waste Management Plans, Retained Vegetation Management Plan and any other management plans relating to the works;
 - The project's Environmental Management System (ISO14001 certification) requirements;
 - References to other relevant information, such as the construction programme, project completion report, design drawings, details of consultation and communication, meeting minutes, reports, technical notes *etc.*;
 - Record of management actions undertaken during construction and implementation and the outcomes;
 - Environmental method statements;
 - Record of environmental monitoring and evaluation undertaken during construction;
 - Record of environmental incidents, and;
 - Environmental Masterplans

7.1.4 The appointed contractor would be required to operate an Environmental Management System (EMS) certified against ISO14001 and would formulate and maintain a CEMP throughout the construction and aftercare phases of the Scheme. This would include the prior development of detailed method statements, consultation with statutory consultees, measures to ensure employment of suitably qualified and experienced specialist sub-contractors and the monitoring of mitigation measures. The Overseeing Organisation or its delegated representative would supervise the satisfactory implementation and execution of the CEMP and subsequent CEMPA. The following HEMP would then be managed by the delegated trunk road authority.

7.2 Environmental Masterplan

7.2.1 The environmental mitigation proposals have been summarised on an Environmental Masterplan (see Figures 7.1 – 7.7, Volume 1a) prepared using the methods recommended in the DMRB, Volume 10, Section 0¹²¹. This provides a consistent system for defining and achieving the environmental objectives, which may be policy or route specific. The Environmental Masterplan forms the basis for the development of the Environmental Management Plan and also for the detailed design and implementation of the proposed scheme and the environmental mitigation measures.

Functions and Elements

7.2.2 The DMRB, Volume 10, Section 0 method uses a system of 'Functions' and 'Elements' to describe environmental features. The use of this system enables environmental data to be recorded and developed in a consistent manner and linked through all stages of a scheme from initial design through to construction requirements and management action plans. The codes represent all of the environmental objectives, apart from Air Quality. Physical environmental features are subdivided for convenience into Environmental, Landscape and Planning/Policy although these elements form an integral part under the heading of 'Environment'.

7.2.3 Each existing or proposed environmental feature on or adjacent to the Scheme has one or more 'Functions' and an 'Element' which describes its physical attributes or designation in statutory terms. The basis of recording and showing these features is that they have an interaction with the Scheme *i.e.* if there are features that do not have an environmental function, or form a constraint upon the design or operation of the project, they would not be recorded. All features ('Elements') may have a multiple purpose and therefore can be ascribed more than one 'Function' *e.g.* a vertical barrier may be designed to achieve visual screening, noise attenuation and vehicle containment.

7.2.4 Within the overall environment of the Scheme and its surroundings there are many features that influence the design and maintenance; of these the Landscape Elements cover the largest area. The landscape and protected species elements help to mitigate the adverse impacts of the Scheme, and thus require regular maintenance or inspection to achieve their longer term objectives. The landscape elements are divided into broad classification types *e.g.* hedges or walls that are then subdivided again according to their detailed design or management needs, in conjunction with the stated 'Function'. For scheme-specific purposes, additional sub-types have been added to further define the requirements. Environmental Elements are those features that are relevant to achieving the non-landscape Environmental Objectives, such as Nature Conservation. The functions and elements applicable to the Scheme are presented in Table 7.1.

7.2.5 The achievement of the functions and elements included in the Environmental Masterplans will be managed and monitored via the Environmental Management Plan process described in Section 7.1.

¹²¹ The Design Manual for Roads and Bridges, Volume 10, Section 0: Environmental Objectives, Highways Agency, February 2001.

Table 7.1: Functions and Elements relating to the Scheme (see also Environmental Masterplans, Figures 7.1 – 7.7, Volume 1a)

Elements
<i>Environmental Elements</i>
E1.1 - Noise Reduction Road Surfacing on main carriageway
E2.1 - Water pollution control measures
E2.2 - Culvert headwalls
E3.1 - Protected species
E3.2 - Ecological protection measures
<i>Landscape Elements</i>
LE1.3 - Proposed species-rich grassland
LE2.1 - Proposed woodland
LE2.6 - Proposed scrub planting
LE2.7 - Proposed native individual trees
LE4.4 - Proposed native hedgerows / fences
LE6.1 - Proposed water bodies and associated planting
LE7.1 - Existing stone wall
LE7.2 - Existing hedgerow to be retained
LE7.3 - Existing established/developing woodland
<i>Planning & Policy Features</i>
P3.1 - Heritage Features
P4.4 - Public Rights of Way
P5.1 - Proposed stock-proof fencing
Functions
EFA - Visual Screening
EFB - Landscape Integration
EFC - Enhancing the Built Environment
EFD - Nature Conservation & Biodiversity
EFE - Visual Amenity
EFF - Heritage
EFH - Water Quality
EFJ - Agricultural/Highway Boundary
EFK - Access

Chapter 8.0: Conclusions

8.1 Summary of Significant Effects

This chapter summarises the significant effects that have been identified in Chapters 5.1 to 5.10 during both the construction and operational phases of the Scheme.

8.1.1 Air Quality

Construction phase

The proposed construction works may result in the generation of dust and PM₁₀, which could potentially result in loss of amenity and/or adverse impacts on health at nearby sensitive locations.

In the absence of any mitigation the Scheme is considered to be **high** risk from demolition, **medium** risk from earthworks and construction and **low** risk from trackout activities in relation to dust soiling effects on people and property. The risks in relation to human health impacts are **medium** from demolition and **low** from earthworks, construction and trackout activities.

Suitable mitigation measures to implement during the construction period in order to control potential dust and PM₁₀ emissions, commensurate with the identified risks, are summarised in Section 8.2.1.

Operational phase

No significant effects on air quality are predicted during the operational phase of the Scheme.

8.1.2 Cultural Heritage

Construction phase

Before mitigation, significant adverse effects are predicted for the following archaeological remains within 300m of the Scheme:

Up to Large: Asset 12 (Tai'r Meibion, Roman Road segments; part of RR67c Caerhun-Caernarfon route) and Asset 49 (Road East of Tan yr Allt Cottages to Crymlyn (Roman Road)).

Moderate: Asset 18 (Hedgerow, Abergwyngregyn) and Asset 25 (Field boundaries, east of Tai'r Meibion).

Slight: Asset 17 (Culverts, North of Tan-yr-Allt cottages), Asset 19 (Revetment walls, north of Tai'r Meibion), Asset 23 (Tai'r Meibion garden), Asset 31 (Field boundaries, East of Wig), Asset 33 (Wig Garden), Asset 37 (Quarry, Bryn Meddyg) and Asset 38 (Coed Bryn Meddyg relict field system), Asset 52 (Slate-built culvert) and Asset 53 (Stone and earth field boundary bank south of Tai'r Meibion).

Unknown: Asset 27 (y Wig medieval township) and Asset 30 (Part of Roman Road, Segontium – Canovium).

With regard to historic buildings within 300m, a **moderate** adverse effect is predicted for Asset 29 (Wig farm) and **slight** adverse effects are predicted for: Asset 6 (Farm buildings at Ty'n-y-Hendre), Assets 13 to 16 (No's 1 to 4 Tan-yr-Allt cottages), Assets 21 and 22 (Tai'r Meibion farm and buildings) and Asset 36 (Cottages, Bryn Meddyg, Abergwyngregyn) due to the modern character of the new roads.

With regard to historic landscapes, there would be a **moderate** adverse effect on Asset 24 (Enclosed fields, South and East of Tai'r Meibion) and **slight** adverse effect on Asset 34 (Lowland coastal area around Wig).

The ASIDOHL2 assessment (see Technical Appendix A, Volume 2) defines the level of impact as **moderate** on both the Dyffryn Ogwen and North Arllechwedd Landscape Areas of Outstanding Historic Interest (HLW (Gw) 10 and 12 respectively). This means that, without mitigation, there would be a developmental impact on key elements of both of the landscape areas with a result that there is some reduction in their overall value.

One Historic Park and Garden, 12 Scheduled Monuments and 49 additional Listed Buildings were identified within the 2km study area. The scheme would have a **neutral** impact on the setting of 51 of these assets and a **very slight** negative impact on the setting of 11.

Operational phase

The significant effects associated with cultural heritage features are predicted to occur during the construction phase, but would last throughout the operational phase as they involve loss of features and impacts on the setting of features. The latter would reduce over time as replacement landscaping establishes.

8.1.3 Landscape

Construction phase

Of the four LCAs identified as part of the assessment two would be directly affected as a result of the Scheme; LCA 1 (Abergwyngregyn Scarp slope) and LCA 2 (Wig Open Farmland). The majority of changes occurring along the boundary of these two areas are marked by the presence of the existing A55(T).

LCA 1 would be impacted by increasing the paved width in addition to modifications to improve access along Roman Road and the formation of a new access track linking Roman Road with the Wig Farm underpass. Whilst some of the changes would be noticeable at a very local level, they are not anticipated to significantly modify the way in which the wooded scarp slopes are perceived within the wider landscape and no significant effects are anticipated.

Impacts on LCA 2 are limited to the formation of the new County road, PMA and NMU route, and whilst this would require the removal and replanting of adjacent hedges, the core of the LCA would be unchanged and therefore no significant effects are anticipated.

No significant impacts are predicted for LCA 3 (Moel Wnion Upland Grazing) or LCA 4 (Traeth Lafan, Shallow Tidal Waters).

The assessment of visual impacts on affected visual receptors across the study area has demonstrated that the magnitude of impact is generally low, whilst receptors themselves are of variable sensitivity to change. Visual receptors would receive **slight** to **moderate** significant effects during the construction period due to visibility of construction plant and associated works.

Operational phase

No significant effects on Landscape Character are predicted during the operational phase.

Slight adverse effects are predicted to remain in the winter of the scheme opening year for 11 visual receptors (Crymlyn farm, Wig farm, Y Glyn farm, No's. 1 and 2 Bryn Meddyg, Cwrtiau, Morfa Aber car park, 1-3 Station Road and Ty Bricks) due to changes to the views from them. The majority of

these would become **neutral** within 15 years after scheme opening as mitigation establishes, although **slight** adverse effects would still remain for Crymlyn farm and No's 1 and 2 Bryn Meddyg.

In the winter of the scheme opening year **slight** adverse effects are predicted for views from Footpath A (PRoW No. 43), Footpath K (PRoW No. 2), and the existing county road south from Wig Crossing Cottages to the A55(T). These would reduce to **neutral** by 15 years after scheme opening.

8.1.4 Nature Conservation

Construction period

The following significant impacts (all of local scale) have been identified on the ecological features in the vicinity of the Scheme during the construction period, before mitigation:

- Degradation of habitats associated with the SAC/SPA/SSSI/LNR, County Wildlife Sites, rivers and streams, otter foraging habitat and reptiles/amphibians arising from siltation and pollution incidents that are not properly managed
- Severance of bat flight paths through the cattle underpasses due to obstruction or loss of connecting habitat (hedgerows)
- Loss of approximately 0.05ha of mature mixed woodland from railway Line Wood 2, constituting a 2% loss from a site of 2.8ha
- Damage to a 40m strip of semi-mature trees along the edge of the Coed Bryn Meddyg County Wildlife Site
- Loss of trees and hedgerows during site clearance
- Loss of 0.23ha mixed and broad-leaved woodland and potential construction damage to retained trees
- Disturbance of the common pipistrelle roost within Tai'r Meibion Farmhouse
- Loss of bat foraging habitat and linear features used by bats for navigation (woodland and hedgerows)
- Loss/disturbance of actual or potential bat roosting habitat within trees
- Disturbance to otters passing along the watercourses
- Loss of badger setts during site clearance/earthworks
- Mortality of badgers during construction
- Disturbance to badgers in retained setts close to the scheme
- Loss of badger, polecat, hedgehog and breeding bird foraging habitat
- Destruction of active bird nests and/or disturbance of nesting birds during site clearance
- Potential disturbance of the nest site of a Schedule 1 bird (Red Kite)
- Reptile and amphibian injury/mortality during site clearance works
- Loss of reptile and amphibian habitat due to site clearance
- Injury/mortality of fish during in-river works
- Disturbance/disruption to fish and their habitats, due to construction activities including pollution risk and mobilisation of suspended solids
- Loss of bluebells currently present within wooded areas and scattered within the verges due to construction
- Potential for construction activities to cause the spread of a Schedule 9 invasive plant species (*Rhododendron ponticum*)

Operational phase

The following significant impacts (all of local scale) have been identified on the ecological features in the vicinity of the Scheme during the operational phase, before mitigation:

Adverse:

- Continued severance of bat flight paths through the cattle underpasses due to initial loss of connecting habitat (hedgerows)
- Loss of approximately 0.05ha of mature mixed woodland from Railway Line Wood 2, constituting a 2% loss from a site of 2.8ha
- Continued damage to a 40m strip of semi-mature trees along the edge of the site for which the Scheme runs through the root protection areas
- Continued reduction in tree and hedgerow habitat
- Continued reduction in woodland habitat
- Changes to hydromorphology of the watercourses due to extension or enlargement of the culverts
- Loss of approximately 70m of open watercourse in total due to extension of the culverts, including loss of the natural stream bed
- Continued reduction in bat foraging habitat and other navigational (linear) features
- Continued loss of bat roosting habitat due to initial tree removal
- Risk of increased mortality of badgers, otters, polecats, hedgehogs, reptiles and amphibians crossing the carriageway due to new concrete central reserve preventing any animals crossing both carriageways and potentially becoming trapped
- Continued reduction in badger, polecat and hedgehog foraging habitat due to initial loss
- Continued reduction in breeding bird nesting and foraging habitat due to initial loss
- Increased traffic speeds due to wider carriageway and loss of trees/woodland adjacent to the carriageway increasing the risk of Barn Owl road traffic mortality during operation
- Continued reduction in reptile and amphibian foraging and hibernation habitat
- Loss of 44m of potential stream habitat for fish due to culvert extensions
- Continued reduction in bluebells due to initial loss during site clearance
- Potential for increased Rhododendron within the vicinity of the Scheme, due to construction activities causing the spread of this Schedule 9 invasive plant species

Beneficial:

- Reduction in erosion in Stream 8 downstream of the Scheme due to geotextile lining likely to improve conditions for plant and animal species
- Improved access for bats, otters, badgers, polecats and hedgehogs underneath the A55(T) using the improved larger culvert proposed for the Afon Wig (stream 5), reducing the chance of road mortality and improving access to foraging habitat on the other side of the A55(T)
- Increase in otter foraging habitat due to the provision of a detention pond

8.1.5 Geology and Soils

Construction phase

No significant effects on geology, hydrogeology or contaminated land are predicted.

The soil within all areas of land required temporarily during the construction period, including the site compound, would receive a **moderate** but temporary adverse impact during this period through compaction and disturbance. Overall the significance of effect during the construction period would be **slight**.

Operational phase

As there would be an overall permanent loss of soils as part of the Scheme the magnitude of impact would be **moderate** adverse. However, as the environmental value is considered to be low the residual significance of effect is assessed as **slight**.

8.1.6 Materials

Construction phase

The generation of site clearance and excavated waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities has potential to create a **negligible** and **minor** adverse impact respectively.

The import of materials for the construction of the Scheme, which could reduce resource and availability of raw construction materials (and the associated risk of introducing contaminating substances or invasive species), has potential to create a **minor** adverse impact.

Movement of materials to/from the construction site causing temporary disturbance to traffic flows and increasing local air pollution and noise levels has potential to generate a **minor** adverse impact, while the movement of materials across the site, which could affect the integrity of ecological features and surface water quality, and can also generate dust which can impact environmental and human receptors has potential to generate a **moderate** adverse impact.

The storage and processing of earthworks and construction materials, which can impact upon sensitive ecological receptors directly through site clearance activities, by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment has potential to generate a **moderate** adverse impact.

Mitigation measures to remedy the adverse impacts identified above are identified in Section 8.2.6.

Operational phase

No significant adverse effects are anticipated being associated with Materials for the operational phase of the scheme.

8.1.7 Noise

Construction phase

Four properties are within the 100m distance at which construction noise is potentially a serious problem (No's. 1 & 2 Bryn Meddyg, Tai'r Meibion and Wig Farm), but this may be offset by the masking effect of the existing high traffic noise levels. During the construction period, local residents would suffer varying temporary adverse impacts from construction noise and vibration arising from excavation, earth-moving activities, compaction of materials and resurfacing works. Additionally, works for the extension of cattle underpasses at Tai'r Meibion and Wig Farm would create noise and vibration.

Construction noise levels will not be significant at protected sites within the study area. Noise impacts to users of the various PRowS that intersect the scheme will be **negligible** to **minor** adverse due to the temporal and short-term nature of potential exposure.

Operational phase

Apart from Wig Farm, all of the affected properties currently experience relatively high noise disturbance levels from traffic using the A55(T). There would be no net effect on Wig Farm and The Old School, whilst Tai'r Meibion would experience a reduction in noise levels, and in consequence disturbance, due to the introduction of a quieter road surface adjacent to this property. At No's 1 & 2 Bryn Meddyg a negligible and imperceptible increase in road traffic noise levels and disturbance is predicted as a direct result of the Scheme. This would result in an overall noise impact of **minor beneficial** to **negligible adverse** significance. As is similar for road traffic noise, the Scheme would result in an overall airborne vibration impact of **minor beneficial** to **negligible adverse** significance.

Given the dominance of road traffic noise generated by the A55(T), noise from the very low number of vehicle movements on the new access road, linking Wig Farm and Junction 12, would not be perceptible at the nearest properties. The operational impact would be of **negligible** adverse significance.

With respect to the protected sites within the study area, road traffic noise from the A55 will be negligible, with other localised noise becoming more dominant, and the noise change is assessed as **no change to negligible beneficial** due to the additional low-noise surfacing to be deployed.

Whilst the magnitude of change would be similar as those predicted at residential properties, the sensitivity of PRow users is less than for permanent residences due to duration and frequency of exposure. The impact significance to users of PRow would therefore be **negligible** adverse at worst.

8.1.8 Effects on All Travellers

Construction phase

Non-motorised Users

The restriction of pedestrian movements due to the closure of PRowS where they meet the A55(T) would be likely to result in a negligible adverse impact of **slight** significance. As pedestrian access onto the A55(T) is considered to be hazardous due to the high volume and speed of traffic, the prevention of these movements by restriction of access could be considered as an improvement to the current situation.

Temporary traffic management during the works could result in a moderate adverse impact of **slight** significance for movement of cyclists and equestrians in the area during the construction phase, particularly during the widening of an 860m length of Roman Road (Henffordd).

Views from the Road

The removal of existing boundary features would open up views to the surrounding landscape even further until new hedge lines become established. However, there would be temporary adverse visual impacts from construction plant and activities immediately adjacent to the route. Therefore, overall there is considered to be a negligible adverse impact to the Views from the Road during construction of a **slight** significance, which would be temporary and short term for the duration of the construction period.

Driver Stress

The traffic management arrangements during the construction period are currently unknown, however it is expected that a minimum of one lane would be open in each direction of traffic movement throughout the construction phase. There would however be an adverse impact on driver stress during the construction period due to disruption to usual traffic flows and potential delays brought about by traffic management. The implementation of traffic management during the construction phase is expected to incur a moderate adverse impact of **moderate** significance.

In addition to vehicle travellers along the A55(T) some disturbance upon users of Roman Road (Henffordd) is also expected to occur during periods of traffic management and road closures as this road is widened. Considering the volume of traffic affected and duration of works to Roman Road (Henffordd) the implementation of road closures and traffic management during the construction phase is expected to incur a moderate adverse impact of **slight** significance.

Operational phase

Some of the measures embedded within the outline design for the Scheme would provide opportunities to improve safety and accessibility for NMUs within the study corridor and therefore could represent significant beneficial effects during the operational phase. Such measures include:

- A new county road, Private Means of Access and NMU route parallel to the eastbound A55(T) carriageway, to provide alternative access to the fields and properties to the north.
- The unclassified Roman Road (Henffordd) widened for a length of approximately 860m from the access to Tai'r Meibion farm to approximately 180m west of the settlement of Crymlyn.
- A new footway between Tan yr Allt cottages and Llain y Ffwlbart to improve pedestrian access to the local bus service.

Non-motorised Users

The changes in amenity of the existing PRow network within the study area are not expected to be significant, though a small benefit by removing access onto/off the A55(T) is plausible. Overall the changes are expected to slightly increase the use of PRowS within the study area by making the network of footpaths safer and better integrated than the current situation, thereby generating a **minor beneficial** impact of **slight** significance.

Overall the changes are expected to slightly increase the number of cyclists within the study area by providing a suitable route which is a safer link between neighbouring sections of the North Wales Coastal Route (National Cycle Network No. 5) than the current situation, thereby generating a **moderate beneficial** impact of **slight** significance.

It is also considered that the Scheme would provide a suitable east-west route for equestrians through the study corridor via the new county road/NMU route, where such a route does not currently exist. Overall the changes are expected to slightly increase the number of equestrians within the study area by providing a suitable route which is a safer link to the surrounding countryside, thereby generating a **minor beneficial** impact of **slight** significance.

Views from the Road

Overall it is considered that the currently open views provided from the carriageway would remain, and that the Scheme would introduce a **minor beneficial** change of **slight** significance in vehicle travellers' ability to see the surrounding landscape.

Driver Stress

Driver stress levels are expected to remain at a low level due to the continued volume of traffic using the A55(T). However, as improvements to road standards are likely to reduce the perception of risk for drivers as well as improve the flow of traffic through the study area a **minor beneficial** improvement in driver stress levels of **slight** significance is expected.

The Scheme is expected to increase safety and reduce driver stress levels for residents of properties within the study area, which would benefit from improved access/egress on/from the A55(T) to/from key facilities on a day to day basis. A marked improvement in driver stress levels for residents of properties along the western (junction 12) side of Roman Road (Henffordd), Wig Crossing Cottages and all properties directly adjoining the A55(T) is therefore expected as a result of the Scheme.

8.1.9 Community and Private Assets

Construction phase

Agricultural Land Quality

The Scheme would involve the temporary loss of 5.5ha of Sub-Grade 3a, 2.8ha of Sub-Grade 3b and 0.8ha of Grade 4 agricultural land for working space, the use of which would be covered by easements and licences. The temporary loss of Sub-grade 3a land is considered to be of low magnitude and **moderate** adverse significance, while the loss of Sub-Grade 3b land is considered to be of negligible magnitude and **neutral** significance. The temporary loss of Grade 4 land is considered to be of negligible magnitude and **neutral** significance.

Farm businesses

Land take, severance and major accommodation works for access, drainage and water supply could temporarily affect six farm businesses to varying degrees during the construction phase.

Operational phase

Agricultural Land Quality

The Scheme would result in the permanent loss of approximately 2.8ha of Sub-Grade 3a land, the best and most versatile agricultural land in the area, and approximately 2.9ha of Sub-Grade 3b land. The small permanent loss of Sub-Grade 3a land is considered to be of negligible magnitude and together with the high sensitivity of this grade of agricultural land, the significance of the permanent loss of agricultural land is considered to be **slight** adverse. The permanent loss of Sub-Grade 3b land is considered to be of negligible magnitude and **neutral** significance.

Farm businesses

Affected landowners and agricultural tenants have been consulted regarding previous studies for the Scheme and therefore the outline design has largely been developed with the needs of farm businesses in mind. **Moderate, beneficial** impacts are predicted as a result of the closure of agricultural access onto/off the A55(T) and their replacement with safer alternative access provisions. The overall magnitude of impact on all farms is slight adverse and of **neutral** significance; the viability of the businesses are not threatened by the proposals.

8.1.10 Road Drainage and the Water Environment

Construction phase

Surface Water

There is potential for the Scheme to have an adverse effect on surface waters and groundwater receptors within the study area during the construction period through spillages of chemicals, cement and fuels into the watercourses. Increased siltation can occur during earthworks and in-stream works and can disrupt the natural environment of the watercourse. In-stream works can have implications for a number of a watercourse's attributes. Pollution entering the watercourse as a result could have implications for water quality. Another effect of in-stream works relates to the potential for disturbance of in-stream habitats and associated communities due to the clearance of in-stream and bankside vegetation. Culverting can also affect flow rates, which could in turn affect the ecological composition of the specific watercourse.

Hydromorphology and Hydrogeomorphology

During the construction period there is potential for changes to occur to the flow rates and capacity of the affected streams, which could have an adverse impact on their natural hydromorphology and

hydrogeomorphology. Any in-river works have the potential to change the hydromorphology of the streams and subsequently increase erosion.

Groundwater

Although there remains a potential for construction works to affect groundwater through storage of materials or accidental spillages, the secondary B aquifer that lies below the Scheme is not at risk of pollution from the works. Furthermore, any pollutants that do infiltrate the groundwater resource are considered likely to diminish over time through natural attenuation processes.

Fluvial flood risk

If work is undertaken within the floodplain and materials are stored within it this could increase flood risk resulting in a potentially minor adverse magnitude of impact. During high rainfall events the streams would become inundated with increased volumes of water, which would increase flood risk to the area during construction.

Pluvial flood risk

During intense and heavy rainfall events surface runoff onto the A55(T) at this location is significantly increased and there is significant risk of flooding from surface runoff from the fields to the south of the Scheme. Mitigation measures would therefore need to be implemented during construction to reduce flood risk from surface runoff during high rainfall events.

Due to the high sensitivity of the receiving watercourses the significance of these effects, before mitigation, could be up to moderate.

Operational phase

Hydromorphology and Hydrogeomorphology

Currently all of the streams within the study area are culverted under the A55; therefore they have already been altered from their natural state. Further extension of these culverts (up to almost 95m in total) will be required to accommodate the extended hard surface area. Lengthening culverts has the potential to impact upon the hydromorphology and hydrogeomorphology of the streams. Where culvert extensions are required energy dissipation and flow reduction mitigation will be applied. Although increased culvert lengths on all the streams will permanently change the natural stream channel at these locations, further adverse effects on the hydromorphology and hydrogeomorphology of the streams is not considered likely to occur during operation.

The proposed lining of Stream 8 has the potential to significantly alter its hydromorphology and hydrogeomorphology. However, the application of the lining will take into consideration the natural stream channel and replicate this as far as possible to ensure that the stream quality and flow regime is not adversely altered. The original materials from within the stream channel will be replaced on top of the lining to further replicate the stream channel. The lining will also allow for natural vegetation to permeate through the material. The use of the geotextile lining will reduce erosion rates significantly and therefore improve the current circumstances.

The upsizing of the culverts at stream 5 and 8 will allow water to flow more easily through them with less constraint than at present. The increased culvert size will therefore reduce erosion rates as the velocity of the water within the upsized culverts will be reduced. Although surface water will be discharged from the highway directly to the streams, the use of energy dissipation measures on each stream (e.g. baffle weirs) will reduce the rate of flows downstream and hence reduce any additional erosion that could occur.

Fluvial Flood Risk

The increased capacity of the culvert on stream 5 (Afon Wig) may increase flood risk downstream to Wig Crossing Cottages. Since it is essential that this upsizing does not cause any increased flood risk to these properties hydraulic flood modelling has been carried out, which confirmed that there would be isolated areas that show increase in flood risk to some properties during the 1 in 1000yr event (increased flood depth of up to 50mm), but a significant decrease during a 1 in 100yr+CC event; the full results can be found in the Flood Consequence Assessment (see Technical Report D, Volume 2). Mitigation of increased flood risk associated with Wig Crossing Cottages during the 1 in 1000yr event is therefore proposed as part of the scheme, with the detailed design aspects to be agreed with the property owners and NRW.

Flood Risk and Agricultural land

Through upsizing culverts at streams 5 and 8 there would be an increase of water that is able to reach downstream fields that would otherwise flood the A55(T). Hydraulic modelling for stream 5 for a 1 in 100 year + 30% and 1 in 1000 year event indicates that the fields associated with Wig Crossing Cottages would see an increase of flood depths estimated up to 200mm during a 1 in 1000year event. However, the location of these fields is within the fluvial floodplain for the Afon Wig and therefore naturally it would be expected that such locations would experience times of increased wetness. No other fields are expected to receive an increase in flood levels as a result of the Scheme. The Flood Consequence Assessment (see Technical Appendix D, Volume 2) outlines the potential changes to flood risk for the area surrounding the Scheme in more detail.

Pluvial Flood Risk

There is significant risk of pluvial flooding along the A55(T) from direct surface run off from the fields upstream of the A55(T). Runoff from these fields would be managed via a new bund and cut-off channel system and sufficient drainage to alleviate flood risk to the A55(T).

Increased Surface Runoff

Due to the increased hard standing area, there would be an increase in surface water runoff, which is therefore to be attenuated and controlled via the new drainage to levels similar to the current or below.

Effects of Routine Runoff on Surface Waters

During operation road drainage can impact the water environment through discharge of sediments, pollutants and volume of water. However, detailed calculations have confirmed that there would be no impact of routine runoff to surface waters during operation, as the change to predicted levels of dissolved copper or total zinc in the receiving watercourses is below the relevant thresholds. As a result, no additional pollution control measures are required for routine runoff. However, where possible surface water would be filtered and managed as close to source as possible to ensure that potential pollution is removed quickly and efficiently. The proposed detention pond and filter strips would also allow pollution to be removed from surface runoff water before discharging to streams.

The cattle underpasses will require improved drainage systems to allow movement of livestock and agricultural machinery. The drainage will be directed away from watercourses as slurry from the underpasses may cause significant pollution to the streams. The drainage design for the cattle underpasses will therefore be confirmed during the detailed design stage, with agreement from NRW.

As part of routine operational maintenance de-icing salts will be applied (as at present) and have the potential to enter the watercourses and affect the water quality. DMRB Volume 4, Section 2, Part 1 HA 103/06 recommends where the use of de-icing salt is likely to be very frequent and the dilution of runoff by receiving waters is low, flow should be diverted to infiltration facilities with groundwater protection or ponds.

In this case, the use of de-icing salt is not currently considered to be very frequent and is not expected to change significantly in the future. Furthermore, the proposed new drainage design would provide improved infiltration via SuDS in the form of grass filter strips and a detention pond before surface runoff enters downstream watercourses. In consideration of this, the current impact is assessed as being minor adverse and temporary, but likely to reduce to negligible adverse during the operational phase of the Scheme.

Pollution Impacts from Accidental Spillages

Pollution from accidental spillages during the operation of the Scheme is potentially the most damaging form of pollution to both surface and groundwater. The significance of the impact on water quality would depend on the nature of the spill, the concentration of contaminants released into the water and the speed at which the spillage enters the watercourse.

The risk of a pollution incident from accidental spillages within the Scheme is <0.5% and is therefore below the acceptable risk threshold recommended by HD 45/09 for sensitive waters (100 years). As a result, no significant effects are predicted and there is no requirement for pollution mitigation measures for accidental spillages to be incorporated into the Scheme design. However, pollution control measures would be provided at downstream outfalls to protect downstream areas in the event of an accidental spillage on the highway.

8.2 Summary of Mitigation Measures

Mitigation measures that have been proposed to reduce the magnitude and significance of the effects identified in Chapter 8.1 are summarised in this chapter. These represent scheme commitments that would form the basis of the Environmental Commitments Register and be incorporated within the CEMP.

8.2.1 Air Quality

Construction phase

Employment of construction best practice would ensure that no significant adverse dust or PM₁₀ impacts would occur during the construction phase. Site-specific mitigation measures based on the IAQM guidance¹²² have been identified for dust soiling, demolition, earthworks, construction and trackout activities associated with the construction phase; these are outlined in Chapter 5.1 (Air Quality) and would be included within the CEMP.

Operational phase

No mitigation measures are proposed during the operational phase as no significant effects are predicted.

8.2.2 Cultural Heritage

Construction phase

The scope of mitigation would be agreed in advance of the works with the archaeological curator for the scheme (Gwynedd Archaeological Planning Service) and formalised in a Written Scheme of Investigation.

The impact on the setting of historic features would be reduced by sensitive planting using species already in existence in the surrounding landscape and reinstatement of boundary features (see Section 8.2.3). Minimal lighting and signage would also be used wherever possible.

Mitigation for historic landscapes would consist of sympathetic design and planting, and reinstatement of boundary features, which would slightly lessen the adverse significance of effect identified, particularly by maintaining the local vernacular field boundary construction styles for any affected slate fences, cloddiau or hedges.

The following mitigation measures are proposed for the individual cultural heritage assets affected (see Figure 5.2.1, Volume 1a for asset locations):

Watching Brief (with appropriate recording if required):

- 12. Roman road south-east of Tan-yr-Allt (Caerhun-Caernarfon route)
- 27. y-Wig medieval township
- 30. part of Roman Road (Segontium – Canovium)
- 38. Coed Bryn Meddyg relict field system
- 49. Road E of Tan yr Allt Cottages to Crymlyn (Roman Road)

A watching brief would also be present during all excavation and soil stripping in order to ensure that unknown sites are identified and recorded. Any newly-discovered archaeological remains would be recorded to an appropriate level in advance of destruction.

¹²² Institute of Air Quality Management (IAQM) (2014) Guidance on the assessment of dust from demolition and construction

Basic recording:

- 17. Culverts, north of Tan-yr-Allt cottages
- 19. Retention Walls, north of Tai'r Meibion
- 25. Field boundaries, east of Tai'r Meibion
- 31. Field boundaries east of Wig
- 33. Wig garden
- 37. Quarry, Bryn Meddyg
- 52. Slate-built culvert
- 53. Stone and earth field boundary bank south of Tai'r Meibion

Detailed recording:

- 18. Hedgerow along Roman Road (along with reinstatement)

Sympathetic landscaping and reinstatement:

- 6. Farm buildings at Ty'n-y-Hendre
- 13. No. 1 Tan-yr-Allt cottages
- 14. No. 2 Tan-yr-Allt cottages
- 15. No. 3 Tan-yr-Allt cottages
- 16. No. 4 Tan-yr-Allt cottages
- 21. Tai'r Meibion
- 22. Farm buildings at Tai'r Meibion
- 23. Tai'r Meibion garden
- 24. Enclosed fields, south and east of Tai'r Meibion (and maintenance of historic features)
- 29. Wig Farm
- 33. Wig garden
- 34. Lowland coastal area around Wig
- 36. Cottages, Bryn Meddyg

Operational phase

No mitigation is required during the operational phase, although it is expected that replacement landscaping (including trees and hedgerows – see Section 8.2.3) would mature during this time to reduce the significance of residual adverse effects on the setting of historic features and appearance of historic landscapes remaining after construction.

8.2.3 Landscape

Construction phase

Landscape mitigation measures form an integral part of the overall proposals. They comprise a combination of earthworks, fencing, planting, grassland measures and other specific habitat creation measures, based on the following two broad objectives:

- Successful integration of the new route into the existing local landscape structure. This may include enhancement of the local landscape or specific features where appropriate, and;
- Mitigation of localised landscape character and visual impacts identified during the undertaking of the environmental assessment by the creation of a strong, ecologically-based landscape framework, developed to integrate with the local retained landscape features.

The following forms of outline mitigation measures have been utilised as part of the overall mitigation strategy (see Chapter 5.3: Landscape for further details):

- Planting;
- Restoration/retention of hedgerow patterns through new planting and, in selected locations, translocation of existing hedgerows, and;

- Creation of ecological diversity and interest.

A number of planting and seeding forms have been adopted to reflect the identified landscape character found throughout the length of the road corridor. These are based on landscape elements as described in DMRB Volume 10, Section 0, Part 3 (HA88/01), as indicated below.

Grassland (LE1)

Two types of grassland mix are proposed:

- Species Rich Grassland (LE1.3) - specifically selected 'wildflower mixes' appropriate to the location and applied across the verge on nutrient poor subsoils (see also Chapter 5.4 – Ecology and Nature Conservation); and,
- Open Grassland (LE1.6) - a standard mix used for the areas to be returned to agriculture.

Native Planting (LE2)

Four types of native planting are proposed:

- Woodland (LE2.1) - Planting comprising a mix of transplants, whips and feathered trees using climax tree species and under-storey where appropriate to establish multi-layered woodland with a mix of native species dominated by oak;
- Shrubs (LE2.6) - Planting comprising native, lower growing shrub species common in the locality;
- Scattered Trees (LE2.7) - Planting comprising a mixture of transplants, whips and feathered native deciduous tree species, forming or capable of forming small scattered groupings, and;
- Native Hedgerow with Trees (LE4.4) - Planting comprising mixed hedgerows containing common individual hedgerow trees.

Operational phase

No mitigation measures are proposed for the operational phase; the planting provided during the construction period will continue to establish during the operational phase. All planting would be subject to a three year establishment period, during which it would be monitored and additional or replacement planting would be provided where planting has failed to establish successfully.

8.2.4 Nature Conservation

Impact: Degradation of habitats associated with the SAC/SPA/SSSI/LNR, County Wildlife Sites, rivers and streams, otter foraging habitat and reptiles/amphibians arising from siltation and pollution incidents that are not properly managed

Proposed mitigation:

- Best practice guidelines including PPG and CIRIA guidance would be followed when working in/near to watercourses. The mechanism for ensuring the delivery would be through the CEMP and associated Method Statements for the works, to be agreed in advance with NRW. The CEMP would include regular monitoring of surface water quality during construction. In addition, a plan to deal with environmental (and other) emergencies would also be put in place.
- Dust generation during construction activities would be controlled using best practice measures (see Chapter 5.1: Air Quality).
- Statutory Drainage Consents would be required for works associated with all of the watercourses within the proposed scheme corridor. All mitigation described within these consents would be undertaken, including pollution prevention measures.
- Construction personnel would be made aware of the sensitive environment of the works through toolbox talks provided by a suitably qualified Environmental Manager or Environmental Clerk of Works, as appropriate.

Impact: Loss of approximately 0.23ha of mixed and broad-leaved woodland (including 0.05ha in Railway Line Wood 2 County Wildlife Site) and potential construction damage to retained trees, damage to a 40m strip of semi-mature trees along the edge of the Coed Bryn Meddyg County Wildlife Site.

Proposed mitigation:

- Tree protection measures in accordance with BS5837:2012 would be utilised to prevent damage to all retained trees during construction
- Total area of 0.26ha of native broad-leaved woodland to be planted in a number of locations to the north and south of the A55(T)

Impact: Loss of trees and hedgerows during site clearance

Proposed mitigation:

- Replanting (with species-rich native broad-leaved hedgerows), translocation or retention of all hedgerows
- Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) so that the total length of all hedgerows translocated/replanted/added would be 8.6km
- Planting of native broad-leaved woodland (0.26ha), scrub (0.03ha) and scattered trees (0.26ha) in a number of locations to the north and south of the A55(T) to provide a larger area of trees than the area lost
- Loss of semi-mature or mature standard trees within the hedgerows to be removed adjacent to the A55(T) to be replaced by small groups of young native trees to be managed as standards within new/translocated hedgerows
- The three large mature oaks that would be removed from within the Roman Road hedgerow (two) and adjacent to the Afon Wig to the north of the A55(T) (one) to be retained on site in close proximity to retained large mature/veteran trees in order to allow some of the associated species to recolonize existing habitat

Proposed compensation:

Loss of 3 large mature oaks to be compensated by planting of trees within field corners and boundaries to the north of Roman Road, to be managed as standard trees (approximately 11 standard trees proposed after thinning)

Impact: Changes to hydromorphology of the watercourses due to extension or enlargement of the culverts leading to increased erosion

Proposed mitigation:

Energy dissipation measures at the outfalls of the culverts to prevent flooding downstream would reduce erosion rates

Impact: Loss of approximately 70m of open watercourse in total due to extension of the culverts, including loss of the natural stream bed

Proposed compensation:

The improvement of 200m of stream 8 due to the reduction in erosion caused by the geotextile lining and measures to improve access for migratory fish and other aquatic animal species to the south side of the A55(T) would compensate for this loss. The proposed detention pond would also provide additional aquatic habitat

Impact: Risk of increased mortality of badgers, otters, polecats, hedgehogs, reptiles and amphibians crossing the carriageway due to new concrete central reserve preventing any animals crossing both carriageways and potentially becoming trapped

Proposed mitigation:

- Provision of 200mm diameter holes in the safety barrier at a minimum of 50m intervals where the height difference each side of the barrier is less than 50mm.
- Provision of 125mm diameter holes in the barrier wherever possible

Improved access underneath the A55(T) due to:

- Mammal ledges/shelves within enlarged culvert at Stream 5 (Afon Wig)
- Dry pipes at Streams 2 and 6
- Use of otter/badger accessible grilles over culvert mouths at Stream 6 to replace existing grilles
- Otter/badger-proof fencing to guide animals towards safe crossing points and away from the A55(T)

Impact: Severance of bat flight paths through the cattle underpasses due to obstruction or loss of connecting habitat (hedgerows)

Proposed mitigation:

- Any obstructions in the vicinity of the cattle underpasses to be removed between sunset and sunrise during construction
- Site facilities to be located at least 150m away from cattle underpasses and any construction lighting directed away from them
- Any boundaries leading into the cattle underpasses that are lost, to be replaced by temporary navigational features (such as hurdle fencing) during construction until navigational features are restored. Hurdle fencing also to be provided between the Tai'r Meibion cattle underpass and Railway Line Wood 2
- Translocating/re-planting hedgerows in the vicinity of the cattle underpasses

Impact: Disturbance of the common pipistrelle roost within Tai'r Meibion Farmhouse

Proposed mitigation:

- Location of any site facilities to the south of the A55(T) at least 150m away from the Tai'r Meibion roost
- No night-time working or lighting in the vicinity of the roost and any required for works on the carriageway to be directed away from the roost

Impact: Loss of bat foraging habitat and linear features used by bats for navigation (woodland and hedgerows)

Proposed mitigation:

- Replanting (with species-rich native broad-leaved hedgerows), translocation or retention of all hedgerows
- Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T) to create an additional sheltered foraging corridor
- Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost

Impact: Loss/disturbance of potential roosting habitat within trees

Proposed mitigation:

- Full endoscope survey of all mature trees to be removed prior to their removal and trees immediately adjacent to the proposed works. For each tree with bats or potential for bats recorded, three tree bat boxes to be erected within suitable habitat nearby and suitable replacement tree stock planted
- Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker
- If actual roosts recorded during endoscope survey, an EPS disturbance licence for bats to be obtained from NRW and associated mitigation undertaken
- Planting of native broad-leaved woodland and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than that lost
- Loss of mature standard trees within the hedgerows to be removed adjacent to the A55(T) to be replaced by small groups of young native trees to be managed as standards within new/translocated hedgerows

Impact: Disturbance to otters passing along the watercourses during construction

Proposed mitigation:

- Pre-construction survey to check for resting places and associated mitigation if any found in close proximity to proposed works
- Location of site facilities at least 30m away from any watercourse
- Minimal lighting in vicinity of watercourses and all construction lighting directed away from watercourses

Impact: Loss of badger setts during site clearance / earthworks

Proposed mitigation:

Badger licence and associated mitigation, expected to include:

- Provision of an artificial sett 6 months in advance of sett closure
- Sett closure according to standard guidelines, including 3 weeks' monitoring prior to destruction under ecological supervision
- Sett destruction and all licensed works within the vicinity of active badger setts to be undertaken between July and November inclusive (outside badger breeding season)
- Monitoring / aftercare will be undertaken on a minimum twice annual basis for one year post-construction, subject to agreement with NRW at the licence application stage; this requirement will be incorporated into the CEMP (Aftercare).

Impact: Disturbance to badgers in setts to be destroyed and retained setts close to the scheme

Proposed mitigation:

As above and:

- Construction lighting minimised in vicinity of remaining active setts
- Site compounds, welfare units and generators to be positioned at least 50m away from the locations of active badger setts

Impact: Mortality of badgers during construction

Proposed mitigation:

As above and:

- Pre-construction survey to check for further active setts

- Covering any excavations or providing an egress for trapped animals
- Location of site facilities at least 50m away from remaining active setts

Impact: Loss of badger, polecat, hedgehog and breeding bird foraging habitat

Proposed mitigation:

- Replanting (with species-rich, native broad-leaved hedgerows), translocation or retention of all hedgerows
- Planting of an additional hedgerow along the northern side of proposed county road and NMU route to the north of the A55(T)
- Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost

Impact: Destruction of active bird nests and/or disturbance of nesting birds during site clearance

Proposed mitigation:

Vegetation removal outside breeding bird season (between March and August inclusive) or ecologist check for active nests immediately prior to removal

Impact: Potential disturbance of the nest site of a Schedule 1 bird (Red Kite)

Proposed mitigation:

- Preconstruction check for red kite nests in the vicinity of the proposed works particularly near Roman Road, in the April prior to any scheduled works in this area
- If any active red kite nests are found that could be disturbed, construction activities to be programmed to avoid the area during the nesting period

Impact: Increased traffic speeds due to wider carriageway and loss of trees/woodland adjacent to the carriageway increasing the risk of Barn Owl road traffic mortality during operation

Proposed mitigation:

- *Replanting, translocation or retention of all hedgerows*
- *Planting of woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) which would provide a greater length of wooded or tree-lined carriageway than exists at present, helping to encourage owls to fly higher over the carriageway*

Impact: Reptile and amphibian injury/mortality during site clearance works

Proposed mitigation:

- Ecological Watching Brief during the translocation/removal of hedgerows, clearance of woodland and scrub and topsoil stripping in these areas
- Translocation of any reptiles/amphibians found to a suitable receptor site

Impact: Loss of reptile and amphibian habitat due to site clearance

Proposed mitigation:

- Replanting (with species-rich native broad-leaved hedgerows), translocation or retention of all hedgerows
- Planting of an additional hedgerow along the northern side of proposed county road/PMA/NMU route to the north of the A55(T)
- Planting of native broad-leaved woodland, scrub and scattered trees in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost

Impact: Injury/mortality of fish during in-river works

Proposed mitigation:

Statutory Consents and associated mitigation for working in watercourses, expected to include fish rescues where required (e.g. Afon Wig)

Impact: Disturbance/disruption to fish and their habitats, due to construction activities including pollution risk and mobilisation of suspended solids

Proposed mitigation:

- Pollution prevention measures as described above
- Direct lighting of watercourses that could support migratory fish (e.g. Afon Wig) to be avoided where possible, particularly during spawning season (generally 16th October to 16th April)
- All construction lighting in vicinity of watercourses to be shielded and directed away from watercourses
- All site compounds, welfare units and generators to be located at least 30m away from watercourses

Impact: Loss of 44m of potential stream habitat due to culvert extensions

Proposed mitigation:

- Energy dissipation measures would be installed at the discharge outfall of all the watercourses to reduce erosion, minimising habitat lost
- Improvements to fish passage through culverts at streams 5 and 6 due to energy dissipation measures downstream and a regraded channel upstream with baffles and weirs to create habitat suitable for fish passage – this would increase habitat available to fish through improved passage and also reduced erosion

Impact: Loss of bluebells currently present within wooded areas and scattered within the verges due to construction

Proposed mitigation:

- Topsoil from wooded areas containing bluebell bulbs to be re-used in areas of proposed planting
- Seed mix containing bluebell to be used in the more shaded areas of the Scheme
- Planting of native broad-leaved woodland in a number of locations to the north and south of the A55(T) to provide a larger area than the area lost would provide additional habitat for the species

Impact: Potential for construction activities to cause the spread of a Schedule 9 invasive plant species (*Rhododendron ponticum*)

Proposed mitigation:

- Topsoil from wooded areas potentially contaminated with *Rhododendron* seed (Railway Line Wood 2) to be re-used in adjacent areas of proposed planting and not moved to another location
- Measures to treat, control and prevent the spread of *Rhododendron* within the footprint of the Scheme to be included in the CEMP and HEMP

8.2.5 Geology and Soils

Construction phase

No mitigation measures are proposed for geology as no significant effects are predicted.

All areas where no site traffic is permitted during the construction period will be clearly defined in order to reduce the level of compaction of the existing soils.

During the construction period, areas of topsoil to be stripped will be stored and (where required) reinstated accordingly on completion of the work. The following mitigation measures will apply for all soil disturbed, and would form part of the Contractor's Construction Environmental Management Plan (see Chapters 2.5 and 7):

- Topsoil and subsoil layers will be identified and clearly defined before being stripped and stored separately under favourable weather conditions so that a proper soil profile can be re-established, with consideration that low nutrient soils are required for the new verges (see Chapters 5.3: Landscape and 5.4: Nature Conservation).
- Soils for reinstatement shall be derived from the site. Storage mounds will be located locally in small batches and re-used in as close to the original location as possible; they shall not exceed 2m in height (see Chapter 5.6: Materials).
- Soil handling will be avoided during wet conditions and shall not be compacted by heavy machinery once spread. Soil shall be kept free of injurious and non-native invasive weeds such as Japanese Knotweed.

Standard pollution control measures based on best working practices will be implemented during construction. Those of relevance in relation to protection of soils and waters are:

- PPG 1: General guide to pollution prevention
- PPG 2: Above ground storage tanks
- PPG 4: Disposal of sewage where no mains drainage is available
- GPP 5: Works in, near or liable to affect watercourse
- PPG 6: Working at construction and demolition sites
- PPG 21: Pollution incident response planning
- PPG 22: Dealing with spills.

If sources of contamination are found during the construction works efforts to remove any source, pathway or receptor linkages will be implemented.

Operational phase

No mitigation measures are proposed during the operational period as no significant effects are predicted.

8.2.6 Materials

Decisions and measures to minimise environmental effects generated from the use of materials and generation of waste would mainly be implemented during detailed design and construction of a project. In order to direct the main contractor and detailed designer towards resource efficient solutions the following series of contractual requirements will provide a framework for sustainable decision making:

CEEQUAL

It is envisaged that the framework provided by the CEEQUAL assessment manual will be used to integrate the principles of sustainable development into the design and construction of the Scheme.

Site Waste Management Plan

Part of the duties placed upon the eventual contractor and their designers would be the preparation and early implementation of a Site Waste Management Plan, allowing waste management principles to be adopted from the outset. Consideration of waste at the detailed design stage through implementation of a SWMP will allow mitigation to be incorporated into the design and for such measures to become part of the scheme; this approach will help to identify opportunities to 'design out' waste prior to construction and allow suitable receptor sites to be identified for surplus waste materials as necessary.

Construction Environmental Management Plan

The eventual contractor would be required to establish a Construction Environmental Management Plan (CEMP, see Chapter 7), the main purpose of which is to enable management of the construction phase to minimize all potential environmental impacts. The CEMP would identify procedures to minimize the impacts associated with the following Materials aspects:

- additional land take selection
- use of temporary working areas
- storage of materials next to watercourses
- nuisance caused by construction traffic
- generation of dust

The reuse of excavated material from earthworks activities would minimise the volume of imported fill required and the volume of waste removed from site for disposal. Using site-won material within the Scheme would mitigate the potential impacts of using large quantities of raw materials and limiting HGV trips associated with construction.

The main contractor will be required to develop plans for the treatment of waste materials from site based on the waste hierarchy.

Imported materials would be from approved sources and the suitability of the material checked. For imported earthworks materials, appropriate chemical testing would be undertaken to confirm that no contamination is present within them (see also Chapter 5.5: Geology and Soils).

To mitigate the potential impacts of transporting materials to site, material would be derived from the nearest practicably available source and suitable location.

Temporary working areas including compounds, storage areas and haul roads will be positioned to avoid sensitive ecological receptors (see Chapter 5.4: Nature Conservation). The temporary storage/processing of materials will follow best practice guidance measures, implemented via the CEMP, to prevent the generation of dust (see Chapter 5.1: Air Quality) and silt-laden run-off towards existing surface water receptors (see Chapter 5.10: Road Drainage and the Water Environment), and would also limit stockpile heights to maintain structure of topsoil during storage (see Chapter 5.5: Geology and Soils).

8.2.7 Noise

Construction phase

Under the Conditions of Contract for the works, the contractor would be required to prepare a CEMP (see Chapter 7), for agreement with the Local Authority Environmental Officers, detailing:

- Plant, machinery and construction techniques to be used;
- Timings of the works;
- Access routes to the areas included in construction;
- Noise thresholds;

- Standard best practicable means in accordance with the statutory requirement of the Code of Practice documents (BS5228 Parts 1 & 2);
- Noise and/or vibration monitoring (if required, scope to be agreed with LA EHO based on assessed risk and duration of works);
- Communication/prior notification requirements, and;
- A formal complaints process.

Operational phase

No mitigation measures are proposed during the operational period as no significant effects are predicted.

8.2.8 Effects on All Travellers

Construction phase

Good site working practices, including clear signage and consideration of the effects on all travellers when designing traffic management measures, would be employed during the construction phase.

Traffic management along Roman Road (Henffordd) during this period will require the main contractor to make alternative arrangements for users (including cyclists).

Operational phase

The embedded design measures (see Section 8.1.8) are aimed at providing ongoing access for all travellers within the study corridor on completion of the work. One of the main aims of the Scheme is to improve safety standards for users of this section of the A55(T) so beneficial effects are therefore predicted for this group and no mitigation measures are proposed during the operational phase.

8.2.9 Community and Private Assets

Construction phase

Agricultural Land Quality

With the correct specification as to soil stripping, storage and replacement, it is considered that the land utilised temporarily during the construction phase can be restored close to its former productive capacity in the medium term.

Care would be applied during the construction period to ensure that the temporary land-take would not extend beyond the currently estimated figures. This would be achieved by fencing the extent of the scheme footprint thereby preventing access onto adjacent areas of agricultural land.

Farm businesses

The following general accommodation works would normally be provided or paid for by way of compensation. However, all such works would have to be agreed with the landowner/occupier beforehand and are not currently firm commitments as part of the scheme:

- Services: Special attention would be paid to maintaining existing services currently serving the land e.g. water supplies, irrigation mains and drainage.
- Returning Land used for Temporary Construction to the Owner: Where land is acquired for construction, it would be returned at a suitable gradient to allow current agricultural practises to continue.
- Reorganisation of Field Boundaries: Appropriate access to the affected fields would be provided where required and any farm boundaries such as hedgerows, fences and walls

affected during construction would be reinstated to maintain the boundary and restore landscape and ecology features. Farm boundaries would generally be reinstated like for like.

Further design and mitigation measures would be provided for the six agricultural holdings affected, although many of the measures outlined are accommodation works to be discussed with the relevant landowner/occupier and are therefore not firm commitments as part of the scheme.

Operational phase

No mitigation measures are proposed during the operational phase as no significant effects are predicted.

8.2.10 Road Drainage and the Water Environment

Construction phase

A Construction Environmental Management Plan (CEMP) would be compiled to provide targeted guidance throughout the construction period (see Chapter 7). This would detail both generic and specific instruction to enable construction to be undertaken with minimal impact on the water environment and ensure appropriate consents are obtained prior to works commencing.

Consultation with NRW and Gwynedd Council as LLFA would also occur prior to undertaking any works with the potential to adversely affect water attributes.

The risk of pollution during construction would be reduced by the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidelines (PPGs), Guidance for Pollution Prevention 5 and CIRIA guidance. The key guidelines with regard to the construction of the Scheme and water features are:

- PPG 1: Understanding your environmental responsibilities - good environmental practice
- PPG 2: Above ground oil storage tanks
- PPG 3: Use and design of oil separators in surface water drainage systems
- PPG4: Treatment and disposal of sewage where no foul sewer is available
- GPP 5: Works and maintenance in or near water
- PPG 6: Working at Demolition and Construction Sites
- PPG 22: Dealing with spills
- Control of pollution from highway drainage discharges (CIRIA report 142)
- Control of water pollution from construction sites (CIRIA C532)
- Containment systems for the prevention of pollution (CIRIA C736)
- The SuDS Manual (CIRIA C753)

Generic prevention and mitigation measures that would be applied prior to and during construction, as part of the CEMP, include:

- Provision of adequate temporary storage to contain surface runoff during the construction period, particularly when there are large areas of exposed earthworks as these lead to substantial increases in surface flows during intense rainstorms and can carry silt to receiving watercourses.
- On-site availability of oil spill clean-up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak.
- Use of drip trays under mobile plant.
- Sediment-trapping matting installed downstream of any construction activities adjacent to or over watercourses.
- Preparation of incident response plans, prior to construction, and present on site throughout construction to inform sub-contractors of required actions in the event of a pollution incident.
- Timing of works close to watercourses so that they do not interfere with spawning fish.

- The use of construction materials on site that are free from contaminated material to avoid any potential contamination of the watercourse.
- Ensuring that wet concrete does not come into contact with river or groundwater.
- Testing of made soils and soils that would be reworked to identify any soil contamination.

Sediment and erosion control and monitoring measures would be implemented, following consultation with NRW, to ensure that increased siltation and erosion does not occur during construction (see also Chapter 5.4: Nature Conservation).

During construction an incident response plan would be in place to deal with any issues as soon as they occur and to ensure that works are undertaken with the utmost care where they have potential to lead to contamination of any watercourse. Emergency action planning would include measures to be taken to prevent pollution caused by severe weather.

Wherever practicable, grey water systems would be used at site compounds to reduce runoff from site, improve water efficiency and lessen the potential for polluting discharges to surface watercourses.

Surface water

Good working practices would include, in so far as is practicable, the implementation of the PPGs and the CIRIA Pollution Prevention guidelines¹²³. Measures to avoid the contamination of surface waters during construction would be incorporated into the construction programme and method statements, and would be agreed with NRW prior to the commencement of works. The need to prepare and enforce appropriate working practices during construction would be included in the CEMP. This would include the requirement for appropriate training of site staff on water environment issues. An agreed contingency plan to deal with emergencies would also be established.

By employing the best practice techniques listed below, the risks of pollutants reaching surface water features would be minimised to a level where any events that did occur would be contained and limited in scale:

- The use of concrete would be monitored carefully to ensure no accidental discharge into any watercourse;
- Mixer washings and excess concrete would not be discharged to water;
- All fuel, oils or chemicals stored on site would be located as far as is reasonably possible, and in no case less than 10m from any water body;
- Stores would be surrounded by an effective and impervious bund capable of holding the full contents of the store plus 10%. Protocol for the storage of fuel, equipment and construction materials, so as to minimise the risk of water pollution, is provided within PPG2;
- Dust suppression measures would be required in order to prevent entry of suspended solids into nearby water bodies, particularly in dry weather conditions (see Section 8.1.1: Air Quality);
- No plant would be used in-stream without prior consent from NRW. Plant operators and contractors would check vehicles and mobile plant on a daily basis for fuel and oil leaks and suitable maintenance would be promptly carried out, and;
- Plant and wheel washing facilities would be sited appropriately. To prevent indiscriminate washing out of the mobile plant, designated wash-out bays would be employed on site. This would avoid cementitious materials from being washed out directly onto the ground. Once

¹²³ Control of pollution from highway drainage discharges (CIRIA report 142), Control of water pollution from construction sites (CIRIA C532), Containment systems for the prevention of pollution (CIRIA C736)

full, the wash out sumps would be pumped into a tanker for disposal off-site at a licensed disposal point. No wash waters would be discharged to surface waters. Refuelling of construction equipment would only occur at locations remote from surface water features.

Regular monitoring of the surface water quality will be carried out throughout the construction period to check for any changes to the water quality.

Groundwater

Precautionary measures would be taken during construction to minimise the potential for contaminants to reach any perched groundwater that may be present.

Best practice techniques, as outlined in the PPGs, would be employed throughout the construction process to minimise the risk of spillages. Appropriate phasing and scheduling of construction activities would play a key role in mitigating potential impacts. Measures to avoid the contamination of groundwater during both construction and operation would be agreed with NRW prior to the commencement of works.

Hydromorphology and Hydrogeomorphology

Impacts on hydromorphology and hydrogeomorphology will be reduced using best working practices and reducing in-stream works. In-stream works will also not be permitted under high flow conditions.

Flood Risk

To ensure that flood risk is not increased during construction the following mitigation measures will be adopted:

- Storage of materials and vehicles will not be within the floodplain or within areas known to have flooded in the past.
- In-stream works will not occur during times of increased rainfall and high flows.
- Increased runoff caused by compound or site areas will be restricted and attenuated to reduce increased runoff from increased impermeable surfaces into the watercourses.

Operational phase

Surface Water

Surface water runoff from the highway would be managed by the improved drainage network. The use of SuDS in the form of filter drains, filter strips, over the edge drainage and a detention pond would be combined with over-sized pipes to allow efficient removal of excess water from the carriageway.

Although the spillage risk is below the applicable threshold for requiring pollution control measures to be provided, pollution control points would be installed at the outfalls of each watercourse (see Chapter 5.10). Subject to agreement with NRW at the detailed design stage, such pollution control measures would typically include a chamber and isolation valve that would cut off flows from the highway, and can be remotely triggered to close in a few seconds.

The cattle underpasses will require improved drainage systems to allow movement of livestock and agricultural machinery. The drainage will be directed away from watercourses as slurry from the underpasses may cause significant pollution to the streams. The drainage design for the cattle underpasses will be confirmed during the detailed design stage, with agreement from NRW.

The new farm accesses are considered not to affect the current effluent management requirements of the farms and the movement of livestock will not be altered significantly. Any changes at the detailed design stage will be assessed and evaluated in consultation with NRW.

Hydromorphology and Hydrogeomorphology

The increase in drainage discharge to streams will increase flow volumes and increased culvert size and length will increase flow rates; therefore energy dissipation measures will be incorporated to mitigate these changes at each stream, such as baffle weirs to dissipate energy, river training walls to ensure the river geometry is retained and weirs. The inclusion of the detention pond, filter strips and the flood bund will help to reduce discharge rates to ensure that flow rates are not increased from current flow rates.

The hydromorphology and hydrogeomorphology will be altered within Stream 8 as there will be a 200m stretch of the stream lined using a geotextile material as an erosion reduction and prevention measure. The lining material will be a flexible geotextile that will replicate the natural stream bed. To mitigate against significantly altering the characteristics of the stream, the river bed will be replicated to ensure that the WFD classification of the stream is not negatively altered through significant changes to the hydromorphology and hydrogeomorphology. The use of the natural stream bed material on top of the lining will further ensure the stream hydromorphology and hydrogeomorphology is not adversely altered, ensuring that channel roughness is replicated. Refer to the Erosion Prevention and Sediment Control Plan, Technical Appendix D, Volume 2 for further details.

Winter maintenance

During the operation of the Scheme it would be ensured that the maintenance contractors comply with current Environment Agency guidance and specifications as detailed in PPG10: Guidelines for storage of salt. It would be ensured that the use of de-icing salts would follow accepted practice and methodologies.

Fluvial flood risk

Mitigation of increased flood risk associated with Wig Crossing Cottages during the 1 in 1000yr event would include a wall/bund surrounding Wig Crossing Cottages and increased outfall points surrounding the properties; with the detailed design aspects to be agreed with the property owners and NRW. The model outputs illustrate that the upsizing of the culvert combined with these mitigation measures and the bund/channel along the southern side of the A55(T) carriageway upstream, significantly reduces the overall flood risk to Wig Crossing Cottages.

However, following concerns raised by NRW and the residents of Wig Crossing Cottages in relation to the potential for surface water to pool behind the proposed wall, further drainage has been incorporated into the Scheme at this location to ensure that Wig Crossing Cottages are not at increased risk of surface water flooding. An additional outfall from the railway embankment of a minimum 300mm diameter to remove surface water is proposed, along with a minimum 300mm diameter pipe incorporated within the surface water drainage to the south of Wig Crossing Cottages draining into the Afon Wig (Stream 5) from the Wig Crossing Cottages access track. The increased outfalls and drainage of surface water will ensure that Wig Crossing Cottages will not be at increased risk of surface water pooling behind the proposed mitigation wall.

Measures to manage the risk of blockages of culverts have been incorporated into the Scheme. These include improved trash screen arrangements including safe access to facilitate regular maintenance and clearing.

Pluvial flood risk

To reduce pluvial flood risk a new bund would be constructed along the westbound carriageway from Tai'r Meibion (NGR: 263051, 371736) to east of stream 8 (NGR: 265087, 372605) combined with a channel to drain any excess water.

Increased surface water runoff

Attenuation facilities would be provided to ensure that surface water runoff from the highway is restricted to existing or below existing runoff. Storage would be provided to contain the volume of a 1% (1 in 100) flood event, plus an allowance of 30% for climate change.

Runoff from the highway would be restricted using controls such as orifice plates or hydro brakes and attenuation would be provided by a pond. Suitable access provision would be provided to all attenuation facilities to allow for future maintenance. Further details can be found in the Flood Consequence Assessment in Technical Appendix D, Volume 2.

Water Framework Directive

Compliance with the WFD has been considered within this assessment (see Technical Appendix D, Volume 2 for further details). A number of mitigation measures have been considered for each element of the Scheme and are summarised below:

- To lessen the impact to the hydromorphology/hydrogeomorphology and aquatic ecology, a box culvert instead of a pipe culvert would be used to upsize Stream 5. The structure would also include a weir at the upstream cascades, with potential benefit for fish, while a baffle weir will be included downstream to reduce the velocity of the flow, allowing the passage of animals and to aid the natural build-up of sediments.
- The new culvert for the Afon Wig (stream 5) would incorporate a raised mammal ledge/shelf on each side (see Chapter 5.4: Nature Conservation).
- All culverts would have erosion control measures downstream of them. The exact designs at the transition points between the natural and artificial channels would be managed with respect to the WFD throughout the detailed design process of the Scheme.

Liaison with NRW has been undertaken as part of the Scheme design process, and agreement with NRW is required at the detailed design stage on which measures are essential to include within the Scheme to ensure compliance with the WFD.

The installation of in-river structures such as road culverts can pose limitations upon the ability of migratory fish (and mammals) to move freely towards upstream reaches of a watercourse under particular flow conditions, this will have a consequential impact upon the status of fish species within a watercourse (and movement of mammals). Measures to help avoid such problems would be considered during detailed culvert design and agreed with NRW, and informed by technical design guidance published by the Environment Agency (EA) and the Scottish Environmental Protection Agency (SEPA).

Chapter 9.0: Abbreviations

This chapter provides a summarised reference of the abbreviations that have been used in this ES.

AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic (Monday – Friday)
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASIDOHL	Assessment of the Significance of the Impact of Development on Historic Landscape Areas
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BS	British Standard
BTO	British Trust for Ornithology
CEEQUAL	The Civil Engineering Environmental Quality Assessment and Award Scheme
CEMP	Construction Environmental Management Plan
CEMPA	Construction Environmental Management Plan (Aftercare)
CIRIA	Construction Industry Research & Information Association
CRoW Act	Countryside and Rights of Way Act, 2000
CRTN	Calculation of Road Traffic Noise
DEFRA	Department for the Environment, Food and Rural Affairs
DM	Do Minimum scenario <i>i.e.</i> without the Scheme
DMRB	Design Manual for Roads and Bridges
DS	Do Something scenario <i>i.e.</i> with the Scheme
EAN	Environmental Advice Note
EC	European Commission
ECR	Environmental Commitments Register
ECoW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPS	European Protected Species
EPUK	Environmental Protection UK

ES	Environmental Statement
EQS	Environmental Quality Standards
EU	European Union
FCA	Flood Consequence Assessment
GAPS	Gwynedd Archaeological Planning Service
GAT	Gwynedd Archaeological Trust
GCR	Geological Conservation Review
GHGs	Greenhouse Gases
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPP	Guidance for Pollution Prevention
GQA	General Quality Assessment
HAWRAT	Highways Agency Water Risk Assessment Tool
HDV	Heavy Duty Vehicle
HEMP	Handover Environmental Management Plan
HER	Historic Environment Register
HGV	Heavy Goods Vehicle
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
ICOMOS	International Council on Monuments and Sites
IEEM	Institute of Ecology and Environmental Management
JLDP	Joint Local Development Plan
JLTP	Joint Local Transport Plan
JNCC	Joint Nature Conservation Committee
LANDMAP	Landscape Assessment and Decision-Making Process
LAQM	Local Air Quality Management
LAQM.TG	Local Air Quality Management Review and Assessment Technical Guidance
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LDP	Local Development Plan
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LPA	Local Planning Authority
LTP	Local Transport Plan
MAFF	Ministry of Agriculture, Fisheries and Food

NERC Act	The Natural Environment and Rural Communities (NERC) Act, 2006
NGR	National Grid Reference
NIR	Noise Insulation Regulations 1975 (amended 1988)
NMU	Non-motorised User
NMWTRA	North and Mid Wales Trunk Road Agent
NNR	National Nature Reserve
NO _x / NO ₂	Oxides of Nitrogen / Nitrogen Dioxide
NRW	Natural Resources Wales
NTFP	National Transport Finance Plan
OS	Ordnance Survey
PM ₁₀ /PM _{2.5}	Particulate Matter
PMA	Private Means of Access
PPG	Pollution Prevention Guideline
PPW	Planning Policy Wales
PRN	Primary Reference Number
PRoW	Public Right of Way
RIGS	Regionally Important Geological Sites
RSPB	Royal Society for the Protection of Birds
RTP	Regional Transport Plan
SAC	Special Area of Conservation
SEB	Statutory Environmental Body
SIAA	Statement to Inform an Appropriate Assessment
SNPA	Snowdonia National Park Authority
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
TAN	Technical Advice Note
UDP	Unitary Development Plan
UKBAP	United Kingdom Biodiversity Action Plan
WCA	Wildlife and Countryside Act
WFD	Water Framework Directive, 2003
WG	Welsh Government
WTS	Wales Transport Strategy, 2008
ZoI	Zone of Influence