A465 Blaenau'r Cymoedd
Adrannau 5 + 6: Dowlais Top – Hirwaun

A465 Heads of the Valleys
Sections 5 + 6: Dowlais Top – Hirwaun

Llywodraeth Cymru
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A465 Heads of the Valleys Sections 5 and 6: Dowlais Top to Hirwaun

Statement to Inform the Appropriate Assessment—July 2017

Contents

Executive Summary

Two European Sites have been considered in this Statement to Inform the Appropriate Assessment in relation to the proposed 17.7 km dualling of the A465 trunk road between Dowlais Top and Hirwaun. They are the Blaen Cynon SAC and the Usk Bat Sites SAC.

This Stage 2: Statement to Inform the Appropriate Assessment has demonstrated that the proposed scheme would not have an adverse effect on the integrity of the Blaen Cynon SAC or Usk Bat Sites SAC, either alone or in-combination with other projects or plans. This has been concluded based on the information provided which shows that progress towards achieving the relevant conservation objectives of the qualifying features will not be interrupted or delayed. The proposed scheme would not disrupt the factors which help maintain favourable condition and interfere with the balance distribution and density of key indicator species of favourable condition these European sites.

For the purposes of Regulation 61 (5) of the Conservation of Habitats and Species Regulations, 2010 (as amended), it is concluded that the proposed scheme would not adversely affect the integrity of the European sites (Blaen Cynon SAC and Usk Bat Sites SAC) considered in this SIAA.

1. Introduction

1.1 Requirement for Assessment of Implications on European Sites (AIES)

The European Community Habitats Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the 'Habitats Directive') provides legal protection for habitats and species of European importance. The Directive is transposed into UK law by the Conservation of Habitats and Species Regulations 2010 (as amended), otherwise known as the 'Habitats Regulations'. Before deciding to give consent for a plan or project, the competent authority (in this case, the Welsh Ministers) must consider under the requirements of Regulation 61 whether the plan or project -

(a) is likely to have a significant effect on a European 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, and in such cases they must make an 'appropriate assessment 'of the implications for that site in view of its conservation objectives.

In the light of the conclusions of this Assessment of Implication in European Sites (AIES), the competent authority may agree to the plan or project only after having ascertained that the project will not, alone or in combination with other plans and projects, adversely affect the integrity of the European site. The only exceptions are where there are no alternatives and there are imperative reasons of overriding public interest (IROPI), in which case compensatory measures must be adopted if the proposed scheme is to proceed.

1.2 AIES process

Specific stages of the assessment process (known as an AIES) need to be undertaken to satisfy the requirements of the Habitats Directive. The AIES process has five stages as defined by Design Manual for Roads and Bridges (DMRB) Vol. 11 Section 4 Assessment of Implications on European Sites (Highways Agency *et al.*, 2009a):

- Stage 1 – Screening which should be undertaken in all cases, followed by;
- Stage 2 – Appropriate Assessment (AA);
- Stage 3 – Alternative Solutions;
- Stage 4 - Imperative Reasons of Overriding Public Importance (IROPI); and / or,
- Stage 5 – Compensatory Measures.

The need for Stage 2 is determined by the outcome of the screening assessment; and the need for Stages 3-5 by the conclusions of the Appropriate Assessment (Stage 2).

1.3 Scope of this report

Following the Stage 1 Assessment of Implications on European Sites (AIES) Screening assessment (Jacobs, 2016 and screening matrices in Appendix A) it was considered that there would be likely significant effects (or uncertainty as to the absence of them) from the proposed scheme on the marsh fritillary *Euphydryas aurinia* qualifying feature of the Blaen Cynon Special Area of Conservation (SAC) and the lesser horseshoe bat *Rhinolophus hipposideros* qualifying feature of the Usk Bat Sites SAC.

It is, therefore, necessary to undertake a Stage 2 Appropriate Assessment for the proposed scheme. This Statement has been prepared to provide information to the Welsh Ministers on the implications of the A465 Sections 5 and 6 Dowlais Top to Hirwaun Dualling (the proposed scheme) on the Blaen Cynon and Usk Bat Sites SACs.

1.4 Background to the proposed scheme

1.4.1 Why the proposed scheme is needed

The A465 Heads of the Valleys road is a key strategic east west route in South Wales and forms part of the Trans - European Transport Network (TEN-T) trunk road network. The proposed scheme is located on the A465, a key strategic route across South Wales, which is a trunk road connecting the English Midlands with South West Wales. Sections 5 and 6 run from Dowlais Top to Hirwaun, a stretch of approximately 17.7 km, and includes a major interchange with the A470 (Cardiff to Glan Conwy) trunk road at Merthyr Tydfil. There is a need for the proposed scheme to overcome issues of safety, connectivity, congestion and resilience.

The existing road was built in the 1960s to the design standards extant at the time. The current trunk road layout is predominately set out as a 2+1 road whereby there are two lanes in one direction (uphill) with one lane in the other (downhill). Modern road standards are set out in the Design Manual of Roads and Bridges, which apply to truck roads and motorways in England and Wales. This guidance has been regularly updated since first published in 1992. The existing road does not meet these current highway standards. Particular issues relate to:

- a lack of central reservation and barrier separating traffic, increasing severity of any traffic accidents that occur;
- insufficient sized laybys;
- no dedicated provision for non-motorized users; and
- the presence of multiple junctions (roundabouts, T-junctions and staggered crossroads) and poor viability on gradients and bends that introduce a greater risk of accidents and build-up of congestion.

The proposed scheme would also have economic benefits, completing the high standard road link critical to:

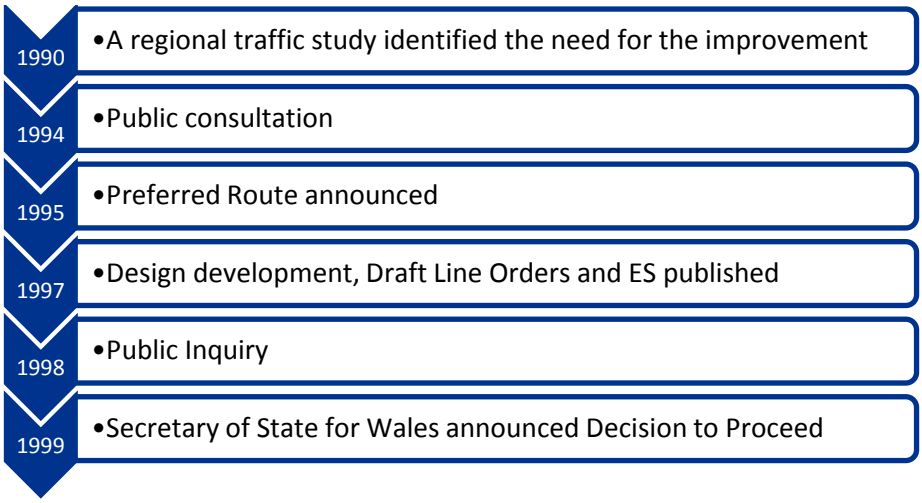
- improve traffic flows and safety between west Wales and the Midlands;
- attract investment into the Valleys and Ebbw Vale Enterprise Zone;
- provide resilience in the network as well as a link to the Enterprise Zones in Milford Haven and Cardiff; and
- support regeneration in northern valley communities.

Traffic projections model an increase in traffic volume and the outline business case for the scheme links to the essential component the proposed scheme would play in the regeneration of the Heads of the Valleys and economic benefits further afield.

In summary, the current trunk road layout of the A465 does not deliver the quality of service required of this important transport link and is below current design standards. The lack of capacity and resilience of the A465 trunk road between Dowlais Top and Hirwaun has a number of impacts relating to reliability of journey times, safety of users, business growth, regeneration, and connectivity from South-West Wales and the English Midlands.

1.4.2 History of the proposed scheme

The Welsh Government is committed to improving the capacity and safety of the A465 trunk road between Hirwaun and Abergavenny and proposals for highways improvements date back to 1990. In 1990 a regional traffic study identified that the A465 between Abergavenny and Hirwaun was in need of improvement. Detail of the work that was undertaken in response to the traffic study is as follows:



However, since the original draft line order proposals in 1997, guidance on carrying out Environmental Impact Assessment (EIA) and Assessment of Implications on European Sites (AIES) on highways projects as set out in Design Manual for Roads and Bridges Volume 11 (Highways Agency *et al*., 2009b), and The Highways (Environmental Impact Assessment) Regulations, 2007 (as amended), have been updated and / or amended. In addition, since 1997, the original 1994 Habitats Regulations that transposed directive 92/43/EEC into UK legislation were replaced by the Conservation of Habitats and Species Regulations, 2010 (as amended). Therefore, new Compulsory Purchase Orders (CPO) have had to be produced, with a new ES required to support Sections 2, 3, 5 and 6 through the statutory process. Sections 1 and 4 were completed in 2008 and 2004 respectively, based on the 1997 ES. Section 3 was completed in 2015. Section 2 is currently under construction and due for completion by mid-2018.

Work re-commenced on Section 5 and 6 in 2015 with a review of the 1997 route options.

1.5 Alternatives considered

1.5.1 Options considered prior to 1997 Orders

The options considered in the 1990s for the entire 40 km section between Hirwaun and Abergavenny (see Plate 1.1), included the 'Do Nothing Scenario'. However, this was rejected on the basis that it would not deliver the proposed scheme objectives. Following a route corridor assessment the main options identified were the Red, Purple, Blue and Orange routes:

- **Red Route** – on-line improvement for the full length of the existing A465 between Hirwaun and Abergavenny with 12 grade separated junctions. Widening would be mainly to one side or other of the existing road, apart from areas where it would be necessary to widen on both sides or to deviate slightly from the existing line.
- **Purple Route** – involved a diversion to the north of Hirwaun (in Section 6) proposed as an alternative to widening the existing A465 within Hirwaun. The Purple Route was a new off-line route, approximately 4 km in length which would run north of Hirwaun in a north-west to south-east direction. Two new grade-separated junctions were also proposed at Hirwaun Industrial Estate and Nant Melyn. Demolition of properties, including the Old Brickworks, and a diversion of the Afon Cynon was proposed.
- **Blue Route** – proposed as an alternative to widening the existing A465 between the industrial estate at Rassau and Garn Lydan (only relevant to Section 3 – Brynmawr to Tredegar).

- **Orange Route** – involved a new off-line route north of the existing road between Waun Rydd (north of Brynmawr) and Gilwern (only relevant to Section 2 – Gilwern to Brynmawr).

The red and purple route options are of relevance to this assessment as they show the route options considered for Sections 5 and 6. In 1995 the preferred route was announced by the then Secretary of State for Wales and involved the combination of the Red and Blue routes with a modification at Hirwaun. This included a new off-line section to the south of Hirwaun between the Hirwaun and Trewaun roundabouts. A junction at Hirwaun was also amended as well as a modification to the route to the south at Dowlais Top.

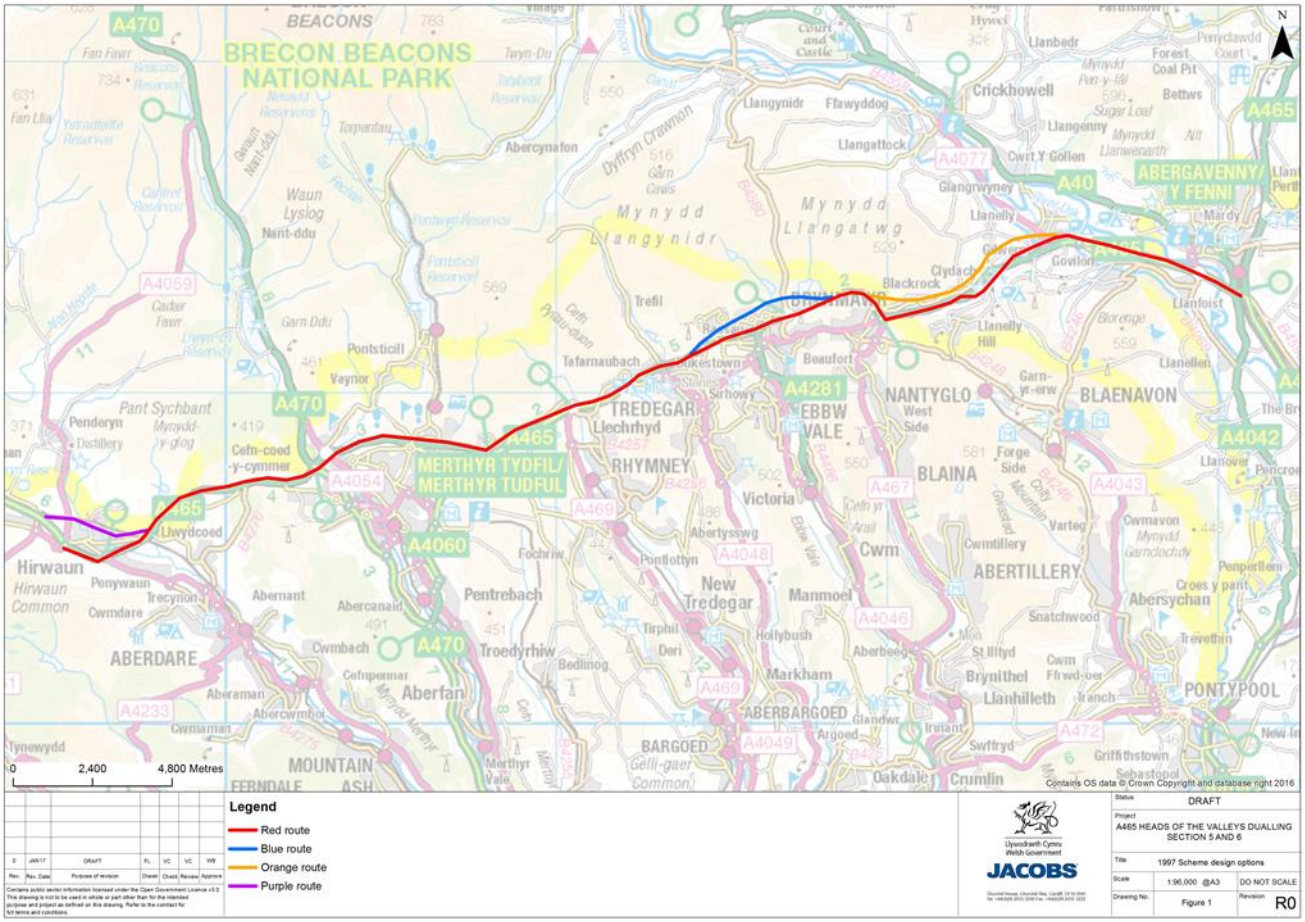


Plate 1.1 : Route options for entire 40 km route between Hirwaun and Abergavenny considered in 1997

1.5.2 WelTAG review of 1997 design for Section 5 and 6

The Welsh Transport Assessment Guidance provides a structure for assessing new transport schemes to identify a preferred option, and aid the decision making process. WelTAG reviews were undertaken in respect of the proposed scheme during 2015.

A WelTAG Phase 1 review for Sections 5 and 6 was completed in May 2015. The review identified and appraised multi modal options for transport improvements at the Heads of the Valleys. Conclusions specifically relating to the environment were that non-highway improvement options would have less direct impact on the environment. Highway improvement would impact on landscape, visual, loss of habitat etc., but also provide opportunity for long term benefits in noise levels and biodiversity through improvements to water quality, habitat creation and planting. However, the only option concept which is likely to provide a significant improvement in accident rates, journey times and reliability and the economic viability of the region is a highway improvement. The overall conclusion of the WelTAG Appraisal 1 was that the preferred solution identified in the 1997 draft orders (on-line dualling) was still the most appropriate solution.

A WelTAG Phase 2 Review was undertaken in August 2015 to provide a comprehensive study of the previous work undertaken to determine the Preferred Route, to make a defined statement upon its robustness and, if necessary, make recommendations for further work. This concluded that:

- the structure and coverage of the appraisal completed with the 1995 Scheme Assessment Report aligned with the requirements of WelTAG;
- that developments across the proposed scheme area since 1995 did not influence the selection of the Preferred Route;
- there were additional ecological and cultural heritage designations, but the proposed scheme remained the most appropriate route;
- it was considered that the route alternatives appraised and reported in the 1995 Scheme Assessment Report capture all viable route alternatives between Hirwaun and Dowlais Top and appropriately considered the views of stakeholders through consultation; and
- the Preferred Route identified within the 1995 Scheme Assessment Report remained the correct option for development.

1.5.3 Design development

Since October 2015, Jacobs undertook a review of the Preferred Route and continued the highways design development, the result of which now forms the proposed scheme. The scheme design put forward for Section 5 and 6 at the 1998 Public Local Enquiry comprised primarily on-line widening of approximately 17.7 km of existing three-lane carriageway to dual two-lane carriageway, with a short off-line section of about 1.4 km at the western end at Hirwaun and a 0.8 km off-line section east of Taf Fechan. The historic design also included six grade separated junctions (junctions where through traffic on the A465 would not be required to enter a roundabout, but at which connectivity with local roads was provided by a roundabout that is located below, above, or to the side of the mainline of the road). These junctions were proposed to be located at Dowlais Top, Prince Charles Hospital, Gurnos, A470, Baverstock and Hirwaun. The design review in early 2016 concluded that this option was still appropriate, subject to detailed design refinement. A further review was undertaken that considered the design and location of all junctions within Sections 5 and 6. This identified a total of 44 additional junction options that were appraised alongside the 13 junction options that had previously been considered.

The proposed scheme has been designed to reduce and / or offset the adverse environmental impacts identified throughout the EIA process wherever practicable, whilst also promoting and enhancing anticipated beneficial impacts. The environmental design principles that were adopted by Jacobs during the design development process since October 2015 are described in Volume 4, the Environmental Masterplan (EMP) and summarised in Table 1.1.

Table 1.1 : Environmental design principles

Principle	Description
Principle 1	Minimise impact on existing marshy grassland habitats by minimising risk of drying out whilst considering the whole life cost of the proposed scheme;
Principle 2	Minimise impact on ancient woodland in close proximity to the proposed scheme
Principle 3	Where technically feasible and not entailing excessive cost, consider opportunities to enhance existing ecological connectivity
Principle 4	Aim to achieve an earthworks balance
Principle 5	Minimise habitat loss from Sites of Interest to Nature Conservation (SINCs) in close proximity to the proposed scheme
Principle 6	Simple and elegant design for structures
Principle 7	Minimise lighting on scheme as a whole, particularly viaducts over Taf Fawr and Taf Fechan

Principle	Description
Principle 8	Ensure structures design, facing and finishes provides integration to current vernacular balanced by whole life cost
Principle 9	Maintain existing underpasses to maintain connectivity for wildlife and minimise habitat severance
Principle 10	Provide linear landscape strips in areas where they currently exist, if appropriate, to re-integrate proposed scheme as per existing highway planting
Principle 11	Where appropriate, minimise tree and shrub planting to create open, outward views from the scheme and integrate with existing upland landscape character
Principle 12	Minimise flooding and water quality impacts

A detailed evolution of the design process is provided in Environmental Statement (ES) Volume 1 Chapter 4: Design Developments and Alternatives Considered.

In comparison to the 1997 design, the proposed scheme would remain an on-line improvement to the existing A465 but there have been a number of key design changes. These are:

- a grade separated junction would be provided at Croesbychan;
- a junction linking local roads and the A465 would be provided at Baverstock;
- no access from local roads to the A465 would be provided at Gurnos; and
- the Prince Charles Hospital junction would be moved west to improve access to the hospital.

Provision for cyclists and pedestrians has also been integrated into the design providing long sections of off-road cycle routes where it would provide key linkages between communities.

1.6 Guidance used

This assessment follows the methodology set out in the DMRB Volume 11, Section 4, Part 1, HD 44/09 Assessment of implications (of highways and / or roads projects) on European sites (including Appropriate Assessment) (Highways Agency *et al*., 2009).

Reference to guidance provided in the following was also made:

- Welsh Government Technical Advice Note (TAN) 5: Nature Conservation and Planning (Welsh Government, 2009), in particular Section 5: Development affecting designated sites and habitats;
- Interim Advice Note 116/08 (W) - Nature conservation advice in relation to bats (Welsh Government 2008); and
- European Commission (2000). Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. European Commission, Brussels.

1.7 Authors of this report

The author of this report was Laura Gore CEnv MCIEEM and the report was checked and reviewed by Iona Pearson CEnv MCIEEM; all of whom are suitably qualified and experienced ecologists.

Laura Gore BSc MSc MIEEM CEnv is a consultant ecologist with ten years of consultancy experience. This includes experience of compiling Habitats Regulation Assessment in both the United Kingdom and Ireland including the Stage 1 AIES Screening report for the proposed scheme (Jacobs, 2016). Laura has also compiled strategic HRA for waste plans for Carmarthenshire, Devon and Buckinghamshire local authorities. Laura has particular experience in producing HRA / AIES for lesser horseshoe bat and marsh fritillary qualifying feature

species of European sites. These species have formed substantial components of Habitats Regulations Assessment (HRA) and AIES deliverables for a range of projects and clients, including Historic Rail Estates (part of Highways England), Highways England, Irish Water and the South Wales Trunk Road Agent (SWTRA).

Iona Pearson BSc MSc MIEEM CEnv is a consultant ecologist with over fifteen years of professional experience. She has extensive experience in the assessment of impacts of major road schemes on the natural environment, and the design and implementation of mitigation measures to minimise such impacts. She is an expert in Habitats Regulations Assessments (HRAs) and has produced HRA and AIES assessment reports for numerous developments including those at the strategic and project level. Iona was part of the Jacobs team that carried out one of the earliest HRA assessment in Wales (A465 Heads of the Valleys Dualling Section 1 – Usk Bat Sites SAC) in the late 1990s. She was also a key member of the team that set up an innovative Technical Advisory Group to advise on the risks to the integrity of the Usk Bats SAC from Section 2 and 3 A465. Additional specific AIES experience in Wales includes the A470 Cwmbach to Newbridge-on-Wye and local authority road schemes in Carmarthenshire. Iona led the Stage 1 Screening AIES of the proposed scheme (Jacobs, 2016).

2. Proposed Scheme

The proposed scheme includes the upgrading of an approximate 17.7 km stretch of the existing A465 trunk road to a dualled carriageway, referred to as Sections 5 and 6:

- Section 5 – Dowlais Top, north-east of Merthyr Tydfil, to an area of land north-west of the junction with the A470; and
- Section 6 – land north-west of the junction with the A470, to the south-west of Hirwaun at the junction with the A4059 and A4061 (Rhigos Roundabout).

The proposed scheme primarily includes online widening of the approximate 16 km stretch of road, except for an approximate off-line section of about 1.4 km at the western end at Hirwaun and a 0.8 km off-line section east of Taf Fechan. The off line section at Hirwaun is between the existing Trewaun roundabout and the existing Rhigos roundabout, where a new length of carriageway would be built to the south of the existing road. The proposed scheme would include a number of grade separated junctions (shown in Figure 1).

2.1 Proposed scheme objectives

The need for the proposed scheme is detailed in section 1.4.1. The specific Transport Planning Objectives (TPO) for the proposed scheme were developed as part of the WelTAG reviews in 2015. These were to:

- TPO1 To maintain the current level of service and to carry out improvements;
- TPO2 To reduce journey times for private and commercial road users;
- TPO3 To facilitate economic regeneration;
- TPO4 To enhance road safety and reduce casualties;
- TPO5 To do all this with proper care for the environment;
- TPO6 To deliver a scheme that is sustainable;
- TPO7 To improve Non-Motorised User (NMU) provision, providing opportunity for healthy lifestyle and a reduction in short vehicle journeys;
- TPO8 To deliver a scheme which minimises future maintenance requirements and disruption to the network;
- TPO9 To reduce journey time variability and improve resilience on the A465;
- TPO10 To use the A465 to manage traffic effectively and improve resilience on the strategic road network in South East Wales; and
- TPO11 To deliver a scheme that integrates with public transport and the local transport network.

2.2 The proposed scheme

The Heads of the Valleys Highways Improvements Scheme, Section 5 and 6 (the proposed scheme) would extend from Hirwaun in the west to Dowlais Top in the east, passing to the north of Merthyr Tydfil. The length of the proposed scheme is approximately 17.7 km. The proposed scheme would be predominately an on-line improvement of the existing A465 trunk road.

It would provide a 70 mph dual carriageway from Hirwaun to Dowlais. The highway cross section for the proposed A465 would take the form of a dual carriageway road with a concrete central reservation. Stock proof fencing would be provided beyond the kerbline of the road with safety barriers installed where appropriate. Additional stock proof fencing would be provided around attenuation ponds and along cycleways and footpaths, as appropriate.

Six junctions would be provided within the proposed scheme, all of which would be grade separated. The junctions would be located at Hirwaun, Croesbychan, Baverstock, A470, Prince Charles Hospital and Dowlais.

The approximate proposed location of each section of the proposed scheme is shown in Table 2.1.

Table 2.1 Section locations on proposed scheme

Section	Start chainage	Finish chainage
Hirwaun Junction	0	2500
Hirwaun Junction to Croesbychan Junction	2500	4450
Croesbychan Junction	4450	5550
Croesbychan Junction to Baverstock Junction	5550	7200
Baverstock Junction	7200	8550
Baverstock Junction to A470 Junction	8550	9800
A470 Junction	9800	11200
A470 Junction to Prince Charles Hospital Junction	11200	12550
Prince Charles Hospital Junction	12550	14000
Prince Charles Hospital Junction to Dowlais Junction	14000	15300
Dowlais Junction	15300	17700

2.2.1 Section 6 (Hirwaun to A470 junction)

The proposed scheme would commence on the existing A465 1.7 km west of the existing Rhigos roundabout (chainage (ch.) 0). The proposed alignment would be on-line until the Hirwaun junction.

2.2.1.1 Hirwaun junction (ch. 1200 to 2500)

The existing 'Rhigos' roundabout would be replaced with a grade separated junction. The proposed roundabout would be larger than the existing and would be located approximately 50 m to the west of the existing junction. It would provide links to the A4059 and the existing A465 route, which would become a local road linking the new A465 alignment to Hirwaun. The road would be on embankment, approximately 11 m above the existing road level, with the roundabout at a similar level to the existing levels. The eastbound sliproad would start to deviate from the mainline at approximately ch. 1150 with the main roundabout between ch. 1750 and 1850 and the eastern sliproads linking to the mainline at approximately ch. 2200.

2.2.1.2 Hirwaun Junction to existing Trewaun junction (ch. 2500 to 3200)

From the Hirwaun junction, the proposed scheme would be routed off-line for approximately 1.3 km with a section of new carriageway, which passes to the south of the recreational ground, to the south of the existing A465 between Hirwaun and Trewaun roundabout. The main line from the Hirwaun junction Underbridge would be on embankment. The proposed road level would be approximately 10.5 m above the existing ground levels at its highest point. The embankment would return to the existing ground level at ch. 2300. From this point onwards the road would be in cutting. The cutting would be at its deepest at Trewaun (covered in the subsequent section). At the end of this section the road is in approximately 12.5 m deep cut.

Access to the colliery along Tower Road would be stopped up, with a new access provided from the Hirwaun junction. Access to the wind farm would be maintained from the existing A465 with an overbridge to take traffic over the new alignment (ch. 3000). Provision for pedestrians, cyclists and equestrians (collectively known as Non-Motorised Users (NMU)) would be incorporated into the windfarm access bridge to reconnect footpath routes severed at Hirwaun. The National Cycle Network (NCN) Route 46, currently connecting to the A465 via overbridge at Tower Road, would be stopped up and realigned through Hirwaun junction and Trewaun via the new realigned carriageway.

2.2.1.3 Existing Trewaun junction (ch. 3100 to 3300)

The existing Trewaun roundabout links the A465 with Brecon Road and Hirwaun Road. This link to the re-aligned A465 would be removed with the existing A465 and Brecon Road crossing above the new A465 on two bridges before linking to Hirwaun Road at a roundabout, which would be located slightly south of its current location.

The proposed A465 would be in cutting at this location with reinforced concrete retaining walls to the north and south of the road. The retaining wall to the north of the road (ch. 3400 – 3450) would be approximately 220 m long, with a maximum height of 10.5 m. The retaining wall to the south of the road (ch. 3230 – 3380) would be approximately 170 m long, with a maximum height of 6.5 m.

2.2.1.4 Existing Trewaun junction to Croesbychan (ch. 3200 to 4450)

From Trewaun, the proposed scheme would involve the widening of the existing carriageway for a distance of approximately 1.9 km. A new overbridge for NMUs would be provided to link Tramway with existing footpaths along the Afon Cynon (which also form part of NCN Route 46) towards Penywaun (ch. 3525).

Two laybys would be provided (one eastbound (ch. 3650) and one westbound (ch. 3660)), located to the west of the Afon Cynon.

2.2.1.5 Croesbychan junction (ch. 4450 to 5550)

A new grade separated junction would replace the existing staggered junction at Croesbychan. Through this junction the A465 mainline would be on embankment with the junction roundabouts, which would be arranged in a dumbbell arrangement, below the carriageway in order to minimise the visual impact of the road on the wider landscape. The junction configuration comprises on and off slips from the A465 which extend approximately 100 m from the mainline A465 and the roundabout.

Access from the eastern residential areas of Hirwaun to Croesbychan junction would be provided by a side road that ties into the local road network at Swansea Road in Hirwaun just prior to the existing rail bridge. The side road would have two roundabouts; one to the north of the A465 at ch. 4600 and one to the south of the A465 at ch. 4900. The second roundabout would then tie into the existing road network to provide the local link to Crematorium Road in Llwydcoed. Both roundabouts would be on the line of the existing road.

Public rights of way (PRoW) that cross the existing A465 at grade would be diverted through the junction with a new NMU bridge across the railway being provided.

The centre line of the road would vary from being at the level of the existing A465 road at the railway bridge, to 10 m above the existing ground level between the railway and Nant Melyn Mainline Viaduct.

2.2.1.6 Croesbychan to Baverstock (ch. 5550 – 7200)

From Croesbychan the proposed scheme would continue to the Baverstock roundabout. The A465 alignment would be slightly south of its existing alignment as it heads east to Baverstock, with a new bridge across the Nant Melyn being constructed.

The road would be on embankment from Nant Melyn to the Nant Moel Underbridge (ch. 5450 – 6350). The embankment would vary in height depending on the surrounding topography and would be 10.5 m at its highest. From Nant Moel to Nant Hir Reservoir (ch. 6650) the road would be in a 6.5 m deep cutting from the north, and to the south, a 9.5 m embankment up to ch. 6525 followed by a cutting up to the Reservoir (ch. 6650).

At Nant Hir Reservoir the road would be widened to the north by means of a proposed new separate structure running immediately parallel to the existing arch bridge. The new structure would be approximately 86 m wide with a 56 m arch. It would be of steel arch construction with a similar arrangement to the existing reinforced concrete arch structure.

A new cycle route would be provided between Croesbychan and Baverstock. From Croesbychan the route would run to the north of the A465 across the existing Nant Melyn road bridge (ch. 5400), which would no longer be used for the main carriageway of the A465. The cycle route would then continue east past an attenuation pond before joining the attenuation pond maintenance route at ch. 5850. This maintenance route would have minimal traffic and would not be open to other motorised users. At ch. 6250 the cycle route would link to a minor road north to Nant Moel Reservoir and go south under the A465 and run to the south of Nant Hir Reservoir (ch. 6650). From there it would follow the east bank of the reservoir then run to the south of the A465 through to Baverstock roundabout. Further information regarding this cycle route is provided in Chapter 15: Effects on All Travellers.

2.2.1.7 Baverstock junction (ch. 7200 to 8550)

The Baverstock junction would be moved approximately 500 m west and would take the form of a grade separated roundabout with the A465 mainline with off-slips connecting to two roundabouts, one to the north and one to the south of the A465. The existing junction with Crematorium Road from the westbound carriageway would be closed. The northern roundabout would connect to the eastbound carriageway and also provide links to the gas works, the Jah-Jireh Residential Home (ch. 8400) and under the A465 to the southern roundabout. The southern roundabout would connect to the westbound carriageway as well as to Merthyr Road and Crematorium Road.

Links for pedestrians, cyclists and equestrians would be provided through the junction linking to local roads and the existing NCN Route 46. It would also provide access to the north to the informal tracks that lead north from the existing Baverstock junction through the plantation past the gas works into plantations within the Brecon Beacons National Park (BBNP).

Through the junction the landscape would fall away quite sharply to the south and as a result there would be large cut slopes on the north of the road and high embankments to the south.

2.2.1.8 Baverstock junction to A470 (ch. 8550 to 9800)

From Baverstock junction the road would continue east for 3 km as an on-line widening to the A470 junction. There would be no NMU provision along this section of the road. From Baverstock junction the landscape would continue to fall away. In order to accommodate this, the road would be on embankment to the north (up to 2.5 m in height) through to ch. 9850 and cutting to the south (up to 6.5 m in depth).

2.2.2 Section 5 (A470 Junction to Dowlais Top)

2.2.2.1 A470 junction (ch. 9800 to 11200)

The A470 junction would be a grade separated junction, with the A465 mainline being carried over the A470 and the mainline being approximately 12 m above higher than the existing road at its highest point. The existing A470 roundabout would be realigned slightly and provide access to and from the westbound carriageways of the A465. There would also be a new roundabout to the north of the A465 which would provide access to the eastbound carriageways. The mainline would run across a single span haunched steel girder bridge with open revetments.

The western slip roads to / from the A470 junction would connect to the A465 approximately 950 m to the west of the existing roundabout. The A465 would cross the Nant Ffrwd via a series of three new bridges and utilise the existing structure as follows:

- Nant Ffrwd mainline bridge - three span 150 m steel and reinforced concrete overbridge with arched beams;
- Nant Ffrwd Approach Structure (eastbound) – new 125 m twin arch bridge with steel box arches and suspended steel deck;
- Nant Ffrwd off-slip (eastbound) slip road overbridge - new 60 m single span steel and reinforced concrete composite structure; and

- Nant Ffrwd on-slip (westbound) - utilises the existing structure.

In addition, there are three retaining walls proposed for the eastbound diverge: -

- A470 Eastbound Diverge North (1) – approximately 30 m in length with a maximum retained height of 4.5 m;
- A470 Eastbound Diverge North (2) – approximately 150 m in length with a maximum retained height of 5 m; and
- A470 Eastbound Diverge South – approximately 60 m in length with a maximum retained height of 3.5 m

In order to minimise the visual impact on the BBNP, within which the junction of the A465 / A470 would lie, the eastbound slip road off the A465 would be in a cutting, which would be up to 24 m at its deepest point.

The realigned A465 mainline would be routed 70 m north of its existing alignment at this location and result in the loss of the southernmost section of the Cefn Coed Cemetery and Jewish Burial Ground; the route of the eastbound on-slip would further encroach on this area which is also a registered park and garden. Similarly, in order to minimise the land take from the north-western boundary of the Cefn Coed Cemetery, a 130 m long retaining wall would be constructed in the north-eastern verge of the A470 to the north of the road, which would have a maximum height of 10 m.

The A465 currently crosses the Taf Fawr on a single structure, which would be retained and utilised for the westbound off-slip. The mainline A465 and eastbound on-slip would be routed across the Taf Fawr on a separate three span 180 m long haunched post tensioned concrete bridge, which would be similar in appearance to the existing structure.

An 8.5 m high 160 m long retaining wall (maximum height approximately 9 m) would be constructed to the north of the road between the existing Grawen Lane junction and High Street.

The existing junction to Grawen Lane would be stopped up, with traffic wanting to link to the A470 northbound being routed north along Upper High Street to another existing junction to the A470, which would be improved. Local traffic from Cefn-coed-y-cymmer heading southbound would join the A470 further south. The bridge across the A465 that links Upper High Street and High Street would be demolished due to the dualling of the A465 and reconstructed.

2.2.2.2 A470 to Prince Charles Hospital junction (ch. 11200 – 12550)

The existing Taff Trail footbridge would be replaced by a new 37 m span bridge over the A465 which would be suitable for pedestrians, cyclists and equestrians.

The existing junction to Lower Vaynor Road would be closed.

The existing Taf Fechan bridge would be widened, with an additional lane being provided to the south of the existing structure. This lane would be a steel arch bridge which would be tied in to the existing concrete structure. Construction of this section of the proposed scheme would be carried out from road level, with no construction activities taking place within the gorge in order to minimise the impacts on the Cwm Taf Fechan Woodlands Site of Special Scientific Interest (SSSI) and Gurnos Quarry Tramroad and Leat Scheduled Ancient Monument (SAM).

A new multispan bridge 115 m long would be provided for NMUs to the south of the main carriageway to connect Lower Vaynor Road and Gurnos Road, providing safer routes for pedestrians and cyclists from Cefn-coed-y-cymmer, Prince Charles Hospital and Pen-y-Dre High School.

East of Taf Fechan the proposed scheme would involve a short off-line section (approximately 800 m); due to the topography of the area a series of cuttings and embankments would be required. The deepest cutting would be 290 m long and up to 16 m deep with the largest embankment being 250 m long and up to 8 m high.

A new underpass from Gurnos Road would provide access to attenuation ponds and Gurnos Farm.

2.2.2.3 Prince Charles Hospital junction (ch. 12550 to 14000)

A new grade separate junction would be constructed to the north of Pen-y-Dre High School. This junction would replace the existing junctions to the east adjacent to the Pant Industrial Estate, which would be closed. This junction would provide enhanced access from the A465 to Prince Charles Hospital for both eastbound and westbound traffic. Access to the Pant Industrial Estate would also be provided from this junction along with a link to the Gurnos ring road.

The mainline of the road would be in cut through the junction with retaining walls visible from the mainline with the sliproads being constructed on embankments. The cut would have a maximum depth of 8.5 m. There would be a 9.5 m high retaining wall to the north of the road as it passes underneath Bryniau Road.

NMU links for pedestrians and cyclists would be provided through the junction. A PRoW would be stopped up which currently links Rocky Road with the industrial estate but NMU links for pedestrians and cyclists would be provided across the Bryniau Road Bridge.

2.2.2.4 Prince Charles Hospital junction to Dowlais Top (ch. 14000 to 15300)

This section would be predominately an on-line improvement, though the local access road below the existing Pant Viaduct would be realigned. The road would be mainly on embankment. The first, which is located to the west of Pant Road would be up to 5 m in height and the second, to the east of Pant Road would be up to 10 m in height.

2.2.2.5 Dowlais junction (ch. 15300 to 17700)

A new grade separated junction would be provided at Dowlais, with much of the infrastructure for this already in place having been constructed as part of Section 4 - Tredegar to Dowlais Top. The mainline would be constructed to over the existing Dowlais roundabout. West of the junction the road would be on embankment, which would be 11 m high at its highest point. To the east of the roundabout the road would use the existing embankment.

A new NMU bridge over the A465 would be provided to the west of the Dowlais reservoirs (ch.15310) and local PRoW would be rationalised to cross the A465 at this location.

PRoW to the east of the reservoirs would be re-routed through to the existing Dowlais Top roundabout, which would become a grade separated junction with the mainline carriageway routed above the roundabout. This would provide the same links to local roads as is currently the case. The existing alignment of the A465 and A460 would form the eastbound on-slip and westbound off-slip from where the mainline would join the dual carriageway road constructed as part of Section 4 A465 Highways Improvements.

2.3 Structures

Table 2.2 summarises the proposed structures along the length of the proposed scheme.

Table 2.2 : Structures along the proposed scheme

Name	Description	Approx. chainage
Hirwaun Junction West Bridge	A new 14 m single span composite steel beam and concrete deck structure.	1740
Hirwaun Junction East Bridge	A new 15.9 m single span composite steel beam and concrete deck structure.	1840
Nant y Bwlch Bridge	A new 10.6 m single span integral structure - precast beams.	2325
Wind Farm Access Bridge	A new 60 m single span composite steel ladder beam and concrete deck structure integral with abutments.	3010
Trewaun West Bridge	A new 67 m single span composite steel beam and concrete deck structure with piled abutments.	3150
Trewaun East Bridge	A new 41.5 m single span composite steel beam and concrete deck structure integral with abutments.	3240
Pentwyn Cynon (Tramway) Footbridge	A new 31 m single span warren truss, steel ramps to north and to south.	3525
Afon Cynon Bridge	Demolish existing and replace with a new 21.8 m single span integral structure - precast beams.	3880
Court Farm Underpass	Demolish existing and replace with a new 4.5 m concrete box.	4145
Vale of Neath Footbridge	A new 26.5 m single span footbridge.	4425
Vale of Neath Railway Bridge	Demolish existing and replace with a new 20.5 m single span integral structure - precast beams.	4480
Court Lodge Underpass	A new 17 m single span integral structure - precast beams.	4660
Croesbychan Junction Bridge	A new 17 m single span integral structure - precast beams.	5090
Nant Melyn Cattle/C	Existing cattle crossing retained for use by non-motorised users.	5389
Nant Melyn NMU	Existing Nant Melyn road bridge retained for use by non-motorised users.	5390
Nant Melyn Mainline Viaduct	A new 82 m single span composite steel beam and concrete deck structure.	5440
Nant Moel Underpass	Demolish existing and replace with a new 6 m concrete box in a different location.	6355
Nant Hir (North) Viaduct	A new 86 m steel arch bridge similar arrangement to existing located to the north of the existing structure.	6690
Baverstock Junction Bridge	A new 20.5 m single span integral structure - precast beams.	7755
Nant Ffrwd Approach Structure	A new 125 m bow string arch with hangers structure.	10300
Nant Ffrwd Off-Slip Bridge	A new 60 m single span steel beams with curved bottom flange and composite with reinforced concrete deck.	10310
Nant Ffrwd Mainline Viaduct	A new 150 m three span haunched steel beams composite with concrete deck slab.	10355

Name	Description	Approx. chainage
Nant Ffrwd Viaduct	Existing structure retained.	10400
A470 Junction Bridge	A new 35 m single span haunched steel girder with concrete deck. Steep revetments to give it an open look.	10720
Taf Fawr Viaduct	Existing 140 m structure retained.	10880
Taf Fawr Mainline Viaduct	A new twin 180 m three-span haunched post tensioned concrete boxes. Similar profile to existing.	10880
Cefn Coed Subway	The existing subway to be extended with a reinforced concrete slab on propped cantilever walls and be used as a service culvert. Not accessible to the public.	10961
High Street Bridge	Demolish existing and replace with a 33.5 m new single span integral composite steel beam and concrete deck structure with piled abutments.	11150
Taff Trail Footbridge	Demolish existing and replace with a 35.5 m new vierendeel truss with arched top chords over the A465. Cantilevered walkway off rock face on the north side to tie in with existing Taff Trail route.	11310
Taf Fechan NMU Bridge	A new 115 m multi span footbridge.	11482
Taf Fechan Viaduct (Widened)	Widen existing steel arch bridge, tied into existing structure (concrete arch), to have a 120 m deck.	11510
Gurnos Farm Underpass	Demolish existing and replace with a 8 m in situ RC Box.	12275
Prince Charles Hospital Overbridge (West)	A new 42 m single span integral composite steel beam and concrete deck structure with piled abutments.	13140
Prince Charles Hospital Overbridge (East)	A new 42 m single span integral composite steel beam and concrete deck structure with piled abutments.	13215
Bryniau Road Bridge	Demolish existing and replace with a 40 m single span integral composite steel beam and concrete deck structure with piled abutments.	13850
Pant Road Bridge	Demolish existing and replace with a 20.8 m single span integral structure - precast beams integral with concrete bank seat on Reinforced Earth abutments and wingwalls.	14765
Jones St Bridge	Demolish existing and replace with a 10.2 m single span integral structure - precast beams.	15055
Reservoir Footbridge	A new 45 m single span truss structure over A465 with earth ramp on south side.	15310
Dowlais Junction West Bridge	A new 16.9 m single span integral structure - precast beams.	16070
Dowlais Junction East Bridge	A new 13.6 m single span integral structure - precast beams.	16160

2.4 Drainage design and attenuation / balancing ponds strategy

The drainage design has been based on the Welsh Government's requirement that the rainfall intensities used to calculate design storms for the design of any element of the road drainage must consider the long term risks associated the effects of climate change. Where rainfall data excludes such an allowance, the sensitivity testing on the design of the drainage system must be carried out by increasing rainfall intensities of the design storms by 20%.

2.4.1 Flood risk

In accordance with current Welsh Government guidance, and as agreed with Natural Resources Wales (NRW), the baseline flood event is the 1% (1 in 100) annual exceedance probability (AEP) event plus climate change. For the purposes of design the following principles have been applied:

- for extended structures the aim would be to match existing conveyance;
- for replacement structures there would be no increase in flood risk elsewhere; and
- for new structures the aim would be to convey a minimum of the 1% AEP year flood event including a 30% increase to allow for climate change.

In accordance with DMRB, surface water runoff from the proposed scheme would drain into concrete surface water channels on embankments and in the central reserve, and grassed surface water channels with a filter drain in cuttings. Runoff from the majority of catchments would be attenuated in ponds and discharged to watercourses at greenfield rates. This would allow both control of discharge rates and provide a Sustainable Drainage System (SuDS) system for pollution control.

A flood consequences assessment has been completed. Further details regarding the assessment of flood risk is provided in ES Chapter 17: Road Drainage and the Water Environment. The flood consequences assessment is a stand-alone report and available on request.

2.4.2 Culverts

The proposed scheme would include 31 existing culverts and there would be 10 new culverts included in the proposed scheme. Crossings requiring a large flow capacity would generally be constructed as box culverts. Table 2.3 provides details of the culverts that have been provided within the proposed scheme.

Table 2.3 : Culvert locations and proposed design details

Culvert	Proposed Design details	Approx. chainage
1	Existing Culvert. No works proposed. This pipe lies adjacent to the proposed scheme and an attenuation pond.	960
2	New 900 mm diameter culvert. This pipe lies between the proposed scheme and a proposed attenuation pond.	1200
3	Retain existing 1.55 m diameter culvert and extend to full width of dual carriageway.	1610
4	Replace existing culvert with a 1.5 m x 2 m box culvert.	1790
5	Provide new 1.5 m x 2 m box culvert.	1950
6	Provide new 900 mm diameter pipe.	2070
7	New 1.5 m x 2.7 m box culvert.	2230
8	Existing Glanant Street culvert 700 mm pipe to be retained.	2930
9	Provide new 900 mm pipe. Proposed highway ditch conveyed under wind farm access.	3010

Culvert	Proposed Design details	Approx. chainage
10	Replace existing culvert with 2.4 m x 1.2 m box culvert.	3300
11	Modify existing to extend 900 mm diameter pipe.	3600
12	Retain existing 900 mm diameter culvert.	3950
13	Replace existing 1.5 m diameter pipe with 1.5 m diameter pipe.	4140
14	Provide new 450 mm pipe.	4150
15	Replace existing with 1.5 m diameter pipe.	4230
16	Provide new 2.6 m x 2.1 m box culvert.	4840
17	Provide new 2.6 m x 2.1 m box culvert.	4850
18	Replace existing culvert with 2.6 m x 2.1 m box culvert.	4860
19	Replace existing culvert with 1.8 m x 1.8 m box culvert.	5010
20	Replace existing culvert with 2.7 m x 1.8 m box culvert.	5970
21	Provide new 900 mm pipe.	6240
22	Provide new 900 mm pipe.	6260
23	Extend existing culvert (2 pipes of 600 mm) to continue through widened road.	6970
24	Replace existing culvert with 2.1 m x 1.8 m culvert.	7450
25	Provide new culvert 1.5 m diameter.	7450
26	Provide new culvert 1.5 m diameter.	7540
27	Replace existing culvert with 1.8 m x 1.2 m culvert.	7550
28	Provide new 2.6 m x 2.1 m box culvert on side road.	7760
29	Provide new 900 m pipe under Merthyr Road.	8260
30	Replace existing culvert with 2.1 m x 1.8m box culvert.	9300
31	Replace existing culvert with 2.1 m x 1 m box culvert.	9640
32	Provide new 1 m x 2.1 m box culvert under Swansea Road.	9640
33	Replace existing culvert with 1.8 m x 1.5 m box culvert.	9940
34	No change to existing 600 mm pipe on slip road (existing alignment of A465).	10300
35	Provide new 1.5 m diameter pipe.	11750
36	Provide new 1.5 m diameter pipe and link to proposed attenuation pond.	12650
37	Modify existing culvert by extending approximately 35 m.	13240
38	Provide new 1.5 m diameter pipe on slip road.	13250
39	No change to existing 460 mm pipe.	14860
40	No change to existing 600 mm pipe.	15110
41	Provide 2 x 600 mm pipes. Overflow between two ponds.	15400

2.5 Relationship between the proposed scheme and European sites

The Blaen Cynon SAC is located approximately 55 m north of the proposed Hirwaun Roundabout. The Usk Bat Sites SAC is located approximately 9.2 km north east of the proposed scheme at its nearest point. These are shown in Figure 1.

The sites presented in Figure 1 are those considered within the Stage 1: Screening Assessment (see Section 4). Coedydd Nedd a Mellte SAC; Elenydd–Mallaen Special Protection Area (SPA); Severn Estuary SAC / SPA / Ramsar; and Burry Inlet SPA were screened out at Stage 1.

2.6 Physical land take

The footprint of the proposed scheme includes both permanent land take and land required temporarily for construction. Table 2.4 lists the habitats that would be lost to the proposed scheme during construction and operation.

No land take from any European site is necessary or required for the proposed scheme.

Table 2.4 : Land take to facilitate the proposed scheme design

Habitat	Approximate area (ha)
Semi-improved neutral grassland	22.0
Semi-natural and plantation broad leaved woodland	48.99
Coniferous and mixed plantation	11.69
Semi-improved acid grassland	12.6
Wet heath/acid grassland mosaic	9.49
Dry heath/acid grassland mosaic	0.88
Dry dwarf shrub acid heath	0.40
Marshy grassland	23.08
Scrub (dense / continuous and scattered)	2.13
Natural inland cliffs	0.02
Hard standing	30.23
Poor semi-improved grassland	22.63
Amenity grassland	10.18
Bracken	6.42
Ephemeral and ruderal grasslands	6.25
Improved grassland	1.78
Spoil	0.82
Standing water	0.51
TOTAL	**210.1 ha**

2.7 Key stages and timescales

The Welsh Government is working towards the following broad programme:

- Summer 2017 – publish Draft Orders, Environmental Statement and associated documents;
- Autumn / Winter 2017/2018 – Public Inquiry (if required) with a decision whether to proceed from the Welsh Ministers Spring 2018;
- Spring 2018 to Autumn 2019 – procurement phase, 'Key Stage 5'. At the end of this Key Stage, the 'Special Purpose Vehicle' (SPV) organisation would be appointed to design, build, finance and operate the scheme;
- Autumn 2019 – commence construction, with completion programmed for 2022 ('Key Stage 6');
- 2022 to 2027 – 5 year post construction phase;
- 2022 to 2042 – 30 year operational and maintenance phase; and
- 2042 – end of operational and maintenance phase; handover of the scheme to the Welsh Government or its nominated maintaining agent.

This Draft Orders, ES and associated documents were published in 2017 and any dates subsequent to this are anticipated rather than fixed. Construction of the proposed scheme is subject to the Welsh Ministers issuing a decision to proceed. A programme for construction has been prepared and is presented in the Constructability and Phasing Report (Jacobs, 2017).

2.7.1 Constructability and phasing summary

The proposed scheme would have three distinct working sections during the construction phase. These have been identified based predominantly around geographic constraints and earthworks movements:

- Section 1: Hirwaun junction to Nant Melyn Viaduct ch. 0 – 6000;
- Section 2: Nant Melyn Viaduct to A470 Junction ch. 6000 – 11000; and
- Section 3: A470 Junction to Dowlais Junction ch. 11000 – 16500.

The construction methodology is based on prioritising the following key construction targets. These are as follows:

- Minimising disruption to the local and wider community where possible;
- Minimising disturbance to very sensitive nature conservation receptors where possible;
- Ensuring safe workings throughout the process; and
- Limiting importing or exporting of material required by means of onsite material excavation and re-use; achieving an earthworks balance.

All three sections of the proposed scheme would have construction works ongoing at the same time; anticipated to be from November 2019 to September 2022. The total duration of these works is currently forecast as 2 years 10 months for the construction phase, with up to a year of pre-construction activities taking place; such as environmental / ecological mitigations and utility diversions. The proposed construction programme is as presented in Plate 2.1.

2.8 Resource requirements through the lifetime of the project

During the construction phase, imported material would include road construction aggregates together with reinforcement steel, concrete, cement, pipes and fencing materials. Throughout the design stage of the proposed scheme the objective has been to attain a balance of earthworks cut to fill, which has been achieved.

Standard highway operation and maintenance procedures would be carried out during the operational phase of the proposed scheme. Typical activities would include:

- Winter maintenance, such as de-icing/gritting.
- Painting.
- Resurfacing.
- Repairs to damage.
- Maintenance of the highway drainage network.
- Management and maintenance of roadside grass areas and vegetation trimming to comply with the environmental objectives.
- Management of nature conservation (habitat and protected species) measures.

All resources for the proposed scheme (for construction and operational phases) are either originated within the proposed scheme footprint itself or externally.

No resources from the Blaen Cynon SAC or Usk Bat Sites SAC would be required at any stage during construction or operation of the proposed scheme.

2.9 Emissions

2.9.1 Waste

The majority of the waste generated during construction of the proposed scheme would likely to be construction site waste from the Contractor Compounds (for example packaging and residual materials). Through the implementation of the Construction Environmental Management Plan (CEMP) and accompanying Register of Environmental Actions and Commitments (REAC), construction waste would be recycled where feasible.

No emission or discharge to European sites would occur during the construction and operational phases of the project.

2.9.2 Discharge to water

A full assessment for discharges to water is made in ES Volume 1 Chapter 17: Road Drainage and the Water Environment (Jacobs, 2017), covering both the construction and operation phases.

During construction and operation water could be discharged to the local waterway network after a period of appropriate collection and attenuation. All water would be discharged at a greenfield rate. In accordance with DMRB, surface water runoff from the proposed scheme would drain into concrete surface water channels on embankments and in the central reserve, and grassed surface water channels with a filter drain in cuttings. Runoff from the majority of catchments would be attenuated in ponds and discharged to watercourses at greenfield rates. This would allow both control of discharge rates and provide a Sustainable Drainage System (SuDS) system for pollution control.

There are no potential pathways that link either existing or proposed highway drainage to any of the European sites considered in this Statement.

2.9.3 Emissions to air

Creation of some fugitive dust during the construction phase in unavoidable. However, it is considered that with an appropriate CEMP and REAC implemented, there would be no unacceptable dust nuisance to European sites during the construction phase and potential effects would be ‘not significant’ (ES Volume 1 Chapter 8: Air Quality).

During the operational phase of the proposed scheme the largest increases in annual mean nitrogen oxides (NO_x) and particulate matter (PM_{10}) concentrations are predicted to occur at locations in close proximity to the A465, at large roundabouts, or in the vicinity of minor roads where the largest increases in Annual Average Daily Traffic (AADT) flows associated with the proposed scheme are likely to occur.

The European sites considered in this Statement are too remote from the proposed scheme for any construction phase dust impacts or operational phase NO_X and PM_{10} impacts to be likely.

Only one site adjacent to the existing A465, would modelled changes in NOx and more detailed modelling regarding acid and nitrogen deposition suggest exceedance of criteria of potential significance; at Tir Mawr a Dderi Hir SSSI only. Similarly, the potential for significant effects as a result of changes in acid deposition are also indicated at Tir Mawr a Dderi Hir, SSSI. There is the potential for changes in acid deposition along the 50 m wide strip of the SSSI that is adjacent to the proposed scheme. This impact on the SSSI is highlighted here as, whilst it is remote from the European sites considered in this Statement, the habitat is used by the marsh fritillary butterfly.

2.9.4 Lighting

No night time working is proposed and therefore any construction phase lighting would be limited to storage area and compounds for security purposes only. Construction phase lighting would be in accordance with the requirements of the CEMP and REAC which would specify a lighting strategy as recommend by CIRIA guidelines (Charles & Edwards, 2015) and the Institute of Lighting Professionals (Bats and the lighting in the UK, ILP (2009) and Guidance Notes for the reduction of obtrusive light, ILP (2012).

The street lighting strategy has been formulated with three key considerations: safety; cost and maintenance; and impacts on the night-time landscape. The aim is to deliver a sustainable network without restraining economic growth, meet the requirements of the 'Welsh Assembly Government Motorway and Trunk Road Lighting Policy' and be in line with the 'Brecon Beacons National Park International Dark Sky Reserve Lighting Management Plan'.

The existing A465 trunk road is partially lit with conventional High Intensity Discharge (HID) street lighting. The proposed scheme would also be partially lit, but with directional Light Emitting Diodes (LED) street lighting. The LEDs have a number of environmental benefits. They:

- use less energy;
- do not emit ultra-violet emissions;
- have a lower impact on flora and fauna; and
- provide a bright true colour at night, enhancing safety.

The proposed lighting is also proposed to be controlled remotely by having the lanterns network remotely switched, controlled, dimmed, trimmed and monitored by a Lighting Central Management System (CMS) to achieve further energy and maintenance savings achieving a healthier, safer and greener network.

Hirwaun junction would be fully lit with lighting provided on the mainline through the junction and on the slip roads. The other junctions at Croesbychan, Baverstock, A470, Prince Charles Hospital and Dowlais would be partially lit with only the on / off-line conflict points lit.

The existing structures over the Taf Fechan and Taf Fawr are currently lit. The existing lighting would be removed and there would be no lighting of these structures as part of the proposed scheme, other than low level spot lighting on the Taf Fechan non-motorised user route.

2.9.5 Excavation requirements

The proposed scheme includes cuttings and embankments with the material removed from the cuttings being used to construct the embankments. An earthworks balance would be achieved within the proposed scheme. Excavation would be limited to extent of the construction footprint. No additional borrow pits are proposed.

No excavation from the Blaen Cynon SAC or Usk Bat Sites SAC would be required at any time during construction or operation of the proposed scheme.

2.9.6 Transportation of construction materials

The proposed scheme will achieve an earthworks balance and the main impacts from transport of construction materials will be related to the import of steel, concrete and other materials. These construction materials will be transported to site via the existing trunk road network (A470 and A465) and there will be no impacts on the Blaen Cynon SAC or Usk Bat Sites SAC due to transportation of construction materials.

2.9.7 Utilities diversions

Utilities diversions or protection works will be required at some locations along the scheme, principally at Hirwaun junction and west of Dowlais junction.

None of the works associated with the utilities diversions or protection work will impact the Blaen Cynon SAC or Usk Bat Sites SAC.

Plate 2.1 : Proposed construction programme (extract from Constructability and phasing report (Jacobs, 2017))

Construction phasing	2019						2021												2022												2022			
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
Section 1																																		
Hirwaun to Trewaun (ch. 0 to 3000)																																		
Trewaun underpass to Vale of Neath railway (ch. 3,000 to 4300)																																		
Croesbychan junction to Nant Melyn viaduct (ch. 4700 to 6000)																																		
Vale of Neath railway to Croesbychan junction (ch. 4300 to 4700)																																		
Section 2																																		
Baverstock main cut (ch. 7900 to 9400)																																		
A470 junction and Taf Fawr (ch. 10300 to 11000)																																		
Baverstock to Nant Ffrwd (ch. 9400 to 10300)																																		
Baverstock junction (ch. 7200 to 7900)																																		
Nant Moel and Nant Hir (ch. 6000 to 7200)																																		
Section 3																																		
Dowlais junction (ch. 15300 to 16200)																																		

Construction phasing	2019						2021												2022												2022			
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
Cefn Coed (ch. 11000 to 11450)																																		
Pant to Pen-y-Wen (ch. 14600 to 15300)																																		
Taf Fechan to Pen-y-dre (ch. 11450 to 13500)																																		
Prince Charles Hospital junction (ch. 13500 to 14600)																																		

3. Sources of Information

3.1 Data sources

The following sources of information have been referenced during the preparation of this report:

- Highways Agency (2009). Assessment of implications (of highways and / or roads projects) on European Sites (including appropriate assessment). DMRB Volume 11, Section 4, Part 1, HD 44/09.
- The following organisations' websites were used to gather information on the European protected sites (including citations):
  - Natural Resources Wales (NRW);
  - Nature Conservation Committee (JNCC); and
  - Multi -Agency Geographic Information for the Countryside (MAGIC).
- The Core Management Plans for the European sites, published by NRW (formerly CCW).
- The Geographical Information Systems (GIS) datasets for European Sites used were downloaded from the JNCC website in 2016 to ensure all relevant European sites and their updated boundaries were taken into consideration as part of this SIAA.
- Records of notable species were requested from South East Wales Biological Records Centre (SEWBReC) and Biodiversity Information Service (BIS) for Powys and the Brecon Beacons, to collate all records within 5 km of the proposed scheme.
- National Biodiversity Gateway (NBN).
- Google Earth aerial photography.
- A465 Section 1 Abergavenny to Gilwern Statement to Inform the Appropriate Assessment.
- A465 Section 2 Gilwern to Brynmawr Statement to Inform the Appropriate Assessment.
- A465 Section 3 Brynmawr to Tredegar Statement to Inform the Appropriate Assessment.

3.2 Field surveys

An extensive programme of field surveys was undertaken to inform the Environmental Impact Assessment and this SIAA for the proposed scheme. All survey methodologies were discussed and agreed with NRW. The surveys of relevance to the SIAA are:

- Phase 1 Habitat Survey (2015 – ES Volume 2, Appendix 11F);
- Bat surveys as listed in Table 3.1 (2015 and 2016 - ES Volume 2, Appendix 11F, Appendix 11G and Appendix 11H); and
- Marsh fritillary survey:
  - Long term baseline monitoring (2008 to 2016, on-going) recording habitat quality and number of adults and larval webs at selected monitoring locations (ES Volume 2, Appendix 11I)
  - habitat suitability (Spring 2016) – identification of suitable habitat for marsh fritillary within 2 km of the Blaen Cynon SAC (ES Volume 2, Appendix 11G); and
  - detailed habitat mapping (Autumn 2016) - Areas identified as having devil's bit scabious present during the Phase 1 habitat survey carried out in August / September 2015, within 100 m either side of the proposed scheme and the Upper Cynon Valley Functional Landscape Area for marsh fritillary (ES Volume 2, Appendix 11G).

Table 3.1 : Summary of bat surveys undertaken by Jacobs

Ecological feature	Survey type	Date(s)	Technical report / appendix reference	Study area
All bat species				
Roosts in trees	Ground assessments of trees	February – March 2015 August 2015 and April 2016	Winter 2015 Ecology Survey Results (ES Volume 2, Appendix 11E) 2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Identification and assessment of trees that have the potential to support roosting bats within a 1.2 km wide corridor centred on the proposed scheme (Feb- Mar 2015). Reduced scope in August 2015 and April 2016- Assessment of trees within a 20 m wide corridor centred on the proposed scheme that were not accessed in Feb / March due to health and safety issues or scheme change.
	Tree climb to determine presence in high and moderate potential trees	March and August 2015 April 2016	Winter 2015 Ecology Survey Results (ES Volume 2, Appendix 11E) 2016 Bat Survey Results (ES Volume 2, Appendix 11H)	All trees likely to be lost or disturbed within a 20 m wide corridor centred on the proposed scheme.
Building roosts	Preliminary external building roost assessments	February, March and August 2015	Winter 2015 Ecology Survey Results (ES Volume 2, Appendix 11E)	Within a 1.2 km wide corridor centred on the proposed scheme.
	Dusk emergence / dawn re-entry surveys of buildings with bat roost potential	May to September 2015	Summer 2015 Ecology Survey Results (ES Volume 2, Appendix 11F)	Buildings identified following preliminary external assessment within a 1.2 km wide corridor centred on the proposed scheme.
	Backtracking surveys	June to August 2015	Summer 2015 Ecology Survey Results (ES Volume 2, Appendix 11F)	Selected locations following desk study and activity survey (see below) within a 1.2 km wide corridor centred on the proposed scheme.

Ecological feature	Survey type	Date(s)	Technical report / appendix reference	Study area
Activity surveys	Automated static monitoring of road culverts	June and July 2015	Summer 2015 Ecology Survey Results (ES Volume 2, Appendix 11F)	All suitable culverts crossed by the proposed scheme.
	Walked bat activity transects	Between May and September 2015	Summer 2015 Ecology Survey Results (ES Volume 2, Appendix 11F)	Transects throughout a 1 km wide corridor centred on the proposed scheme with a focus on potential crossing points identified during desk study.
Lesser horseshoe bat				
Cave surveys	Bat cave mapping survey	March and July 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Caves within 1 km of the existing A465 in the Taf Fawr Gorge and the Taf Fechan Gorge at Cefn-coed-y-cymmer.
	Bat cave inspection surveys – hibernation and summer	March and July 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Caves within the Taf Fawr Gorge and the Taf Fechan Gorge.
	Automated bat activity cave surveys	May – September 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Caves within 1km of the existing A465 (dependant on safe access) within the Taf Fawr Gorge and the Taf Fechan Gorge.
Structure surveys	Preliminary roost assessment of structures	February – April 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Existing A465 structures between Hirwaun and Dowlais Top.
	Dusk emergence / dawn re-entry surveys of structures with the potential for lesser horseshoe bats (plus automated bat activity surveys of structures)	May – September 2016	Bat Survey Report 2016 (ES Volume 2, Appendix 11H)	A470 viaduct (southern abutment)
	Internal inspection of structures with the potential for lesser horseshoe bats	August and September 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	A470 viaduct (southern abutment) and Taf Fawr Viaduct (western abutment).

Ecological feature	Survey type	Date(s)	Technical report / appendix reference	Study area
Activity surveys	Taf Fawr and Taf Fechan walked bat activity transect surveys	May – August 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Taf Fechan Gorge. Taf Fawr Gorge.
	Taf Fawr and Taf Fechan automated bat activity	August and September 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Three locations along the Taf Fawr and the Taf Fechan Rivers.
	Automated bat activity surveys at Gurnos Quarry and Taf Fawr Gorge	May – September 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Gurnos Quarry and the Taf Fawr Gorge.
Roost / backtracking	Dusk emergence / dawn re-entry surveys	May – September 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Gurnos Quarry.
Trapping and radio-tracking surveys	Trapping and radio tracking	July and August 2016	2016 Bat Survey Results (ES Volume 2, Appendix 11H)	Trapping locations - seven caves in Taf Fechan Gorge and A470 viaduct. Radio-tracking - Tagged bats were searched for in an area of at least 5 km radius from the trapping locations on public access routes.

4. Review of Stage 1 Screening Information

The Stage 1: Screening Report (Jacobs, 2016) considered all the possible impacts, pathways and effects on European sites from the proposed scheme. Impacts considered included land take, hydrological changes, dust deposition, discharge of pollutants to watercourses, aerial emissions, including effects on air quality, changes to traffic flows/speeds, noise and vibration and visual and lighting impacts. The possible pathways for effects on European sites were fully considered including effects on effects on mortality, disturbance and displacement of qualifying species and loss or degradation of supporting habitats of those qualifying feature species.

The full list of European sites considered at Stage 1 Screening Stage is included in the table below

Table 4.1 : European sites

European site	Approximate distance from scheme	Qualifying features of designated sites
Blaen Cynon SAC	0.05 km north	1065 Marsh fritillary
Coedydd Nedd a Mellte SAC	1.1 km west	91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles 9180 Tilio-Acerion forests of slopes, screes and ravines * Priority feature
Usk Bat Sites SAC	9.2 km north east	1303 Lesser horseshoe bat 4030 European dry heaths 7120 Degraded raised bogs still capable of natural regeneration 7130 Blanket bogs (* if active bog) 8210 Calcareous rocky slopes with chasmophytic vegetation 8310 Caves not open to the public 9180 Tilio-Acerion forests of slopes, screes and ravines *Priority feature
Severn Estuary SAC / SPA / Ramsar SPA	37 km south east	<u>SAC</u> 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1110 Sandbanks which are slightly covered by sea water all the time 1170 Reefs 1095 Sea lamprey *Petromyzon marinus* 1099 River lamprey *Lampetra fluviatilis* 1103 Twaite shad *Alosa fallax* <u>SPA</u> Overwintering Bewick's swan Cygnus *columbianus bewickii* Curlew *Numenius arquata* Dunlin *Calidris alpina alpine* Pintail *Anas acuta*

European site	Approximate distance from scheme	Qualifying features of designated sites
		Redshank *Tringa tetanus* Shelduck *Tadorna tadorna* Migratory Ringed Plover *Charadrius hiaticula* <u>Ramsar</u> Due to unusual estuarine communities, reduced diversity and high productivity. This site is important for the run of migratory fish between sea and river via estuary. The fish of the whole estuarine and river system is one of the most diverse in Britain. Bird assemblages of international importance.
Burry Inlet SPA	37 km south east	Overwintering: Oystercatcher *Haematopus ostralegus*; Pintail *Anas acuta*; and supporting at least 20,000 waterfowl.
Elenydd–Mallaen SPA	40 km north west	Breeding: Merlin *Falco columbarius*; Peregrine *Falco peregrinus*; and Red Kite *Milvus milvus*.

When carrying out screening, account was taken of the avoidance and mitigation measures that had been built into the proposed design. Mitigation measures considered in this assessment are those which are plainly established and uncontroversial. These are presented in Table 4.2.

Detail on methodology and judgement taken to determine whether effects were significant, or not, are presented in the Stage 1: Screening Report and are not repeated here. In-combination assessment was not undertaken at the Stage 1: Screening Stage. It has been undertaken in Stage 2: Appropriate Assessment and is presented in Section 11 of this report.

Table 4.2 : Avoidance and plainly established and uncontroversial measures (incorporated into the proposed scheme design)

Summary of activity	Plainly established and uncontroversial measure	European site and likely significant effect avoided
Minimise habitat loss (including outside of designated sites) for mobile SAC qualifying species	Incorporate alignment changes to minimise land take of key sites and habitats.	All mobile species of listed European sites
	Incorporate retaining walls instead of cuttings or embankments to minimise land take of key sites and habitats.	All mobile species of listed European sites

Summary of activity	Plainly established and uncontroversial measure	European site and likely significant effect avoided
Maintain / improve connectivity for mobile SAC qualifying species	Diameter of new culverts to be of a minimum 1.5 m x 1.5 m. Tie-in culverts to existing vegetation, plant between culverts and retained ecological / landscape features to maintain / enhance commuting routes.	Lesser horseshoe bat of Usk Bat Sites SAC
	Retain existing culverts on existing alignments.	Lesser horseshoe bat of Usk Bat Sites SAC
Avoid/ minimise hydrological change	Outfalls designed to prevent significant change to hydrological conditions.	Hydrological links to: Habitats used by mobile species used by marsh fritillary (Blaen Cynon SAC); and Habitats used by foraging lesser horseshoe bats (Usk Bat Sites SAC).
	Implementation of best practice pollution prevention guidance. Comply with best practice pollution prevention guidelines Construction Industry Research and Information Association (CIRIA) to treat run-off in relation to routine pollution and major spillages and reduce or avoid impacts to the water quality of watercourses and waterbodies through monitoring during and post construction where necessary. This includes measures to manage different types of water pollution (such as sedimentation, nutrients from wastewater, surface water pollution, and chemical pollution from vehicles). Specific guidance would be implemented from: • CIRIA C532 Control of water pollution from construction sites; • CIRIA C648 Control of water pollution from linear construction projects – technical guidance; • GPP2: Above ground oil storage tanks; • GPP5: Works and maintenance in or near water; and • GPP13: Vehicle washing and cleaning.	
	Sensitive drainage design. The design of the drainage to consider the location of sensitive receptors, for example designated sites and freshwater fish, and avoid impacts.	
	Sensitive restoration of culverted watercourses. Reference to be made to The River Restoration Handbook (River Restoration Centre, 2013).	
	Attenuate all drainage. All road drainage would be held in attenuation ponds that would also act as a filtering system before discharging into local waterways at greenfield rate.	
	Pollution prevention. During construction and operation, filter drains, soak-aways, infiltration trenches and oil separators to be used to reduce runoff into watercourses and susceptible habitats.	
Fence retained vegetation and trees	All retained vegetation and ecologically valuable features and constraints to be appropriately fenced (including temporary fencing) to protect them from incidental damage or disturbance from construction activities. To avoid / reduce the effects of local compaction of ground within the root protection zones of retained trees and	Habitats used by mobile species of the Blaen Cynon SAC and Usk Bat Sites SAC.

Summary of activity	Plainly established and uncontroversial measure	European site and likely significant effect avoided
	hedgerows, or other accidental damage, appropriate tree protection measures would be implemented in accordance with (find relevant BS 5837:2012- 'Trees in relation to design, demolition and construction. Recommendations') and additional arboricultural advice.	
Demarcate exclusion zones for sensitive species	Exclusion zones around sensitive resources in the form of fencing would be erected to protect retained habitats, sites and species (for example marsh fritillary habitat and bat roosts), immediately adjacent to construction works.	Habitats used by mobile species of the Blaen Cynon SAC and Usk Bat Sites SAC.
Sensitive location of temporary works areas	Site compounds, soil storage areas, haul roads to be located sensitively to minimise land take of key sites and habitats and disturbance to species and their places of rest. Site compounds and soil storage areas would not be permitted within suitable marsh fritillary habitat.	Habitats used by mobile species of the Blaen Cynon SAC.
Fugitive dust produced during construction	Dust Management Plan	Habitats used by mobile species of the Blaen Cynon SAC and Usk Bats Sites SAC.
Construction noise and vibration	When pumps / generators are to be used they shall be set at least 10 m away from watercourse and suitably baffled to reduce the noise. They would be located as far away from known bat roosts as practicable, at least 25 m.	Lesser horseshoe bat of Usk Bat Sites SAC.
Construction lighting	No night time working is proposed. However, if temporary lighting is required it would be controlled and follow guidance on lighting including the use of directional lighting or preventative measures such as installation of shields, hoods or limiting the height of lighting columns. The following guidance would be followed: • CIRIA C741 – Environmental Good Practice on Site (4th Edition); • Institute of Lighting professionals (2011) Guidance Notes for the reduction of obtrusive lighting (GN01:2011); and • CIE 150: 2003 Technical Report, Guide to the Limitation of the Effects of Obstructive Light from Outdoor Lighting Installations. Mitigation for temporary lighting would be directed and approved by the ECoW prior to works commencing.	Lesser horseshoe bat of Usk Bat Sites SAC.
Landscape planting	Landscape planting would use stock of local provenance.	Lesser horseshoe bat of Usk Bat Sites SAC.

4.1 Findings of Stage 1: Screening

The AIES Stage 1: Screening assessment (Jacobs, 2016) considered potential connections between the proposed scheme and the following European sites:

- Blaen Cynon SAC;
- Coedydd Nedd a Mellte SAC;
- Usk Bat Sites SAC;
- Elenydd–Mallaen Special Protection Area (SPA);
- Severn Estuary SAC / SPA / Ramsar; and
- Burry Inlet SPA.

There was considered to be no connection between the proposed scheme and the qualifying features of the following sites. Therefore, no effect would be possible:

- Coedydd Nedd a Mellte SAC;
- Elenydd–Mallaen SPA;
- Severn Estuary SAC / SPA / Ramsar; and
- Burry Inlet SPA.

As detailed in Appendix A, there are considered to be likely significant effects (or uncertainty as to the absence of them) from the proposed scheme on the qualifying features of the Blaen Cynon SAC through:

- habitat loss;
- habitat fragmentation; and
- direct mortality of marsh fritillary (larval webs).

In addition, there are considered to be likely significant effects (or uncertainty as to the absence of them) from the proposed scheme on the qualifying features (lesser horseshoe bat only) of the Usk Bat Sites SAC through:

- habitat loss (direct loss of roosts); and
- construction phase disturbance.

4.2 Update of Stage 1: Screening

A review of the Stage 1 Screening report was undertaken with consideration of consultation and comments at Environment Liaison Group (ELG) meetings and when the results of the air quality assessment and noise assessment became available to the project team.

4.2.1 Direct mortality of marsh fritillary butterfly

In the Stage 1 Screening report, the effects of mortality of adult butterflies during the construction period was considered negligible due to timings of site clearance (programmed for winter 2019 / 2020) when butterflies would not be present. During operation of the proposed scheme mortality of adults was deemed negligible as Thomas, Snazell and Ward (2002) suggest that the aerodynamics of modern vehicles allow butterflies to be swept up and over speeding cars (in contrast to the more upright, less streamlined vehicles of previous years).

However, a review of more recently published scientific literature indicated significant uncertainty as to the movement of butterflies across roads and associated risk of mortality. Two academic studies into the effects of habitat fragmentation caused by roads resulting in road mortality of butterflies in Poland discovered that collision blackspots were associated with high traffic volume when cover of grassland in a landscape was high and the verges had low species richness or verge mowing frequency was high (Skorka *et al*., 2015). Conclusions from similar studies that found that the number of species and abundance of butterflies killed on roads were positively dependent on both the abundance of butterflies on road verges and on traffic volume, but negatively correlated with the richness of plant species on the road verges (Skorka *et al*., 2013).

In light of the uncertainty, the precautionary principal has been applied and the mortality of adult marsh fritillary (butterfly life stage) has been considered a likely significant effect on the Blaen Cynon SAC and has been considered as part of this Stage 2 Statement to Inform the Appropriate Assessment.

4.2.2 Habitat degradation impacts on marsh fritillary

At Stage 1: Screening, possible air quality impacts causing potential habitat degradation effects on the Blaen Cynon SAC were not considered as likely to be significant and were screened out. This conclusion was justified on the functionality of the habitat for marsh fritillary being dependent on the presence of its food plant, devil's-bit scabious *Succisa pratensis*, and vegetation structure; both being highly unlikely to be affected in changes in air quality.

Subsequent to the Stage 1 Screening report, the air quality assessment (ES Volume 1 Chapter 8: Air Quality) has identified the potential for significant changes in nutrient nitrogen deposition within areas of suitable marsh fritillary habitat. This refers specifically to habitat used by the wider marsh fritillary meta-population of the Blaen Cynon SAC and Upper Cynon Valley Landscape Functional Area, but not habitat within the designated site itself. As such, potential degradation of marsh fritillary habitat used by the Blaen Cynon SAC marsh fritillary metapopulation is considered possible, resulting in a likely significant effect on the Blaen Cynon SAC. This required further assessment as part of the Stage 2 process.

4.2.3 Disturbance of lesser horseshoe bat - lighting

A potential significant effect caused by construction lighting on the lesser horseshoe bat of the Usk Bats Sites SAC was identified in the Stage 1 Screening report. However, since that time it has been confirmed that there would be no night time working, hence no artificial lighting necessary. Any security lighting at site compounds would be located away from the Taf gorges and implemented in accordance with the following guidance to prevent light spill into terrestrial habitats or watercourse where lesser horseshoe bats (and bats in general) may be present:

- CIRIA C741 - Environmental Good Practice on Site (4th Edition) (CIRIA, 2015a);
- Institute of Lighting professionals (2011) Guidance Notes for the reduction of obtrusive lighting (GN01:2011); and
- CIE 150: 2003 Technical Report, Guide to the Limitation of the Effects of Obstructive Light from Outdoor Lighting Installations.

This would avoid changes in light levels by; prescribing position and direction of lighting, appropriate levels of illumination and use of hoods, louvers, shields and reflectors and baffles to avoid light spillage into surrounding areas.

Lighting of the operational scheme was screened out in the Stage 1 Screening report. This was confirmed during the 2017 screening review, based on the proposed lighting strategy for the scheme. No street lighting is proposed on the structures that span the Taf Fechan or Taf Fawr, where lesser horseshoe bat roosts and the majority of lesser horseshoe bat commuting and feeding has been recorded. The existing structures over the Taf Fechan and Taf Fawr are currently lit. The removal of this lighting in the proposed scheme lighting design is regarded as beneficial for lesser horseshoe bat. Low height spot lighting is proposed on the Taf Fechan non-motorised user route but would be targeted at a defined low-height area with no spillage into the gorge areas.

The construction disturbance identified as a likely significant effect on lesser horseshoe bat of the Usk Bat Sites SAC, considered during the Stage 2 process, concerned noise and vibration effects on roosts during the construction phase only.

4.2.4 Direct mortality of lesser horseshoe bat

In the Stage 1: Screening report (Jacobs, 2016), the potential likely significant effect of road mortality of lesser horseshoe bats during the operational phase of the proposed scheme was screened out. In light of the design development and the detailed programme of lesser horseshoe bat survey undertaken in May to September 2016 (ES Volume 2, Appendix 11H) this potential likely significance was reviewed. The survey information showed that lesser horseshoe bat activity was concentrated in the Taf Fawr and Taf Fechan gorges. More specifically, lesser horseshoe bat activity was concentrated at watercourse level, at some considerable distance below (at least 30 m) the existing road structures that span them. Walked activity transects along the top of the cliffs at both gorges did not record any lesser horseshoe bat activity. The proposed structures over the Taf Fawr and Taf Fechan involve widening the existing structures only and spans would remain at the same height above the watercourses, maintaining existing bat commuting and foraging routes.

The only other location where lesser horseshoe bat was recorded was a single pass through a culvert near Trewaun. This culvert would be retained and no works are proposed. Figure 7 and Section 7.3.2 provide additional survey information.

As such there is no pathway to effect for road mortality to occur via traffic collisions on the proposed scheme. This potential likely significant is not considered further during the Stage 2 process.

4.3 Likely significant effects taken forward to Stage 2

The likely significant effects identified in Stage 1: Screening are still valid. No additional likely significant effects on the European sites screened out in Stage 1: Screening have been identified.

In conclusion, the following likely significant effects were taken forward for assessment in the Stage 2 process.

Blaen Cynon SAC, specifically on the marsh fritillary:

- habitat loss;
- habitat fragmentation;
- habitat degradation (air quality impacts);
- direct mortality – larval webs (vegetation clearance); and
- direct mortality – butterfly (road traffic collisions).

Usk Bat Sites SAC, specifically on the lesser horseshoe bat (no pathways to effect was identified for the habitat qualifying features of this site):

- habitat loss (direct loss of roosts during rock cutting for structures); and
- construction disturbance (noise and vibration).

5. Assessment Methods

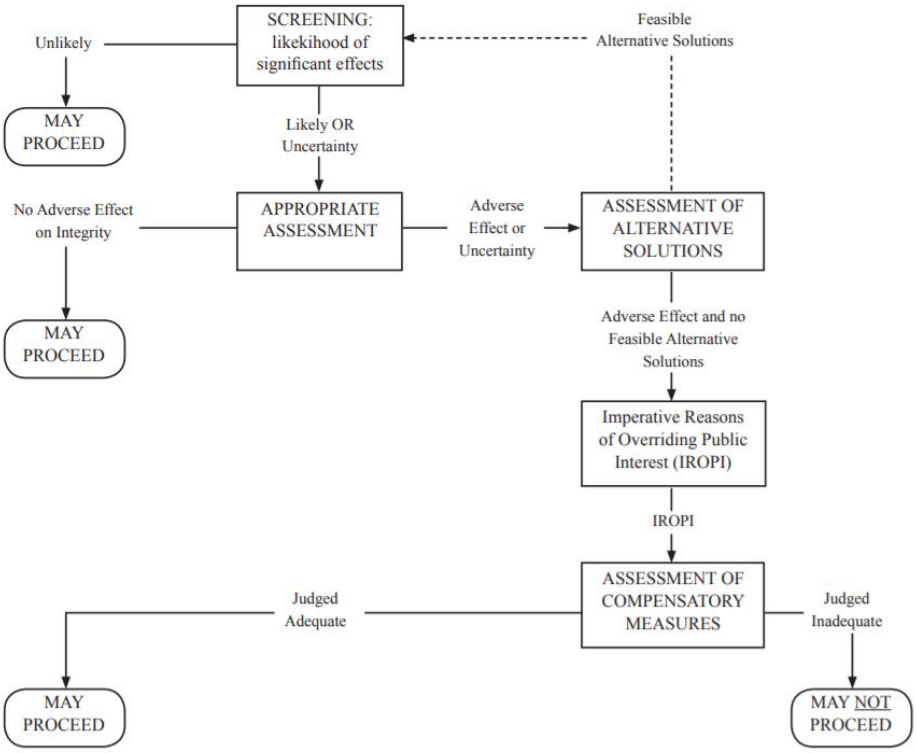
5.1 Assessment methodology

This section sets out the method and assumptions made for the consideration of the proposed scheme with regard to the requirements of the Conservation of Habitats and Species Regulations, 2010 (as amended) and the AIES process as set out in DMRB HD44/09 guidance.

AIES is a five stage process as illustrated in Plate 5.1. These stages are:

- Stage 1 – Screening: to test whether a plan or project (either alone or in combination with other projects and plans) is likely to have a significant effect on a European site.
- Stage 2 - Appropriate Assessment: to determine whether, in view of a European site's conservation objectives, the plan or project (either alone or in combination with other projects and plans) would have an adverse effect on the integrity of the site with respect to the site structure, function and conservation objectives. If adverse impacts are anticipated (or there is uncertainty as to the absence of such), mitigation measures to alleviate impacts should be proposed and assessed.
- Stage 3 - Assessment of alternative solutions: where a plan or project is assessed as having an adverse impact on the integrity of a European site, there should be an examination of alternative solutions (e.g. alternative locations and designs of development).
- Stage 4 - Consideration of Imperative Reasons of Overriding Public Interest (IROPI): where a plan or project is assessed as having an adverse effect on a European site and it has been demonstrated that there are no alternative solutions, the imperative reasons of overriding public interest must be demonstrated.
- Stage 5 - Compensatory Measures: where a plan or project is proposed despite a negative assessment of adverse effect because of IROPI, then sufficient compensatory measures are required to maintain the overall coherence of the site or integrity of the European site network.

Plate 5.1 : The AIES process (Fig 3.1 in DMRB HD44/09)



Each European site potentially affected by the proposed scheme has been assessed at the Stage 1 Screening Stage assessment using the Screening Matrix template provided in Appendix C of Section 4: HD44/09. The resulting screening matrices for the proposed scheme are given in Appendix A. The precise methodology for this stage of assessment is not repeated here, but can be found in the separate Screening Report (Jacobs, 2016).

The scope of the assessment reported in this statement is Stage 2 of the process: Appropriate Assessment. This stage in AIES determines whether or not there would be an effect on the integrity of the European sites shown to have likely significant effects on their conservation objectives in Stage 1 Screening; alone, or in combination with other projects / plans / programmes. The process for Stage 2: Appropriate Assessment was as follows:

- Detailed consideration of desktop information and site-specific field survey, with specific focus of the qualifying interest feature species of the European sites where likely significant effects were identified during Stage 1 Screening (i.e. marsh fritillary and lesser horseshoe bat).
- Use of scientific literature. Previous project experience and professional judgement to predict potential adverse impacts on each qualifying interest feature species, specifically on the delivery of its conservation objectives and consequently on the integrity of the European site. Namely (taken from 'Integrity of Site Checklist', Annex F of HD44/09:

Conservation objectives
Does the project have the potential to: • cause delays in progress towards achieving the conservation objectives of the site? • Interrupt progress towards achieving the conservation objectives of the site? • disrupt those factors that help to maintain the favourable conditions of the site? • Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?

Other indicators
Does the project have the potential to: • Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem? • Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site? • Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)? • Reduce the area of key habitats? • Reduce the population of key species? • change the balance between key species? • Reduce the diversity of the site? • Result in disturbance that could affect population size or density of the balance between key species? • Result in fragmentation? • Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding, etc)?

- Three potential outcomes from Stage 2: Appropriate Assessment were then possible:
  - That evidence is sufficient and that it demonstrates beyond reasonable scientific doubt that there will be no adverse effects;
  - That evidence is sufficient but that it indicates that there will be an adverse effect; or
  - That there is insufficient information or evidence to make a determination.
- Where the latter conclusion was reached then the 'precautionary principle' should be applied, and it was assumed that adverse effects would result.
- On conclusion of the Appropriate Assessment where the evidence is sufficient and that it demonstrates beyond reasonable scientific doubt that there will be no adverse effects and the competent authority and relevant Statutory Environmental Bodies (SEBs i.e. Natural Resources Wales and the local authorities) are in agreement, the normal approvals process can be followed and the requirements in terms of AIES are complete.
- If either an adverse effect is possible or likely or the relevant SEBs are not in agreement, then there is a need to proceed on the basis that the project will adversely affect the integrity of the site. As such there is a need to proceed to the later stages of the AIES (i.e. Stages 3 to 5 above).

5.2 Identification of plans or projects considered for in-combination assessment

A requirement of the Conservation of Habitats and Species Regulations, 2010 (as amended) is to also examine the potential for a plan or project to have a significant effect either alone or in combination with other plans and projects. For the purposes of this assessment the following classes of projects have also been included:

- transport projects proposed by local highway authority on non-trunk roads due to be implemented in a reasonable timeframe, for example as part of a planned programme of works;
- planning applications, for which formal EIA is a requirement, that has been submitted for determination and is pending a decision (up to the end of February 2016); and
- major development schemes for which specific policies, development briefs, supplementary guidance or area action plans are identified and included in the relevant development plan (recognising that much information on any relevant proposals would be limited).

Following a judgment of the European Court of Justice in October 2005, it is also necessary to include as part of in-combination checks, the following proposals:

- allocations or other forms of proposals in adopted development plans; and
- allocations or other forms of proposals in draft development plans which have been published for consultation purposes.

Tyldesley (2011) advices the following criteria are also used to confirm the types of projects to be considered in the in-combination assessment:

- the incomplete parts of consented projects that have been started but which are not yet completed;
- projects given consent but not yet started;
- projects that are subject to applications for consent;
- projects that are subject to outstanding consenting process appeal procedures;
- any known projects that are not subject to any consent;
- ongoing projects subject to regulatory reviews, such as discharge consents or waste management licences;
- policies and proposals that are not yet fully implemented in plans that are still in force; and
- draft plans that are being brought forward by other public bodies.

The study area for the in-combination assessment extends 5 km from the proposed scheme boundary. This study area has been selected on the basis that it covers the likely zone of influence for the specific qualifying features identified in this AIES and is also likely to cover any overlap with the study areas for assessments undertaken for other major plans or projects.

A list of projects and plans has been collated from relevant local authority planning websites (Neath Port Talbot, Rhondda Cynon Taf County Borough Council, Brecon Beacons National Park, Merthyr Tydfil County Borough Council, Caerphilly County Borough Council and Blaenau Gwent County Borough Council). These are listed in Section 11, where the in-combination assessment is detailed.

5.3 Use of professional judgement

Professional judgement was used in this assessment where specific guidance was not available and in the interpretation of desk and field survey results. Where there was insufficient information regarding the likelihood of qualifying interests being present or of the pathway to effect, the assessment used the precautionary principle to inform the judgement. The precautionary principle has been applied to ensure that any assessment errs on the side of caution, without being overly cautious. This principle means that the conservation objectives and site integrity should prevail where there is any uncertainty or that harmful effects will be assumed in the absence of evidence to the contrary.

5.4 Precautionary principle

In assessing impacts and designing mitigation, the "precautionary principle" as described in HD 44/09 has been adopted which is as follows:

"*It is important to recognise that in undertaking assessment of the implications of plans and projects, there is a need to apply the "precautionary principle", that is "… the conservation objectives … should prevail where there is uncertainty" or that harmful effects will be assumed in the absence of evidence to the contrary. The basis of this is the 'Communication from the Commission on the precautionary principle' which indicates that the Treaty does not define this term but that it "… prescribes it only once" in that its purpose is "– to protect the environment." This communication goes further in providing detailed advice on when recourse to this principle is relevant, recourse to this principle should occur when there is*":

- *"identification of potentially negative effects resulting from a phenomenon, product or procedure;*

- *a scientific evaluation of risks which, because of the insufficiency of the data, their inconclusive or imprecise nature, makes it impossible to determine with sufficient certainty the risk in question".*

It follows from the above that when assessing the likelihood of impacts, it is assumed if there is sufficient uncertainty of whether there is an impact then there is the potential for an impact.

6. European Sites

6.1 Characteristics of the Blaen Cynon SAC

6.1.1 Overview

The Blaen Cynon SAC is located approximately 55 m north of the proposed scheme, as shown in Figure 1.

The Blaen Cynon SAC covers a total area of 66.62 ha and includes land designated within the following Sites of Special Scientific Interest (SSSI):

- Cors Bryn-y- Gaer SSSI; and
- Woodland Park and Pontpren SSSI.

Marsh fritillary is the single qualifying feature of the SAC (JNCC, 2016). The CCW, now Natural Resources Wales (NRW) Core Management Plan for the SAC (CCW, 2008) provides the following overall description of the SAC:

"*Blaen Cynon contains an extensive complex of damp pastures and heaths supporting the largest metapopulation of marsh fritillary on the southern edge of the Brecon Beacons National Park. The marsh fritillary butterfly is found in a range of habitats in which its larval food plant, devil's-bit scabious (Succisa pratensis), occurs. Marsh fritillaries are essentially grassland butterflies in the UK, and although populations may occur occasionally on wet heath, bog margins and woodland clearings, most colonies are found in damp acidic or dry calcareous grasslands. Populations of marsh fritillary vary greatly in size from year to year, and, at least in part, this is related to cycles of attack from parasitic wasps. Adults tend to be sedentary and remain in a series of linked metapopulations, forming numerous temporary sub-populations, which frequently die out and recolonise.*

Blaen Cynon also supports a range of habitats. Marshy grassland, and flush and spring are of particular importance as they provide habitat for the marsh fritillary. Also present are areas of raised bog, species-rich neutral grassland, acid grassland and semi-natural broadleaved woodland".

6.1.2 Conservation objectives

The Core Management Plan (CCW, 2008) sets out the conservation objectives for the marsh fritillary butterfly qualifying feature for which the Blaen Cynon SAC is designated. Each conservation objective consists of the following two elements:

- vision for the feature; and
- performance indicators.

The performance indicators are actions of the conservation objectives that are measureable. These are provided in Appendix B.

The vision for marsh fritillary is set out below, as taken from the Core Management Plan (CCW, 2008).

The vision for marsh fritillary is for it to be in a favourable conservation status, where all of the following conditions are satisfied (Fowles, 2004):

- the site would contribute towards supporting a sustainable metapopulation of the marsh fritillary butterfly in the Penderyn / Hirwaun area. This would require a minimum of 50 ha of suitable habitat, of which at least 10 ha must be in good condition, although not all of this is expected to be found within the SAC. Some would be on nearby land within a radius of about 2 km;
- the population would be viable in the long-term, acknowledging the extreme population fluctuations of the species;

- a minimum of 30% of the total site area would be grassland suitable for supporting marsh fritillary butterfly (as the total area of the SAC is 66.62 ha, 30% represents approximately 20 ha);
- at least 40% of the suitable habitat (approximately 8 ha) must be in optimal condition for breeding marsh fritillary butterfly;
- suitable marsh fritillary butterfly habitat is defined as stands of grassland where devil's-bit scabious is present and where scrub more than 1 m tall covers no more than 10% of the stands; and
- optimal marsh fritillary butterfly breeding habitat would be characterised by grassland where the vegetation height is 10 to 20 cm, with abundant purple moor-grass *Molinia caerulea*, frequent "large-leaved" devil's-bit scabious suitable for marsh fritillaries to lay their eggs and only occasional scrub. In peak years, a density of 200 larval webs per ha of optimal habitat would be found across the site.

6.1.3 Current condition of Blaen Cynon SAC

The last habitat condition assessment of the Blaen Cynon SAC was undertaken in 2008 by NRW. Results from 2008 showed that 13% of the site was in 'suitable' condition for marsh fritillary with an additional 5.4% being in 'good' condition. The site is in an overall unfavourable condition and does not currently meet its site-based conservation objective for habitats. It is acknowledged by NRW that the Blaen Cynon SAC is not currently in Favourable Conservation Status (FCS).

Annual counts on the SAC for larval webs have been undertaken (since 2008 by NRW) with results shown in Table 6.1. This would suggest that larval web counts are higher in recent years, possibly a reflection of habitat improvements. However, no habitat surveys have been undertaken to substantiate this.

A performance indicator for the SAC is a specified limit for 200 larval webs per hectare of good condition habitat. Using the 2008 habitat data, the 5.4% coverage of good condition habitat equates approximately 3.6 ha. To meet the performance indicator larval web counts should have a lower limit of 720 across the site. A maximum count of 220 larval webs was recorded in 2015 suggesting the SAC is not achieving its conservation objectives for this indicator.

Table 6.1 : NRW Larval web counts (NS – not surveyed)

Monitoring site	2008	2009	2010	2011	2012	2013	2014	2015	2016
1 - Blaen Cynon SAC	16	93	158	18	20	NS	172	220	196

6.1.4 Core landscape and Upper Cynon Valley Functional Landscape Area

Marsh fritillary is a mobile species and although the Blaen Cynon SAC has a definitive boundary, the metapopulation of marsh fritillary lives across a much wider area. This is referred to specifically within the conservation objectives of the Blaen Cynon SAC which refers to a core metapopulation area; which is defined as being within 2 km of the SAC boundary. As detailed above, conservation objectives require a minimum area of suitable habitat present within 2 km of the SAC.

The Upper Cynon Valley Functional Landscape Area is a wider area which comprises the functional distribution of marsh fritillary butterfly habitat centred on 2 km concentric rings around existing records of the species creating one large functional landscape. The extents of both of these areas are shown in Figure 2.

Previous survey work by Smith (2005) indicated that there was a large amount of suitable habitat (248.79 ha) in the functional landscape surrounding Blaen Cynon SAC (as defined by Fowles, 2005) of which 24.37 ha was considered to be in good condition. This is greater than the required 50 ha of suitable and 10 ha of good condition detailed in the performance indicators, but relates to a wider metapopulation than that covered by the SAC conservation objectives.

This SIAA report includes consideration of effects relating to the wider Functional Landscape Area as well as the core metapopulation area specified within the SAC conservation objectives. This is in line with best practice

consideration of the extent of marsh fritillary metapopulations outlined in Fowles (2005) and in consultation with invertebrate specialists at TWG meetings.

6.2 Characterisation of the Usk Bat Sites SAC

6.2.1 Overview

The Usk Bat Sites SAC is located approximately 9.2 km north east of the proposed scheme at its nearest point, as shown in Figure 1.

The Usk Bat Sites SAC covers a total area of 1686.4 ha and includes land designated within the following Sites of Special Scientific Interest (SSSI):

- Mynydd Llangatwg / Mynydd Llangattock SSSI;
- Siambre Ddu SSSI;
- Buckland Coach House and Ice House SSSI; and
- Foxwood SSSI.

Each component SSSI may have additional land or features that are not part of the SAC interest features. Lesser horseshoe bats are the only SAC qualifying feature screened into this assessment (other qualifying features of the SAC are Annex I habitats).

The site encompasses a series of lesser horseshoe bat roosts, upland habitats, woodlands and cave systems located around the valley of the River Usk near to Abergavenny (CCW, 2008a). The site contains one of the largest known maternity roosts for lesser horseshoe bat in south-east Wales as well as a number of important hibernacula in caves in the area. The area contains up to 5% of the UK population, though counts in hibernation sites suggest this may be an underestimate (JNCC, 2016a).

Buckland Coach House and Ice House provide maternity and hibernation sites for the bats, approximately 16.3 km north of the proposed scheme at Taf Fechan. The caves at Foxwood (approximately 29.6 km east of the proposed scheme at Taf Fechan) and Siambre Ddu (approximately 21.8 km east of the proposed scheme at Taf Fechan) provide hibernation sites for the bats and the surrounding habitats provide foraging areas for the bats. Mynydd Llangatwg is mostly common land, generally used for sheep grazing but also comprises a northern limestone escarpment which has caves supporting lesser horseshoe bats.

6.2.2 Conservation objectives

The Core Management Plan (CCW, 2008a) sets out the conservation objectives for the lesser horseshoe qualifying feature for which the Usk Bat Sites SAC is designated. Each conservation objective consists of the following two elements:

- vision for the feature; and
- performance indicators.

The performance indicators are actions of the conservation objectives that are measureable. These are provided in Appendix C.

The vision for lesser horseshoe bats at the Usk Bat Sites SAC is set out below, as taken from the Core Management Plan (CCW, 2008a).

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- the site would support a sustainable population of lesser horseshoe bats in the River Usk area;
- the population would be viable in the long-term, acknowledging the population fluctuations of the species;

- buildings, structures and habitats on the site would 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;
- 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;
- there would be no loss or decline in quality of linear features (such as hedgerows and tree lines) which the bats use as flight lines - there would be no loss of foraging habitat use by the bats or decline in its quality, such as due to over-intensive woodland management; and
- all factors affecting the achievement of the above conditions are under control.

6.2.3 Current condition of Usk Bat Sites SAC

The most recent conservation status given to the lesser horseshoe bat qualifying feature was “Favourable” in 2006 (CCW, 2008a). This status was given due to the good counts of bats in maternity roosts at Buckland House and hibernation roosts at Agen Allwedd, Clydach Gorge, Buckland Ice House and Foxwood. While the buildings were considered likely to continue to be stable roosting sites, this was dependent on the buildings being maintained and access retained via large access points to be unaltered.

Specific reference of management issues that need to be addressed to maintain or restore cave structures used by bats is provided in the Core management plan for the SAC (CCW, 2008a). Relevant sections are given below.

“*Lesser horseshoe bats prefer to enter roosts through holes large enough for unimpeded flight. It is important that bat access points into the roost sites remain open and of suitable size. Vegetation close to entrances should be maintained, but should not obstruct them.*

It is important that access to the cave systems is managed to protect the bats. Lesser horseshoe bats are very sensitive to disturbance and even the presence of a single person in close proximity can cause problems. Cavers and geologists should avoid areas where bats are likely to be disturbed during the winter months…. Any structures placed at cave entrances to prevent unauthorized access should not hinder the passage of bats.

Occasionally excavation may be required to maintain cave entrances and clear debris that has fallen in the caverns and passages. Any excavation or clearance work needs to be carefully controlled. Early July is likely to be the best time for any works required to the cave itself, with a higher chance of no bats being resident in day time hours. Any materials or treatments used and any fumes created or residues left would need to be non-toxic to bats. Likewise operations outside the roost would also need to avoid the creation of fumes that may enter the roost areas or persist in areas that the bats use.

Underground hibernation roosts should be dark, cool and humid with stable temperature (8 -12°C) beyond the entrance zone. However, the boulder roof of the Foxwood cave is gappy and internal temperatures are dependent on external temperatures, unlike the situation in many true caves. The consequence is that declining winter ambient temperature leads to a decline in roost temperature and in the colder winter months roost temperature falls below the required temperature range, triggering departures of bats to other unknown roosts. These may be within deeper unknown caves within the SSSI or elsewhere…”

Habitat management issues are also set out in the Core Management Plan (2008a) stating;

“*Connectivity of woodland, hedgerows, linear habitat and field boundary features should be maintained as lesser horseshoe bats tend to feed in wooded areas and use linear features to navigate their way between roosts and foraging habitat*”.

7. Baseline Knowledge and Ecological Surveys Undertaken

7.1 Phase 1 habitat survey

Jacobs undertook an Extended Phase 1 habitat survey in 2015 (ES Volume 2- Appendix 11F). The survey identified a range of habitats present within the 500 m study area around the proposed scheme which contained, or had the potential to contain, the preferred food and egg laying plant for marsh fritillary devil's-bit scabious: marshy grassland; unimproved grasslands; semi-improved grasslands; heathland mosaics; and bogs, mires and fens. These habitats are shown in Figure 3.

Habitats were also identified as having potential to provide roosting, commuting and foraging resources for bat species, particularly lesser horseshoe. Potential roosting habitats recorded in the study area were buildings (residential and business premises), caves (in limestone cliffs at Taf Fawr and Taf Fechan gorges) and trees. Woodland habitats, watercourses, geological / landscape features and hedgerows provided commuting habitat for bats in the study area. Species diverse marshy, acid and neutral grassland, heaths and watercourses are likely to sustain good levels of invertebrates and subsequently optimal feeding habitat for bats. The extent and distribution of these habitats within the study area is shown in Figure 3.

7.2 Marsh fritillary

7.2.1 Desk study

Wales provides one of the European strongholds for marsh fritillary which has declined in almost all European countries. However, in Wales the population has also declined with a 60% reduction in range with the rate of loss as high on protected sites (i.e. SSSIs and nature reserves) as on unprotected ones (Barnett & Warren, 1995).

To maintain an up-to-date picture of Welsh marsh fritillary population distribution and population resilience, Butterfly Conservation Wales and NRW undertake:

- a Wales-wide programme of visits in which every known population gets at least one survey visit every five years; and
- an annual larval web count of 21 key populations - Wales Marsh Fritillary Surveillance Programme.

Marsh fritillary is known to be present in the following vice-counties: Monmouthshire, Glamorgan, Brecknockshire, Carmarthenshire, Pembrokeshire, Cardiganshire, Merionethshire, Caernarvonshire and Anglesey. An annual report is published detailing the results.

The latest report - The Status of the Marsh Fritillary in Wales: 2016 (Butterfly Conservation Wales, 2017) provides the following overview:

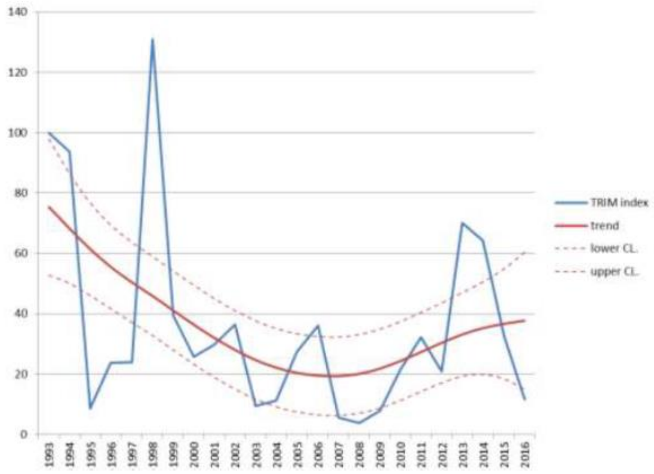
'*In summary, the 2016 results mean an addition of five populations and a 'loss' of three populations for the most recent five-year period (2012-2016). The 'lost' sites still support areas of breeding habitat and may be reoccupied in the future, as would be expected in a functioning marsh fritillary metapopulation. The 'net gain' of two populations is encouraging in what was otherwise a lean year….*

At a Wales level, the combined data from the 21 populations continues to show an overall long-term decline between 1993 and 2016. The TRIM[1] output (blue line on graph [Plate 7.1]) highlights just how poor 2016 was – in fact the worst year since 2009. To better separate patterns of general change from annual fluctuation, the TRIM output was run through TrendSpotter software, which produces a smooth trend through the abundance data (red line). This indicates that in the most recent five years period (2011-16) the web index is higher than it was over the previous five years (2006-10). So, although the Wales trend still shows an overall decrease, with

[1] TRIM (Trends and Indices for Monitoring Data) analysis provided by the UK Butterfly Monitoring Scheme. The multiplicative overall slope estimate in TRIM is converted into one of six trend classification categories: Uncertain: no significant increase or decline, but not certain if trends are less than 5% per year.

low web numbers in 2015 and 2016 compared to the previous couple of years, the overall decline continues to be non-significant and an increasing trend remains evident from 2008 onwards.'

Plate 7.1 : Larval web trend for Wales 1993 – 2016 (Butterfly Conservation Wales, 2017)



More locally, the Blaen Cynon population is regarded as one of the strongholds in Wales, being one of four sites in Wales where larval web density exceeds 10 webs per hectare in 2016 (Butterfly Conservation Wales, 2017).

A desk study of marsh fritillary records (from SEWBReC) was undertaken to ensure that The Upper Cynon Valley Functional Landscape Area (the wider area which comprises the functional distribution of marsh fritillary habitat centred on 2 km concentric rings around existing records of the species creating one large functional landscape) included all recent records and, therefore, truthfully represented its modern day extent. The updated Functional Landscape Area is shown in Figure 3.

7.2.2 Long-term baseline monitoring

The extent of devil's-bit scabious is an important limiting factor as to the extent and distribution of marsh fritillary. The marsh fritillary is dependent upon the plant for adults to lay eggs on and the resulting caterpillars to eat, as the only food plant. The structure of the vegetation in habitats for marsh fritillary is also very important with the optimal range of 12 to 25 cm providing: protection for laid eggs; pupae with shelter to develop; larvae to overwinter in dense tussocks; and robust devil's-bit scabious plants to locate and eat later in the year.

Jacobs has undertaken annual monitoring (since 2008) of marsh fritillary habitat of ten specific areas (see Figure 4) along the existing A465, between the A4060 junction (Dowlais Top Roundabout), in the east, and the Rhigos roundabout, south of Hirwaun, in the west.

The aim of this monitoring was to provide a robust baseline of current conditions and give an indication of trends in species and habitat changes. Annual monitoring over a long timeframe is particularly important on habitats where the characteristics of the supported species (in this case marsh fritillary) is prone to significant reductions after cycles of caterpillar parasitism by braconid wasps. Changes in habitat quality are not always immediate and may take some years to become apparent. Recording changes in habitat quality over time can alert monitors to identify (new) causes of habitat degradation, be it generally observed or site specific, and help identify better management practices. The long term data also provide a range of results, allowing for any external / unknown, effects on habitat to be recorded before the proposed scheme is constructed and operational. The continuation of monitoring once the proposed scheme is operational would allow detailed comparisons to be made, making allowances for any patterns or trends in habitat quality or the local metapopulation.

Habitat assessment can be a much more useful tool in assessing the conservation status of species like marsh fritillary than adult and larval web counts alone. However, long term monitoring of adults and larval webs show how the metapopulation responds to habitat changes and can identify, or even predict, when subsequent numbers of adults and larval webs may reduce due to parasitism.

The selected monitoring locations were chosen as representative habitats of those across the proposed scheme or those likely to undergo significant change with implementation of the proposed scheme. These monitoring are located:

- Within the 2 km Blaen Cynon SAC metapopulation area (sites 1, 5, 6 and 6a);
- Within the Upper Cynon Valley Landscape Functional Area adjacent to the proposed scheme (sites 1, 2, 2a, 3, 4, 4a and 5); and
- Within the Upper Cynon Valley Landscape Functional Area to the west of the proposed scheme, outside of any areas where direct impact due to the proposed scheme would occur (sites 6, 6a, 7 and 7a).

Using the habitat suitability assessment methodology of Fowles (2005), every 10 m x 10 m block of habitat within each monitoring site was assessed for its suitability for marsh fritillary. The categories and explanation for each is as follows:

- Good Quality Habitat (GC): Grassland where, for at least 80% of the quadrat, the vegetation height is within the range of 12 to 25 cm, and devil's-bit scabious *Succisa pratensis* is present within a 1 m radius. Scrub (>1 metre tall) Cover<5%
- Suitable (Under-Grazed) Habitat (SU); Grassland where vegetation height is above 25 cm and devil's-bit scabious is occasional / frequent / abundant. Or in which sward height is between 12-25 cm and devil's-bit scabious at least occasional, but Scrub (>0.5 m tall) covers >5% of area
- Suitable (Over-Grazed) Habitat (SO): Grassland with frequent-abundant devil's-bit scabious but which is currently over-grazed such that the sward is below 12 cm on average
- Suitable (Sparse) Habitat (SS): Grassland with sparse occasional or rare devil's-bit scabious and vegetation height is less than 25 cm on average
- Potential (Rank) Habitat (PR): Grassland with rare devil's-bit scabious but which is currently under-grazed or neglected such that the sward is above 25 cm on average and devil's-bit scabious occurs as scattered plants in a rank, tussock sward
- Not Suitable (NS): All other unsuitable habitat, not containing devil's-bit scabious.

The 10 monitoring sites were also surveyed annually between 2008 and 2016 for larval webs and adults at appropriate times of year by Jacobs' Ecologists (see Table 7.2 and Table 7.3).

7.2.2.1 Habitats

Table 7.1 summarises the results setting out the percentage cover of 'suitable habitat' (combined coverage of Suitable Undergrazed, Suitable Overgrazed, Suitable Sparse and Potential Rank sub-categories) and 'good condition' habitat (defined by Fowles, 2005) for marsh fritillary at each monitoring site. Full details can be found in annual monitoring reports with a detailed summary in the 2016 monitoring report (ES Volume 2, Appendix 11I). Site 1, the Blaen Cynon SAC, is solely monitored by NRW who do not record habitat suitability. The most recent results from 2016 are shown in Figure 5.

Table 7.1 : Habitat suitability – 'suitable habitat' percentage cover / 'good condition' percentage cover at monitoring sites (NS – not surveyed)

Monitoring site	2008	2009	2010	2011	2012	2013	2014	2015	2016
1 - Blaen Cynon SAC	13 / 5.4	NS	NS	NS	NS	NS	NS	NS	NS
2 - Dderi Hir	44 / 1.0	43 / 0.5	36.2 / 3.2	35.2 / 4.1	31.5 / 7.2	32.1 / 6.5	30.2 / 8.8	30.5 / 8.4	32.6 / 8.3
2a - Ger-y-bont, Croesbychan	NS	43.3 / 0.0	42.5 / 0.0	43.4 / 0.0	33.3 / 22.5	35 / 14.2	10.8 / 38.3	10.8 / 38.3	10.8 / 38.3
3 - North Crematorium	3.4 / 0.3	5.2 / 0.4	4.8 / 0.9	4.9 / 0.7	5.4 / 0.4	5.0 / 0.7	5.0 / 0.7	5.0 / 0.7	NS
4 - Bryncarnau Grasslands	49.3 / 2.5	56.8 / 0.8	54.1 / 1.6	53.8 / 0.4	52.2 / 0.9	52.2 / 0.9	51.4 / 1.7	63.8 / 2.4	63.8 / 2.4
4a - South Bryncarnau Grasslands	NS	59.4 / 2.2	51.7 / 7.6	60.8 / 0.0	58.2 / 0.0	58.2 / 0.0	58.2 / 0.0	58.2 / 0.0	NS
5 - Near Playing Field	26.2 / 2.8	30.9 / 1.2	29.6 / 2.4	23.0 / 4.3	22.5 / 3.4	23.3 / 2.4	NS	24.6 / 3.1	24.3 / 3.4
6 - Heol-Y-Graig	33.8 / 0.2	46.1 / 0.0	43.6 / 0.2	44.7 / 0.6	44.5 / 1.0	45.5 / 0.0	42.4 / 3.2	40.9 / 4.8	45.2 / 0.0
6a – Halt Road	NS	74.0 / 1.3	16.0 / 59.3	16.5 / 57.6	45.9 / 27.7	45.9 / 27.7	49.4 / 24.2	52.0 / 21.6	74.0 / 0.0
7 – Mount Road	1.4 / 0.1	4.1 / 0.2	4.6 / 0.3	4.2 / 0.1	4.2 / 0.2	4.1 / 0.3	NS	NS	NS
7a – East of Mount Road	NS	34.0 / 0.0	30.2 / 2.9	33.7 / 0.0	33.7 / 0.0	33.7 / 0.0	33.4 / 0.4	32.6 / 1.8	32.6 / 1.8

Sites 4, 4a, 6 and 6a had the highest coverage of suitable condition habitat for marsh fritillary with a percentage cover of 74% at Site 6a in 2016. However, it should be noted that Site 6a which has had a consistently high percentage cover of good and suitable habitat, has a declining proportion of "good condition" habitat (since 2010). This trend is not replicated elsewhere and is attributed to changes in management. This exemplifies the importance of a considered and reactive habitat management plan for the long-term conservation of the species. It also shows that an area is unlikely to ever be 100% suitable for marsh fritillary due to the mosaic of habitats and structural diversity often found in these habitats.

7.2.2.2 Larval Webs and Adults

In summary, the latest monitoring report from data collected in 2016 (Jacobs, 2017) states:

- Larval webs – NRW survey in 2016 recorded approximately 196 larval webs in the Blaen Cynon SAC. Peak years of larval web counts in the SAC were 158 in 2010 and 220 in 2015. Larval webs have also been recorded on nine of the 10 monitoring sites surveyed by Jacobs (see Table 7.2) with regular positive results found at Sites 2, 3, 4 and 6a.
- Adult counts – adult marsh fritillary butterfly have not been surveyed on the SAC site since 2009. Adult marsh fritillary butterfly were recorded on eight of the 10 sites surveyed by Jacobs Ecologists with regular, positive counts made at Sites 2, 4 and 6a (see Table 7.3). A maximum count of 433 adults was counted at Site 4 in 2015.

Table 7.2 : Larval web counts (NS – not surveyed)

Monitoring site	2008	2009	2010	2011	2012	2013	2014	2015	2016
1 - Blaen Cynon SAC	16	93	158	18	20	NS	172	220	196
2 - Dderi Hir	0	0	6	9	32	137	361	355	160
2a - Ger-y-bont, Croesbychan	NS	0	0	0	0	0	1	0	2
3 - North Crematorium	0	0	1	4	1	10	12	20	NS
4 - Bryncarnau Grasslands	0	1	31	0	6	2	122	433	117
4a - South Bryncarnau Grasslands	NS	0	0	0	0	0	0	3	NS
5 - Near Playing Field	0	0	0	0	0	0	NS	0	0
6 - Heol-Y-Graig	0	0	0	0	0	0	1	0	1
6a – Halt Road	NS	0	107	151	136	332	72	54	0
7 – Mount Road	0	0	0	0	0	0	NS	NS	NS
7a – East of Mount Road	NS	0	1	0	0	0	0	1	0

Table 7.3 : Adult counts (NS – not surveyed)

Monitoring site	2008	2009	2010	2011	2012	2013	2014	2015	2016
1 - Blaen Cynon Special Area of Conservation	21	51	NS	NS	NS	NS	NS	NS	NS
2 - Dderi Hir	2	4	12	62	15	16	316	333	20
2a - Ger-y-bont, Croesbychan	NS	0	0	0	1	0	2	5	0
3 - North Crematorium	0	0	0	10	0	2	5	26	NS
4 - Bryncarnau Grasslands	0	11	70	84	2	28	296	435	3
4a - South Bryncarnau Grasslands	NS	13	0	0	0	0	9	14	0
5 - Near Playing Field	0	0	0	0	0	0	0	0	0
6 - Heol-Y-Graig	0	0	0	0	0	0	2	3	0
6a – Halt Road	NS	0	68	114	254	111	126	148	0
7 – Mount Road	0	0	0	0	0	0	NS	NS	NS
7a – East of Mount Road	NS	0	0	0	2	0	0	0	1

7.2.3 Habitat suitability assessment

Further habitat assessment for marsh fritillary suitability, outwith the long-term monitoring, was undertaken by Jacobs in 2016:

- habitat suitability (Spring 2016) – identification of suitable habitat for marsh fritillary within 2 km of the Blaen Cynon SAC; and

- detailed habitat mapping (Autumn 2016) of areas identified as having devil's bit scabious present during the Phase 1 habitat survey carried out in August / September 2015, within 100 m of the proposed scheme and the Upper Cynon Valley Functional Landscape Area for marsh fritillary.

Full details are provided in ES Volume 2, Appendix 11G (Jacobs 2017). The objectives of these surveys were to confirm the total amount of 'suitable' and 'good condition' habitat for marsh fritillary within 2 km of Blaen Cynon SAC as defined by Fowles (2005) to provide a base against which the conservation objective of 50 ha of suitable habitat could be assessed. Specific locations outside of this which could be directly impacted by the proposed scheme were also surveyed.

The combined survey results for marsh fritillary habitat types recorded at the long term monitoring sites, and in the Spring and Autumn 2016 habitat surveys are shown in Figure 5 and are shown in Table 7.4.

In summary, approximately 115 ha of suitable habitat for marsh fritillary, of which 35 ha was identified as good condition habitat, was recorded within 2 km of the Blaen Cynon SAC.

Table 7.4 : Area of marsh fritillary habitat recorded

Marsh fritillary habitat descriptions (Fowles, 2005)	Approximate area (ha) of habitat recorded within 2 km SAC core metapopulation area (Jacobs survey Spring 2016 – ES Volume 2 App11G and long term monitoring 2016 – ES Volume 2 App11I)	Approximate area (ha) of habitat recorded outside of the 2 km SAC core metapopulation area, but within the Functional Landscape Area and within 100 m of the proposed scheme (Jacobs survey Autumn 2016 – ES Volume 2 App11G)
Good Quality Habitat	35.0 ha	2.8 ha
Suitable (Under-Grazed) Habitat	3.2 ha	0.5 ha
Suitable (Over-Grazed) Habitat	28.0 ha	9.7 ha
Suitable (Sparse) Habitat	43.6 ha	13 ha
Potential (Rank) Habitat	5.2 ha	1.7 ha
Not Suitable	439.2 ha	38.8 ha

7.2.4 Interpretation of results

Although marsh fritillary is vulnerable throughout Wales, the local Blaen Cynon population is considered to be one of the strongest and most resilient due to the availability, extent and distribution of 'suitable 'and 'good condition' habitat. Boom and bust cycles are an integral part of marsh fritillary population dynamics and numbers can recover providing that good habitat condition is maintained.

7.3 Lesser horseshoe bat

7.3.1 Desk study

The lesser horseshoe bat is rare in the UK with a distribution restricted to Wales and western England. Approximately 28,000 individuals are thought to be present in Wales (Mathews & Halliwell, 2009). Welsh-level population trend analysis by the Bat Conservation Trust shows that there has been a significant increase in the lesser horseshoe bat population from hibernation surveys since 1999. This has been mirrored by significant increase in the population recorded from summer roost counts (Bat Conservation Trust, 2017).

7.3.1.1 Existing records

SEWBReC data show that lesser horseshoe bats have been recorded roosting, foraging and commuting within Taf Fechan and Taf Fawr gorges in the vicinity of the proposed scheme, see Figure 6. The broadleaved woodland and riparian habitat present within the gorges provides high quality foraging and commuting habitat for lesser horseshoe bats. The limestone outcrops and steep cliffs present within the gorges offer an abundance of potential roost habitat for lesser horseshoe bats. A number of caves that are known to exist within the gorges are listed on the Cambrian cave registry, as shown on Figure 6. However, there are numerous fractures and fissures within the limestone throughout both gorges for which no data are available and which may offer potential roost habitat for lesser horseshoe bats.

Bat surveys undertaken during September 2010 (Capita Symonds, 2010) confirmed the presence of 21 lesser horseshoe bats roosting within Leat Cave, located at the bottom of the east cliff face approximately 200 m south of the existing Taf Fechan viaduct.

There were no records to suggest the presence of a lesser horseshoe bat maternity roost within the Taf Fawr or Taf Fechan and literature suggests that it is rare to find a lesser horseshoe bat maternity roost in an underground site within Britain (Schofield, 2008). The nearest known maternity roosts of this species are located:

- at Pontneddfechan viaduct, Resolven, approximately 19 km to the west of Taf Fechan;
- under the viaduct on the A465 (Section 2) Clydach Viaduct approximately 17 km east (John Messenger, pers comm.); and
- at Gilwern, approximately 24 km north-east of Taf Fechan (not shown on Figure 6).

It is considered likely that there are unrecorded caves and other geological features within the Taf Fawr and Taf Fechan that are used by lesser horseshoe bats as hibernation roosts, transitional roosts and night roosts.

7.3.1.2 Links to Usk Bat Sites SAC

Lesser horseshoe bats are known to typically occupy a core foraging range of between 4 and 6.4 km around maternity roosts (Dietz, 2011). However, individual lesser horseshoe bats from the Usk Bat Sites SAC have been recorded travelling up to 24.1 km from the SAC (Smith and Morgan, 2004).

The Taf Fawr and Taf Fechan gorges, spanned by the existing A465 and proposed scheme, have active lesser horseshoe bat hibernation roots recorded within them and are located within approximately 17 km of the Usk Bat Sites SAC. Figure 6 shows the possible woodland and watercourse habitat links between the Usk Bat Sites SAC and the Taf Fawr and Taf Fechan gorges. The additional overlay of SEWBReC records of lesser horseshoe bats in this wider, 10 km area, also suggests that there could be some connectivity.

Based on the commuting distances recorded by Smith and Morgan (2004) and potential habitat connections between the Usk Bat Sites and the proposed scheme, it is considered feasible that lesser horseshoe bats found to be roosting and active within the Taf Fawr and / or Taf Fechan gorges, crossed by the existing and proposed scheme, could be part of the same population of bats that occupy the Usk Bat Sites SAC.

7.3.2 Field study

An extensive programme of bat surveys with additional targeted lesser horseshoe bat surveys has been undertaken by Jacobs to inform the ES and SIAA. These are listed in Table 3.1.

The methodology used for the bat surveys was with cognisance of Bat Surveys: Good Practice Guidelines, 2nd edition (Hundt, 2012) and later with Bat Surveys for Professional Ecologists - Good Practice Guidelines 3rd edition (Collins, 2016). No significant limitations were recorded during the surveys.

The results are detailed in ES Volume 2, Appendices 11F and 11H. The core results are illustrated on Figure 7 and summarised below:

7.3.2.1 Roosts

- no evidence of lesser horseshoe bat roosting was found in trees;
- no evidence of lesser horseshoe bat roosting was found in buildings within 500 m of the proposed scheme;
- radio tracking of three captured and tagged male lesser horseshoe bats in Gurnos Quarry (Taf Fechan) found them day roosting in:
    - Bat 1 (T4620): A470 viaduct, south abutment, east most bay (approximately 450 m north of the proposed scheme);
    - Bat 2 (T4623): a derelict boiler room in Cyfarthfa Park Industrial Estate (approximately 1.7 km south of the proposed scheme); and
    - Bat 3 (LHS T4624): Ogof Ffordd y Blaenau Uchaf (cave in Taf Fechan, approximately 210 m north of the proposed scheme) for three nights and then in a shed in Maple Crescent (approximately 515 m north of the proposed scheme) for five consecutive nights.
- All existing A465 bridge and viaduct structures between Hirwaun and Dowlais Top were assessed for lesser horseshoe bat roosting potential. Two structures were assessed as having features that could be utilised by lesser horseshoe bats and were internally inspected:
    - A470 Dan-Y-Darren Viaduct: a lesser horseshoe bat roost was found in the southern abutment of the A470 Dan-Y-Darren Viaduct. Emergence and re-entry surveys identified a roost of a maximum of seven individuals in August. An internal inspection recorded 16 adult lesser horseshoe bats hanging within the abutment with one with pup.
    - Taf Fawr Viaduct: droppings from a small number of lesser horseshoe bats (or possibly even a single bat) were found during an internal inspection of the main box void of the Taf Fawr Viaduct. The sparse evidence of lesser horseshoe bat activity inside the void did not indicate any significant roosting behaviour. It was considered more likely to be consistent with exploratory behaviour or opportunistic short-term roosting at a time that the void was temporarily accessible through an open grille.
- Evidence of lesser horseshoe bats were recorded in 17 of the 30 caves surveyed in March 2016 (winter hibernation survey) and September 2016 (summer survey):
    - Taf Fawr: Ogof Pont y Meirw and Taf Fawr cave.
    - Taf Fechan: Gurnos Quarry Cave 2 (Odin's Cave); Ogof Fford Y Blaenau; "Finale" cave; "Knuckleduster west" cave; Ogof Sanws 1; Ogof Sanws 2; Ogof Sanws 3; Ogof y Fran; Ogof Fford Y Blaenau uchaf; Vaynor Quarry North Rift; Vaynor Quarry South Rift; Vaynor Quarry Cave 2; Zehmke's cave; Leat Cave; and Ysgol y Graig cave.
    - Lesser horseshoe hibernation roosts were found in the:

      - Taf Fawr cave in the Taf Fawr gorge (approximately 175 m north of the Taf Fawr crossing);

      - "Knuckleduster west" cave in the Taf Fechan gorge (approximately 20 m east of the Taf Fechan structure but extending underneath the proposed scheme); and

      - Ogof Ffordd y Blaenau in the Taf Fechan gorge (approximately 200 m north east of the proposed scheme).

A small number (maximum no. 8) of live, hibernating bats identified at each of these locations.

- Lesser horseshoe evidence in the remaining caves was sparse and in low volume through the summer months.

7.3.2.2 Activity (commuting and foraging)

- walked bat activity transects along the top of Taf Fawr and Taf Fechan recorded no bat passes by lesser horseshoe between May and August, even though there were no limitations regarding temperature, precipitation or wind. Survey effort was switched to automated static monitoring at the water's edge of Taf Fawr and Taf Fechan at three separate locations in August and September.
- automated static monitoring on the Taf Fawr recorded an average of 0.72 lesser horseshoe bat passes per night surveyed.
- Automated static monitoring on the Taf Fechan recorded an average of 3.19 lesser horseshoe bat passes per night surveyed.
- Automated static monitoring in the Gurnos Quarry recorded an average of 0.24 lesser horseshoe bat passes per night surveyed.
- Lesser horseshoe bat activity throughout the survey months at Taf Fawr and Taf Fechan was generally low compared to other species. At Taf Fechan while the average bat passes per night was 3.19, the number of bat passes per night by other species were: common pipistrelle (*Pipistrellus pipistrellus*) – 32.99; soprano pipistrelle (*Pipistrellus pygmaeus*) – 55.01; and *Myotis* bat species – 515.26.
- Automated static monitoring of road culverts recorded a single pass by lesser horseshoe bat through Pentwyn Cynon Culvert near Trewaun.
- bat activity (based on number of passes per night) recorded in the Leat Cave, approx. 200 m south of the Taf Fechan structure, was higher (statistically significant) in September that any other month (May to September). The average number of passes per night in September was 30.43. This is compared to a range between 0.78 and 3.30 between May and August, inclusive.

7.3.3 Interpretation of results

7.3.3.1 Roosts

The lesser horseshoe bat roosts identified were located either directly within the Taf Fawr or Taf Fechan gorges, or in locations with direct links to them (see Figure 7, specifically sheet 4). The roosts found in caves within the Taf Fawr and Taf Fechan were a mixture of hibernation roosts (obligate) and occasionally used summer night roosts (non-obligate) by lesser horseshoe bats.

No evidence was recorded to suggest the caves were used as maternity roosts. In Britain, lesser horseshoe bats typically form maternity colonies within buildings built during the 19th Century (Schofield, 2008). Based on the survey results above, it is considered that lesser horseshoe bats are unlikely to have a maternity roost within the Taf Fawr and Taf Fechan cliffs. The maternity roosts for the population of bats that use the gorges are likely to be within old buildings located within a five kilometre radius of the existing A465 Taf Fechan and Taf Fawr viaducts.

The lesser horseshoe roost found in the A470 Dan-Y-Darren viaduct comprised 16 adults and one pup. The radio tracking survey showed that at least one of these adults was male. As females frequently change their roost site during summer (Bristol University, 2017) and with consideration of the accompanying emergence and re-entry numbers (four in June and July, seven in August and 1 in September), this suggests that the roost could be a satellite roost originating from a larger nearby maternity roost. The volume of lesser horseshoe bat droppings indicated prolonged use as a roost.

7.3.3.2 Activity

Results from the walked bat activity transects, across the entire proposed scheme, show that much of the lesser horseshoe activity is based in the Taf Fawr and Taf Fechan gorges. A single bat pass was made at a culvert in Hirwaun but is likely to be associated with the Afon Cynon, approximately 200 m to the east, which is linked to the Penderyn Quarry to the north where similar roosting features such as those at Taf Fawr and Taf Fechan would likely be found.

Detailed analysis of lesser horseshoe bat activity results from static detectors in caves show that presence is intermittent and general activity is low and irregular. This suggests that the lesser horseshoe bats using the Taf Fawr and Taf Fechan caves in summer do so as occasional day roosts showing little fidelity to any particular roost / cave, using a variety of different roosting locations over the active season.

No lesser horseshoe bat activity recordings during the walked activity survey along the safe walkways at the top of the Taf gorges and, conversely, the regular (if few in number) recordings along the water's edge indicates that the lesser horseshoe bats commuting and foraging activity is located deep in the gorge, close to the watercourse. This is where invertebrates would be present over the flowing water and the entrances to many caves are accessible from ground level.

The Leat cave had an increased activity level (statistically significant) during September 2016. The tenfold increase in number of bat passes per survey night in September when compared to other surveyed months suggests that the Leat Cave may have an important function. Previous survey roost emergence survey of the cave in September 2010 recorded 21 lesser horseshoe bats. This consistent presence of increased numbers of lesser horseshoe bats at the Leat Cave in September could indicate its use as swarming site where individuals congregate to mate. However, the number of passes recorded in September 2016 at the Leat cave (average of 30 per night) does not suggest that this is a significant mating site.

7.3.4 Summary

Across the proposed scheme, lesser horseshoe roosting and activity is focused in the Taf Fawr and Taf Fechan gorges. The three hibernation roosts identified in the Taf Fawr gorge and Taf Fechan gorge were of no more than eight individuals each. A variety of summer roosts were intermittently used by few bats suggesting summer roosting features in the Taf gorges were not obligate and plentiful alternative options for occasional summer roosting are available and indeed, used. Lesser horseshoe bat commuting and foraging activity was located at river level, rather than at height, along the top of cliff faces.

8. Blaen Cynon SAC

8.1 Likely significant effects in relation to conservation objectives

The impacts identified as potentially having likely significant effects on the Blaen Cynon SAC are:

- habitat loss;
- habitat fragmentation;
- habitat degradation;
- direct mortality (larval webs); and
- direct mortality (butterfly).

Table 8.1 links these likely significant effects and the specific conservation objectives of the Blaen Cynon SAC that could be delayed or interrupted if the effects were realised. No direct effects on the Blaen Cynon SAC site were identified.

Table 8.1 : Likely significant effect on the Blaen Cynon SAC and corresponding conservation objectives

Likely significant effect of proposed scheme	Conservation objective
Habitat loss Habitat degradation	The site would contribute towards supporting a sustainable metapopulation of the marsh fritillary butterfly in the Penderyn / Hirwaun area. This would require a minimum of 50 ha of suitable habitat, of which at least 10 ha must be in good condition, although not all is expected to be found within the SAC. Some would be on nearby land within a radius of about 2 km.
Habitat fragmentation Direct mortality	The population would be viable in the long-term, acknowledging the extreme population fluctuations of the species.

8.1.1 Habitat loss

Due to the dynamic nature and distribution of the marsh fritillary metapopulation, it is assumed that all suitable and good condition habitat for marsh fritillary could support the species and therefore any loss of this habitat (whether adults or larval webs have been recorded recently or not) could have a likely significant effect on the metapopulation and therefore the Blaen Cynon SAC. Such habitat loss has the potential to reduce density and distribution of the species. The natural boom and bust population dynamics of marsh fritillary populations are accepted variables of marsh fritillary ecology. However, the presence and maintenance of suitable and good condition habitat is essential so that populations can recover after 'bust' periods.

The areas of suitable and good condition habitat that would be lost under the footprint of the proposed scheme are shown in Figure 8. Habitat lost in the construction footprint, immediately adjacent to the proposed scheme, is also considered as permanent loss of habitat for this assessment.

Although no loss of marsh fritillary habitat would occur within the boundary of the Blaen Cynon SAC, the proposed scheme would result in the direct loss of approximately 5.53 ha of habitat suitable for marsh fritillary butterfly consisting of:

- 3.25 ha within the 2 km of the SAC (the Blaen Cynon SAC metapopulation area) between ch. 1950 - 3300 north and south and 3550 - 3950 south; and
- an additional 2.28 ha within the wider Upper Cynon Valley Landscape Functional Area between ch. 5500 - 6500 south, 7850 – 8300 south and 9500 - 9800 south.

8.1.2 Habitat fragmentation

The potential for fragmentation effects on marsh fritillary, as a result of new road projects, was researched in academic literature. GIS modelling of the permeability of the landscape by marsh fritillary (Davies, u.d.) in Carmarthenshire identified a simplified network of likely flyways (and avoided routes / barriers) connecting suitable habitat patches across a wide area to inform planning decisions. Although useful in identifying barrier features, this level of modelling was considered to have limited use when transferring to the project stage. The height of features (tall hedgerows and trees) was considered a significant barrier to dispersal.

The majority of the proposed scheme consists of on-line widening of the existing A465 which would not result in isolation or fragmentation of suitable habitat for marsh fritillary. However, the proposed off-line section south east of Hirwaun, between chainage 2000 and 3000 (see Figure 8), would result in isolation of an area of suitable habitat for marsh fritillary between the operational proposed scheme and existing A465. This area provides approximately 2.19 ha of habitat for marsh fritillary, comprising 1.14 ha of good condition habitat and 1.05 ha of suitable habitat) within the 2 km SAC metapopulation area. Although this area would be retained, the constituent habitat suitable for marsh fritillary could lose its functionality over time due to abandonment or subsequent change in management caused by isolation. Applying the precautionary principle to this assessment, this 2.19 ha of habitat was considered to be lost.

The potential for this likely significant effect has not been identified in any other location. Where portions of fields containing suitable habitat have been taken to facilitate the proposed scheme elsewhere, sufficient access and size would be retained to enable continuation of the current management regime (the principal factor in creating suitable habitat structure for marsh fritillary).

8.1.3 Habitat degradation

There is the potential for marsh fritillary habitat degradation to occur during the operational phase of the proposed scheme due to a change in air quality as a result of increased vehicular emissions. Increased nitrogen oxide (NOx) concentration and nitrogen and acid deposition from increased vehicle emissions can have the following impact on sensitive habitats:

- changes in species composition, especially in nutrient poor ecosystems with a shift towards species associated with higher nitrogen availability (e.g. dominance of tall grasses);
- reduction in species richness;
- increases in plant production; and /or
- decrease in or loss of sensitive lichens and bryophytes.

A detailed assessment on changes in air quality is presented in ES Volume 1 Chapter 8: Air Quality.

8.1.3.1 Critical level – nitrogen oxides

The modelled concentrations at marsh fritillary habitat receptors were compared to the relevant critical levels for the protection of vegetation. A ‘critical level’ is an air quality standard or guideline for ambient concentrations of a pollutant that applies at ecological receptors. The critical level is 30 µg/m^3 for all habitat types.

No exceedance of this critical level was modelled at the Blaen Cynon SAC, nor any of the marsh fritillary habitats identified.

8.1.3.2 Critical load – nitrogen and acid deposition

The modelled nitrogen and acid deposition at marsh fritillary habitat sites was compared to the relevant ‘critical loads’. The critical loads for habitat types in the UK have been published by the Centre for Ecology and Hydrology and are available from the UK Air Pollution Information System (APIS) website [www.apis.ac.uk]. Critical loads are defined on the APIS website as, “…a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge.”

The significance of the modelled long-term (annual mean) deposition at marsh fritillary habitat sites were determined in line with guidance provided by the Environment Agency (Environment Agency, 2016). This is summarised below.

- Where the process contribution (PC) is less than 1% of the relevant critical level or critical load, the emission is not likely to have a significant effect alone or in combination irrespective of the existing concentrations or deposition rates.
- Where the contribution is above 1%, further consideration of existing background concentration or deposition rate is required, and where the total concentration or deposition is less than 70% of the critical level or critical load, calculated in combination with other committed projects or developments included within the traffic data, the emission is considered to be unlikely to have a significant effect.
- Where the contribution is above 1%, and the total concentration or deposition rate is greater than 70% of the critical level or critical load, either alone or in combination with other committed projects or developments, then this may indicate a significant effect and further consideration is likely to be required

The modelled increase in acid deposition was less than 1% of the specified critical load at the Blaen Cynon SAC and at all the marsh fritillary habitats identified.

The existing nitrogen deposition rate already exceeds the relevant critical load across the entire extent of the proposed scheme. An additional 'more than 1% increase' in nitrogen deposition was modelled at four locations with suitable habitat for marsh fritillary. No increase was modelled within the Blaen Cynon SAC.

The approximate locations and areas of marsh fritillary habitat that could be degraded are shown in Table 8.2. Using a transect approach to modelling deposition enables a calculation of area likely to be affected. The data (ES Volume 2, Appendix 8E) indicate the potential degradation of up to 5.4 ha of marsh fritillary habitat.

The modelled increase in nitrogen deposition range between 25.9 and 26.3 kgN/ha-year; marginally more than the existing 25.3 kgN/ha-year deposition rate recorded at Tir Mawr a Dderi Hir SSSI; where some of the best quality habitat for marsh fritillary has been recorded. This suggests that the modelled increase in nitrogen deposition could have minimal, if any, measureable ecological impact. However, due to uncertainty in the exact impact, the precautionary principle has been applied and the risk of habitat degradation (outside of the Blaen Cynon SAC) caused by increased nitrogen deposition is considered a likely significant effect.

Table 8.2 : Suitable marsh fritillary habitat within the functional landscape area likely to be affected by changes in air quality during the operational phase

Location of habitat suitable to support marsh fritillary	Existing nitrogen deposition (kgN/ha-year)	Max modelled nitrogen deposition (kgN/ha-year)	Approximate chainage	Within 2km of SAC	Good condition habitat affected (ha)	Suitable habitat affected (ha)	TOTAL (ha)
Hirwaun Common SINC (Site 5 from Jacobs monitoring)	25.3	25.9	2650 -3250 (south)	yes	0.2	1	1.2
North of Trewaun	25.3	25.4	3550-5950 (south)	yes	0.6	1.4	2.0
Tir Mawr a Dderi Hir SSSI (Site 2 from Jacobs monitoring)	25.3	26.3	5450 – 6500 (south)	no	0.4	1.6	2.0

Location of habitat suitable to support marsh fritillary	Existing nitrogen deposition (kgN/ha-year)	Max modelled nitrogen deposition (kgN/ha-year)	Approximate chainage	Within 2km of SAC	Good condition habitat affected (ha)	Suitable habitat affected (ha)	TOTAL (ha)
Coed Meurig SINC	25.5	26.1	9500-9800	no	0	0.2	0.2
TOTAL							**5.4**

8.1.4 Summary - habitat impact

In summary, a direct habitat loss of approximately 7.72 ha of habitat suitable for marsh fritillary butterfly is anticipated. It is possible that a further approximate 5.4 ha of suitable habitat could undergo degradation due to increased nitrogen deposition from increased traffic volumes. None of these impacts would occur within the boundary of the Blaen Cynon SAC.

Table 8.3 details the amount and relative location of the marsh fritillary habitat affected. A total of approximately 13.12 ha of marsh fritillary habitat would be affected; approximately 8.64 ha within the 2 km SAC core metapopulation area with an additional 4.48 ha outside of this in the wider Upper Cynon Valley Functional Landscape Area.

Table 8.3 : Summary of effects on marsh fritillary habitat

Habitat lost	Within 2 km SAC Core metapopulation	Remaining Upper Cynon Valley Functional Landscape Area	Total area
<u>Direct loss</u> Under proposed scheme footprint plus construction footprint	Good condition – 1.54 ha	Good condition – 0.71 ha	*5.53 ha*
	Suitable condition – 1.71 ha	Suitable condition – 1.57 ha	
	Sub-total – 3.25 ha	*Sub-total – 2.28 ha*	
<u>Indirect loss</u> Habitat fragmentation at Hirwaun off line section	Good condition – 1.14 ha	-	*2.19 ha*
	Suitable condition – 1.05 ha	-	
	Sub-total – 2.19 ha	-	
<u>Habitat degradation</u> Habitat degradation as a result of increased nitrogen deposition	Good condition – 0.8 ha	Good condition – 0.4 ha	*5.40 ha*
	Suitable condition – 2.4 ha	Suitable condition – 1.8 ha	
	Sub-total – 3.2 ha	*Sub-total – 2.2 ha*	
Total	**8.64 ha**	**4.48 ha**	**13.12 ha**

8.1.5 Direct mortality (larval webs)

Direct mortality of any marsh fritillary caterpillars in larval webs during site / vegetation clearance could occur if located within areas of proposed land take. Loss of larval webs and the mortality of the marsh fritillary caterpillars they contain could conceivably result in the population declining below a viable level.

It is assumed that all suitable habitats (Fowles, 2005) to support marsh fritillary within the 2 km Blaen Cynon SAC metapopulation area and the Upper Cynon Valley Functional Landscape Area could have marsh fritillary larval webs present. Approximately 7.72 ha of suitable habitat for marsh fritillary that would be directly lost. However, the number of larval webs likely to be located within this habitat is unknown and is likely to fluctuate in different years. An indication in number of larval webs potentially present within the proposed construction footprint is provided by monitoring surveys undertaken by Jacobs in 2016 (see ES Volume 2 Appendix 11I for details). These surveys identified approximately 54 larval webs within the proposed scheme footprint (all within Site 2 - the Tir Mawr a Dderi Hir, Llwydcoed SSSI) of a total of 160 recorded at that specific site and 476 recorded across all the monitoring sites that year. It must be borne in mind that the monitoring sites (and the total number of larval webs counted by Jacobs Ecologists in 2016) are only a sample of those suitable habitats in the 2 km Blaen Cynon SAC metapopulation area and Upper Cynon Valley Functional Landscape Area. Many more additional larval webs are likely to be located in sites outside of the monitoring locations. Thus the magnitude of the effect would be reduced.

8.1.6 Direct mortality (butterfly)

The behaviour of butterflies, specifically of marsh fritillary and their ability to navigate across roads is unclear with little published scientific literature. Other than the Blaen Cynon SAC, much of the existing marsh fritillary habitat within 500 m of the proposed scheme is located south of the existing road suggesting there is at least some successful crossing is currently occurring. The north-south interchange on individuals and the likelihood and location of road crossing by adult butterflies is unknown. As such, it is possible that the proposed widening of the existing A465 by 3 m could result in the increased risk of marsh fritillary butterfly mortality from traffic collisions due to the increased length of flight lines and forecast increases in traffic flows.

8.2 Mitigation measures

8.2.1 Overall objectives of mitigation

The survival of marsh fritillary metapopulations is dependent upon two main factors (Fowles, 2005; Gustafson *et al*., 1996; Moilanen and Hanski, 1998; Smith, 2005; and Thomas *et al*., 2001):

- landscape scale, extent and distribution of habitat patches; and
- habitat quality.

In order to develop an effective mitigation strategy, the objectives of any mitigation should be clear. The term mitigation is taken to encompass a hierarchy of measures as follows:

- prevention of effects by avoidance;
- reduction of the magnitude of adverse effects that cannot be avoided; and
- if progression to further stages of the AIES process is required, measures to compensate any residual effects that cannot be remedied.

The aims of the mitigation strategy for marsh fritillary butterfly that have been developed in relation to the proposed scheme are, therefore, to:

- influence proposed scheme design and construction methods to limit loss of habitats known to support marsh fritillary and suitable habitats for marsh fritillary;
- influence proposed scheme design to limit fragmentation and isolation of marsh fritillary habitats within the immediate area of the proposed scheme and in the wider Upper Cynon Valley Functional Landscape Area;
- protect retained adjacent habitats suitable for, and with confirmed marsh fritillary records, during construction;
- ensure direct mortality of larval webs is minimised during the construction phase;
- provide new habitat or enhance potentially suitable habitat (defined as grassland or heathland habitat that could support devil's-bit scabious) for marsh fritillary so that there would be no net loss of suitable habitat as a result of the proposed scheme and that new habitat would be of enhanced quality to that lost;

- enhance reinstated habitats for adult feeding marsh fritillary;
- provide habitat 'stepping-stones' linking existing habitats to provide improved connectivity along the proposed scheme;
- facilitate long-term management of mitigation habitat to ensure habitats establish successfully and persist long term; and
- complement existing and strategically planned marsh fritillary mitigation for other consented developments in the Upper Cynon Valley Functional Landscape Area.

8.2.2 Mitigation - habitat impacts

8.2.2.1 Provision of suitable habitat

By their very nature, marsh fritillary butterflies exist in a metapopulation exhibiting extinction-colonisation dynamics (Hanski, 1999). Processes of disturbance and succession cause natural patch networks to be dynamic with regional extinction being prevented through the process of habitat tracking, whereby a species is able to follow the shifting mosaic of suitable environmental and habitat conditions (Thomas, 1994). In an anthropogenically modified landscape, restoration or creation of new habitat can allow such habitat tracking to occur (Smee, 2011).

It is proposed to mitigate for the direct and indirect habitat loss and habitat degradation by providing and managing an area of grassland (as detailed in Section 8.2.2.2) with the aim of achieving no net loss of suitable habitat for marsh fritillary, and of an increased quality compared to that lost. The provision of approximately 14.4 ha mitigation land for effects on approximately 13.12 ha of habitat represent a slight net gain.

Suitable habitat would be created using three main actions:

- planting of land acquired for mitigation with nursery grown devil's-bit scabious plants using seed of local provenance (further detail in Section 8.2.2.4);
- translocation of turves of suitable and good condition from under the footprint of the proposed scheme to the land acquired for mitigation(further detail in Section 8.2.2.4); and
- implementing a suitable preparatory and long-term management programme on the land acquired for mitigation (further detail in Section 8.2.2.5).

The creation of suitable habitat through enhancement is considered to be a standard mitigation option for marsh fritillary and has shown to be successful for the Church Village Bypass scheme in RCTCBC where marsh fritillary larval webs have been found in restored habitats where they had not been previously recorded (County Ecologist, RCTCBC, ELG 3, 28 February 2017.). Habitat provision for marsh fritillary in regards to the Bryndefaid Open-cast mine and EnviroPark development schemes in RCT have also followed this approach to mitigation.

8.2.2.2 Selection of mitigation area

Restoration experiments have shown that unmanaged habitat can be quickly restored to conditions suitable for marsh fritillary (Bulman, 2001). The following selection process was then carried out to select areas suitable for enhancement. The selection process was designed to increase the likelihood of success of the mitigation area.

1) A desk based identification process was undertaken within a defined search area (the 2 km SAC Core metapopulation area and within 500 m of the proposed scheme outside of this) to select land parcels with existing potentially suitable habitat types (marshy grassland, unimproved and semi-improved grasslands, heaths, bogs, fens and mires).
2) Of these, land parcels with existing or planned development, Local Development Plan site allocation, a national level nature conservation designation, or areas with existing persistent and relatively common marsh fritillary records or devil's bit scabious, were excluded.
3) Only land parcels larger than 4 ha were selected as this was considered a minimum viable mitigation habitat area because of:

- the requirements of on-going management (recommended grazing densities suggest one cow per ha),
- NRW preference for fewer, larger locations to maximise ecological potential and make long-term management more deliverable; and
- academic research that found that increasing the size and connectivity of suitable habitat increases the chances and rate of (re-)colonisation of unoccupied but suitable habitat (Botham *et al*., 2011).

4) Where land access permitted, these land parcels were then surveyed. Those land parcels that exhibited the habitat type or vegetation structure that were optimal for devil's bit scabious and marsh fritillary but did not contain devil's-bit scabious or were inappropriately managed (at that time) were selected. Logistical suitability was also recorded at this stage.

5) Of these land parcels, links to existing suitable habitat, the SAC and areas where marsh fritillary have already been previously recorded were investigated[2], thereby improving potential dispersal within and around the Functional Landscape Area. Figure 9 identifies all potential areas for marsh fritillary mitigation and raw data is provided in the 2016 Ecology Factual Report (ES Volume 2, Appendix 11G).

Bulman (2001) and Bulman *et al* (2007) state that approximately 100 ha of suitable habitat is necessary to achieve a 95% probably persistence for marsh fritillary for 100 years (within a 4 km x 4 km area). As over 100 ha of suitable habitat for marsh fritillary has been confirmed within the 2 km SAC core metapopulation area (with the potential for much more – see Table 6.4) advanced mitigation works to secure suitable and functional habitat before works on the proposed scheme begin is deemed unnecessary. Plentiful alternative suitable habitat is present within the area, in sufficient abundance, to absorb any temporary habitat loss effect on marsh fritillary, and that loss would not reduce the remaining "suitable habitat" to less than the 100 ha minimum threshold for suitable condition and 10 ha threshold for "good condition" habitat, as per the revised conservation objective of the Blaen Cynon SAC. Mitigation habitat (re-) creation would begin with commencement of the on-site works for the proposed scheme.

The loss of suitable habitat for marsh fritillary within the 2 km SAC Core metapopulation area would not reduce the available habitat to below the 100 ha threshold (for a viable metapopulation (Bulman, 2001 and Bulman *et al* 2007) therefore it was not considered essential to provide the mitigation site within 2 km of the Blaen Cynon SAC. The final selection of mitigation area was undertaken in consultation with the SEBs at a Technical Working Group meeting on 23 November 2016.

8.2.2.3 Llwydcoed Slopes

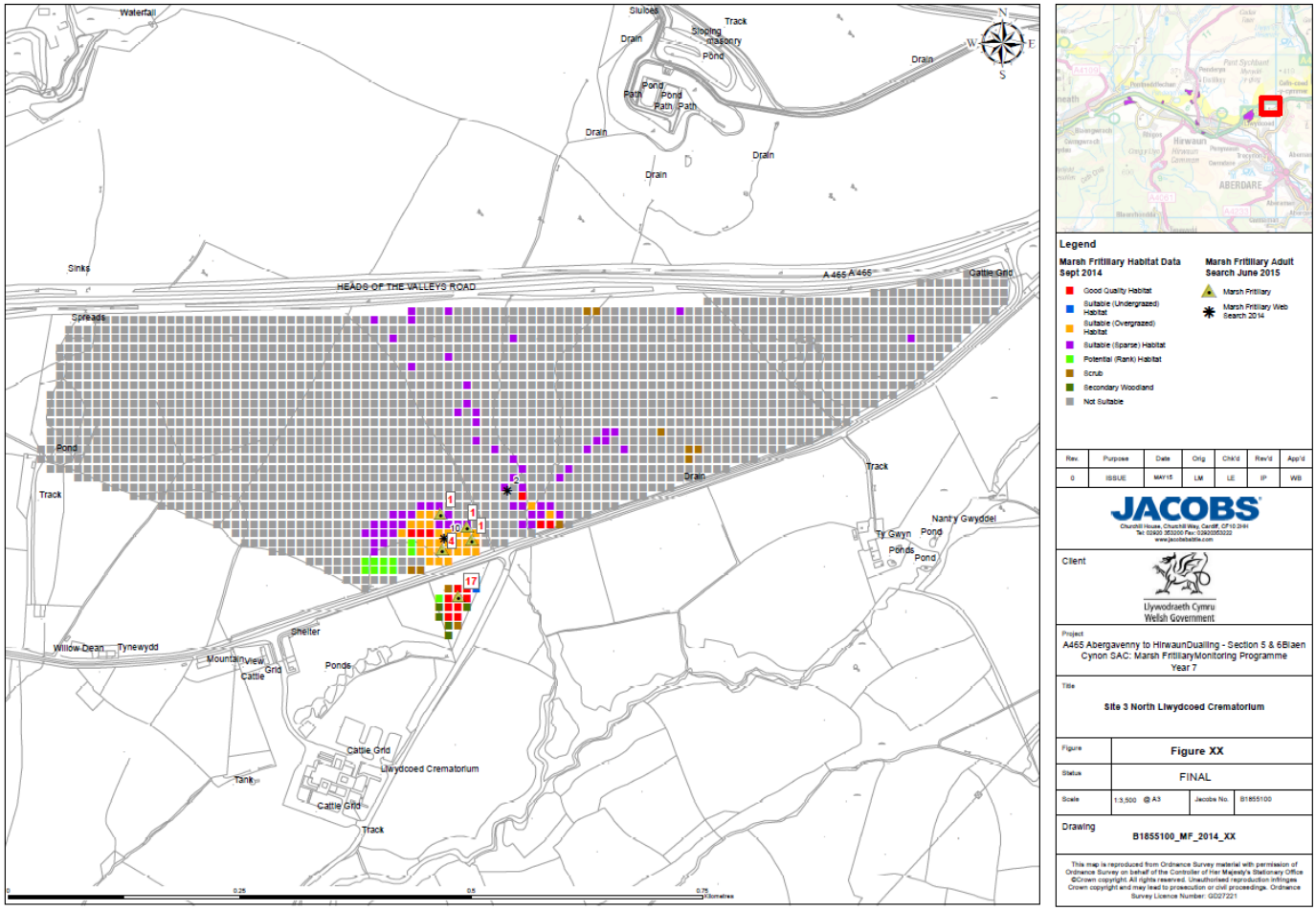
A proposed mitigation site of approximately 14.4 ha at Llwydcoed Slopes, south west of the proposed Baverstock junction, was selected (see Figure 9). Justification for this particular site is due to its existing characteristics which increase the likelihood of success, as follows:

- existing, recent, records of marsh fritillary in a limited area to the south of the Llwydcoed site (see Figure 8.1);
- existing structural diversity of vegetation required by the larval life stage, increasing successful establishment of marsh fritillary habitat;
- presence of existing devil's-bit scabious plants in a limited area to the south of the Llwydcoed site indicating that the plant is able to establish and survive here. It is considered likely that historic sheep grazing has removed much of the devil's-bit scabious originally present;
- potential to create suitable and good condition habitat;
- location within the Upper Cynon Valley Functional Landscape Area;
- provides a landscape connection between two established areas of marsh fritillary habitat, Tir Mawr a Dderi Hir SSSI and Bryncarnau Grasslands SSSI;

[2]Warren (1994) states that marsh fritillary butterfly rarely travel further than 750 m, other studies, including mark and recapture studies suggest that adult butterflies can travel much further.

- provides a habitat connection to aid natural dispersal to the east and south east with potential to bolster limited presence in the Cwm Glo area (see Figure 2);
- provides a habitat link with the Nant Hir valley in the west, permitting marsh fritillary to disperse under the proposed structure which would be located at height (approx. 30 m) above the valley bottom;
- the availability of existing long-term (since 2008) habitat information to inform future management;
- appropriate safe access from the new highway to support transport and movement of grazing livestock on and off the site. Grazing livestock, specifically cattle or ponies, are essential to maintain the structural and species diversity of marsh fritillary habitat as they do not selectively eat away devil's-bit scabious; and
- in close proximity of fields with existing grazing management regimes being delivered by Butterfly Conservation, local authorities and PONT[3].

Figure 8.1 : Llwydcoed Slopes mitigation site - 2015 (also Site 3 in Jacobs long – term monitoring programme – not surveyed in 2016)



8.2.2.4 Translocation and planting of devil's bit scabious

The primary way of creating good / suitable habitat within the mitigation area will be via planting and translocating devil's bit scabious. The aim of getting mitigation habitat into suitable condition for marsh fritillary could consist of planting between 200 plants (assume 1 plant per 1 m square; 1 ha = 10,000 m square; 2% cover = 200 m square – 200 plants per hectare) and 1000 plants per hectare (10% cover = 1000 m square =

[3] It was suggested during ELG meetings that long-term grazing management of the mitigation area could be added to the existing local grazing management programmes run by Butterfly Conservation / local authorities / PONT.

1000 plants per hectare). The final density of devil's-bit scabious planting would be dependent on the specific management plan for the site and would be developed during detailed design in consultation with key stakeholders. The Llywdcoed Slopes mitigation area is approximately 14 ha therefore, a minimum of 2800 viable devil's-bit scabious plants would be planted.

Translocation of turves of suitable habitat from the proposed footprint of the scheme into the Llywdcoed Slopes mitigation area would also be undertaken. This would have the added benefit of translocating the associated soil mycorrhizal community and act as a beneficial inoculant for the rest of the area. Translocation of devil's-bit scabious has been proven to be successful in a number of locations, including in RCT at the Rhigos sub-station site at Hirwaun Industrial Estate (Peter Sturgess *pers.comm*) and academic research on previous translocation projects support the use of turf translocation as a restoration technique where the alternative is the complete loss of the site and where the process of reconstructing the functioning of the ecosystem meets certain standards (Trueman, Mitchell, & Besenyei, 2007).

Increasing the abundance and distribution of preferred food and egg-laying plant species in habitats as a method of aiding natural dispersal and colonisation of invertebrate species to new areas and / or increasing the carrying capacity of existing habitats for invertebrate populations is an established and proven enhancement / mitigation strategy. The M40 Waterstock-Wendlebury road scheme successfully planted blackthorn *Prunus spinosa* scrub to increase the abundance and distribution of the black hairstreak *Satyrium pruni* (Bickmore, 1992) while growth of common milkweed *Asclepias syriaca* was encouraged to enhance monarch *Danaus plexippus* butterfly reproduction (Fischer *et al*., 2015).

Planting of devil's-bit scabious plants is the preferred method in increasing presence of marsh fritillary with numerous studies finding that seeding and habitat management alone was not viable (Borsje, 2005; Bulman, 2001; and Preston *et al.*, 2008). To ensure the presence and viability of the "large-leaved" plants that are specifically mentioned in the conservation objectives for the SAC, plants would be grown from both locally sourced seed supplemented by general "British seed", which due to its limited genetic variation (Jones, 2015) would be unlikely to have a negative effect on successful establishment and the local population of devil's-bit scabious.

A number of UK based research experiments and development mitigation schemes have shown that introduction of devil's-bit scabious to habitats where it was not previously present has been a vital stage in increasing the abundance and distribution of marsh fritillary. In the A30 Bodmin to Indian Queens road improvement scheme planting devil's-bit scabious was stated as being a "key factor" in creating breeding habitat for marsh fritillary (Spalding, 2005). The M3 Twyford Down road scheme in Hampshire planted between approximately 8,000 and 11,000 plug plants of devils-bit scabious per hectare in their habitat restoration scheme which saw a resulting increase in abundance and distribution of marsh fritillary (Flora locale, 2012). However, Fowles (2004) discusses how habitat patches supporting marsh fritillary rarely occupy an entire enclosure as soil structure, hydrology and stock behaviour lead to a heterogeneous mix. Indeed, a successful mitigation scheme for marsh fritillary in Carmarthenshire used irregular planting at specific locations within sites to replicate the natural distribution of devil's-bit scabious which was shown to grow in clumps on the drier, slightly raised and more open parts of a site (Caeau Mynydd Mawr Conservation Officer *pers*. *comm*.). There is no evidence to suggest that the hydrology of the mitigation site would change once the proposed scheme was built but existing hydrology will influence the development of the final management plan for the site. Fowles (2004) also stated that cover values corresponding to frequency estimates of devil's-bit scabious are likely to be in the order of 10% for 'Frequent' and 2% for 'Occasional'.

8.2.2.5 Habitat provision in the proposed soft estate

Seeding of marshy grassland areas around proposed attenuation ponds within the 2 km Upper Cynon Valley Functional Landscape Area with nectar rich plants, including devil's bit-scabious, as well as within the wider soft estate would provide increased resources for adults to feed and facilitate dispersal along the soft estate. This would also facilitate opportunity to expand the current density and distribution of the species to the wider landscape. This approach was used in the A30 improvement scheme where although these sites may not support permanent colonies of marsh fritillary, they would provide additional stepping-stone habitat reducing the distance between existing breeding sites, facilitating further colonisation (Spalding, 2005).

8.2.2.6 Long-term habitat management

Long-term grazing management is widely recognised as an essential factor to creating and maintaining suitable habitat for marsh fritillary. A management plan which would need to be dynamic to meet the requirements of an individual site and changing responses to management techniques is fundamental to the long-term success of the proposed mitigation plan.

Butterfly Conservation, local authorities and PONT (Pori Natur a Threftadaeth / Grazing, Nature and Heritage) have set up local grazing schemes to manage marsh fritillary habitats (Butterfly Conservation Officer, TWG 29 March 2016 and County Ecologist RCTBC, ELG 28 February 2017). Such active grazing programmes in the local area offer opportunities to develop collaborative management plans such as the 'Flexigraze' partnership operated by Northumbrian Wildlife Trust whereby grazing management across a number of different sites with differing requirements can be co-ordinated by a single enterprise without the need for specific organisations to invest in their own stock ownership (Morris, 2017). Future management should involve liaison with local parties to develop a site specific management plan or create partnerships to produce a collaborative one with others to ensure that the management plan would fulfil the aims of this mitigation area.

8.2.3 Mitigation - habitat fragmentation

The potential habitat fragmentation identified at the proposed off-line section south of Hirwaun has been mitigated as if that habitat were lost to the scheme. The method for mitigation would be based on the Compulsory Purchase Order (CPO) of mitigation land at Llwydcoed Slopes which is detailed above.

8.2.4 Mitigation – habitat degradation

The potential habitat degradation identified at four locations across the proposed scheme (within the 2 km SAC metapopulation area and Upper Cynon Valley Functional Landscape Area) has been mitigated as if that habitat were lost to the scheme. Even though this habitat would be retained, functionality for marsh fritillary could be lost. The method for mitigating would be based on the CPO of mitigation land at Llwydcoed Slopes which is detailed above.

8.2.5 Mitigation – direct mortality (larval webs)

The key mitigation for the potential direct mortality of marsh fritillary caterpillars in larval webs would be translocation of caterpillars in their larval webs to retained, undisturbed suitable habitat at the mitigation site at Llwydcoed Slopes.

Although avoidance of the direct impact would be preferred by limiting the timeframe for vegetation clearance in suitable habitat for marsh fritillary, the larval stage of marsh fritillary extends over much of the year with a small gap of approximately six to eight weeks in May to June where butterflies are on the wing. During this time butterflies mate and eggs are also laid to create the next generation of marsh fritillary, further restricting the very refined avoidance period, which is also dependent on weather and temperature. Therefore, time restricted vegetation clearance and avoidance cannot be relied on to avoid the risk of mortality at this crucial life stage.

Larval webs, the devil's-bit scabious plant upon which they are found feeding and their immediate turf would be translocated from the proposed scheme construction footprint to the prepared receptor location at Llwydcoed Slopes. Construction and site clearance is currently programmed to begin in November 2019. Translocation would take place at this time when the caterpillars are minimally active in the grassland turfs and can be easily relocated, as a whole. As part of the annual habitat monitoring programme undertaken by Jacobs ecologists, the habitat quality of the monitoring sites, particularly that under the proposed footprint of the scheme, would be recorded using detailed GPS mapping in spring / summer 2019, the season prior to construction. This would also include the suitable habitat areas that would be lost outside the monitoring areas, as shown in Figure 8. This mapping would identify the good and suitable quality habitat to be translocated later (winter 2019 / 20). These mapping and translocation activities would be undertaken in accordance with a detailed method statement agreed with NRW.

Capture and translocation of marsh fritillary larval webs has been shown to be successful with a large reintroduction scheme of thousands in Cumbria (Porter & Ellis, 2011). It is unlikely that the proposed scheme

would require the relocation of this many larval webs. The translocation of larval webs and planting of devils-bit scabious plants to mitigation habitat showed presence of larval webs in each of the subsequent three years of monitoring in Cumbria (where before there were none present) showing that the translocated caterpillars not only survived but subsequently reproduced successfully.

By securing the survival of individuals from the proposed scheme footprint, no impact on site integrity would occur.

8.2.6 Mitigation – direct mortality (adult butterfly)

The likely crossing location and success rate of marsh fritillary crossing the existing A465 and proposed scheme, and the risk of traffic collision, is uncertain. Although not directly concerning marsh fritillary, a recent academic study into traffic collisions resulting in mortality of butterfly in Poland discovered that collision blackspots were associated with high traffic volume, but only when cover of grassland in the wider landscape was high and the road verges had low species richness or verge mowing frequency was high (Skorka *et al*., 2015). This appears to concur with conclusions from similar studies that found that the abundance of butterflies killed on roads were positively dependent on both the abundance of butterflies on road verges and on traffic volume, but negatively correlated with the richness of plant species on the road verges (Skorka *et al*., 2013) i.e. species rich road verges reduces road mortality of butterfly species. Conversely, Munguira and Thomas (1992) found that while movement of some butterfly species were unaffected by wide busy roads, others were slightly impeded.

Although this research suggests that sowing of a diverse plant species seed mix, less frequent mowing and maintaining a high grassland cover in the vicinity of roads are recommended conservation actions for the improved conservation value of road verges for butterflies (Skorta *et al*., 2013), the proposed soft estate would not be planted but allowed to establish naturally from retained top soil to create a natural and representative habitat for the region. However, as exemplified by the A30 road improvement scheme in Cornwall, stepping stones / habitat connections for marsh fritillary can also be made by habitat (re-)creation on and around attenuation ponds, linking existing breeding sites and aiding adult dispersal. This approach would be proposed around the attenuation ponds within the Upper Cynon Valley Functional Landscape Area and is detailed in section 8.2.2.5.

Recent local experience suggests that roads are unlikely to cause a barrier effect in terms of dispersal or mortality of mash fritillary. In the first year after a programme of devil's-bit scabious translocation and habitat enhancement at a Rhigos development site, west of Hirwaun, eight flying adults and 29 larval webs were counted. It has been proposed that the existing dual two-lane A465 at this location, between the Blaen Cynon SAC and the Rhigos site, was highly unlikely to have created a significant barrier to colonisation (nor inferred significant mortality of butterfly). The major factor aiding dispersal was likely to be scrub clearance on adjacent road verges which had previously created a barrier effect. Clearance of scrub provided dispersing marsh fritillary with open landscapes to aid dispersal and colonisation of the new habitat (Peter Sturgess *pers. comm*.).

The key way of mitigating this potential mortality impact would be to strengthen the existing population on the south side of the A465 by providing more suitable habitat for marsh fritillary. This would be achieved within the proposed new soft estate throughout the proposed scheme and by establishment and management of new habitat on the land acquired for mitigation at Llwydcoed slopes. The net gain and improved connectivity of marsh fritillary habitat, in the long term, would ensure no effect on site integrity of the Blaen Cynon SAC.

8.2.7 Mitigation summary for marsh fritillary

The breakdown of mitigation for each likely significant effect is summarised in Table 8.4. A net gain of suitable habitat would be provided.

Table 8.4 : Mitigation summary – marsh fritillary

Impact	Approximate area of habitat affected (ha)	Mitigation provided
Direct habitat loss	5.53	14.4 ha at Llwydcoed Slopes; and 8 ha 'stepping-stone' habitat in soft estate
Fragmented habitat (assumed lost)	2.19	
Habitat degradation	5.4	
Butterfly mortality	n/a	
Total	***13.12 ha***	***22.4 ha***
Mortality of larval webs	7.72	Translocation into Llwydcoed Slopes mitigation area

8.3 Summary of mitigation delivery

The mitigation for the proposed scheme for marsh fritillary and the Blaen Cynon SAC would be delivered as set out in Table 8.5.

The mitigation commitments described in the SIAA would be comprehensively compiled into the REAC. Mitigation commitments would be delivered by the Compulsory Purchase Order (CPO) process and the implementation of such commitments would be fulfilled as a legal requirement of the Orders. The commitments would include actions, procedures and standards to avoid or mitigate likely significant effects; avoid offences; and demonstrate no adverse effects on the integrity of European sites. The REAC would form part of the Contract documents to ensure the Contractor delivers effective planning, management and control during the construction of the proposed scheme to implement the commitments within the REAC.

The contract documents would explicitly require the Contractor to fulfil all commitments in the SIAA, ES and REAC. The REAC would include the requirements for consents and licences necessary post-confirmation of Orders, which would provide further mechanisms for ensuring impacts are avoided or mitigated as well as ensuring no offences would be committed. The REAC would also include commitments to the liaison and consultation with statutory environmental bodies required to ensure agreement on, and implementation of, management plans, method statements and protocols as would be required to fulfil the commitments made.

Table 8.5 : Summary of mitigation delivery pending agreement to proceed – marsh fritillary

Key Stage	Phase	Estimated Date(s)	Mitigation
Key Stage 3 (Development of outline design, ES, SIAA and Draft Orders)	Pre-construction	October 2015 - July 2017	Inform and influence detailed scheme design and construction areas to limit direct and indirect impacts on marsh fritillary and its habitats using baseline and survey data gathered to date
			Continue programme of marsh fritillary habitat monitoring and adult / larval web counts and extend this to include areas identified as suitable for marsh fritillary in Figure 8
			Develop indicative Construction Environmental Management Plan (CEMP) and Register of Environmental Actions and Commitments (REAC)
Key Stage 4 (Public Local Inquiry and Minister 's Decision)	Pre-construction	July 2017 to April 2018	Harvest and propagate devil's-bit scabious plants at plant / garden nurseries
Key Stage 5	Pre-construction	May 2018 to	Acquire land for mitigation under the Highways Act 1980 (as amended) process (to manage in the long-term) to mitigate for loss of habitat

Key Stage	Phase	Estimated Date(s)	Mitigation
(Procurement of the DBFO Contractor)		Oct 2019	suitable to support marsh fritillary
			Continue to propagate devil's-bit scabious plants and plant first wave with grassland translocation
			Mark out grassland turves (with larval webs) for later translocation to mitigation sites
Key Stage 6 (Construction phase)	Construction – Pre vegetation clearance	Nov 2019 to Jan 2020	Establish construction phase version of CEMP; and implement the CEMP and associated REAC
			Re-identify and translocate larval webs present, with their immediate turves, in the footprint of the proposed scheme in November, to the land acquired for mitigation under a detailed method statement agreed with NRW.
			Strim down suitable habitat for marsh fritillary, not translocated, within the footprint of the proposed scheme once it has been cleared of larval webs to prevent recolonization.
			In areas of direct habitat loss and where appropriate, translocate turfs containing devil's-bit scabious to mitigation sites under a detailed method statement. The condition of turfs would be assessed by a marsh fritillary specialist at the time of construction with any good quality turves being translocated to the mitigation receptor sites. If the devils-bit scabious plants in the mitigation areas fail, the turfs could be used in these areas as replacements.
	Construction – Post vegetation clearance	Nov 2019 to Oct 2022	Protect retained habitats suitable for marsh fritillary immediately adjacent to construction works (using fencing if necessary)
			Provide tool box talks to all operatives on site
			Provide permanent presence of ECoW during the construction phase (including the site / vegetation clearance) to monitor implementation of the mitigation
			Plant second wave of nursery grown devil's-bit scabious into the mitigation site
			Monitor mitigation habitats and marsh fritillary presence thereon as part of the ongoing monitoring programme (in addition to existing sites shown in Figure 4).
			Establish working partnerships with grazing organisations so that a management plan is in place by the end of the construction phase.
5 year post construction phase (first 5 years of 30 year Operational and Maintenance Phase)	Post construction	Nov 2022 to Nov 2027	Planting of devil's-bit scabious seeds around attenuation ponds and reinstated working areas using retained topsoil and natural recolonization processes. Supplementary wildflower seeding / planting would be used in very specific locations only (whilst retaining the natural and visual character of the local vegetation), for example, by use of green hay collected from local sources.
			In the unlikely event that wildflower seed mix was required, emphasis on specific feeding plants for adults - betony *Stachys officinalis*, bugle *Ajuga reptans*, cuckooflower *Cardamine pratensis*, hawkweeds *Hieracium / Hypochoeris*, knapweeds *Centaurea* species, ragged robin *Lychnis flos-cuculi* and tormentil *Potentilla erecta*, whilst retaining the natural and visual character of the local vegetation, would be specified.

Key Stage	Phase	Estimated Date(s)	Mitigation
			Monitor mitigation habitats and marsh fritillary presence thereon as part of the ongoing monitoring programme (in addition to existing sites shown in Figure 4).
30 year operational and maintenance phase	Post construction	Nov 2022 – Nov 2052	Development and implementation of a long-term management plan (likely to include extensive cattle grazing) for the mitigation habitats for the benefit of marsh fritillary (in consultation with NRW and specialist parties). To include monitoring programme to be agreed in consultation with NRW. After 2052 the operational scheme would be handed over to SWTRA or the relevant maintaining agent body in existence at that time.

8.4 Effect on site integrity

Table 8.1 set out the conservation objectives of the Blaen Cynon SAC that could be compromised by the likely significant effects of the proposed scheme and Table 8.6 sets out the assessment of whether or not the likely significant effects will prevent the conservation objectives being achieved.

The loss and degradation of a total approximate area of 8.64 ha of suitable marsh fritillary habitat from a total of 115 ha identified within the 2 km Blaen Cynon SAC metapopulation area would result in a reduction to 106.36 ha. This amount is above the conservation objective threshold of 50 ha. It is also above the 100 ha cited in scientific literature. Of the 8.64 ha lost, 3.6 ha has been categorised as in good condition. A reduction of 3.6 ha from the 35 ha of good condition habitat within the 2 km Blaen Cynon SAC metapopulation area would result in a reduction but not below the 10 ha threshold as stipulated in the conservation objectives.

It should be noted that the 115 ha of suitable habitat within the 2 km Blaen Cynon SAC metapopulation area is only a proportion of the likely suitable habitat present. In 2016, landowner access was not permitted for Jacobs Ecologist to survey the 45% of the habitats identified via CCW Phase 1 mapping as potentially being suitable for marsh fritillary. This suggests that at least a further 100 ha of suitable habitat could be present within the 2 km Blaen Cynon SAC metapopulation area.

Although the mitigation site at Llwydcoed Slopes is not located within the 2 km Blaen Cynon SAC metapopulation area, it is located within the Upper Cynon Valley Functional Landscape Area which incorporates the SAC and its surrounding 2 km. Agreement has been reached with NRW, Butterfly Conservation, RCTCBC and MTCBC that the benefits to the wider marsh fritillary population by locating the mitigation site at Llwydcoed Slopes outweighed the fact that it would not be within the 2 km SAC metapopulation area.

The mitigation for this proposed scheme is uncontroversial as it has been used elsewhere and has been found to be successful. The mitigation proposed would marginally increase overall availability of marsh fritillary habitat once functional.

No adverse effect on the site integrity would be anticipated as a result of the proposed scheme, as summarised in Table 8.6 with full implementation of the mitigation stated in this report.

Table 8.6 : SIAA summary table – Blaen Cynon SAC

Likely significant effect identified at screening stage	Proposed mitigation (how it would be implemented and by whom)	Certainty of mitigation success	Timescale for mitigation implementation	Relevant conservation objective	Consideration against relevant conservation objectives
Habitat loss Direct loss of marsh fritillary habitat	Habitat creation at a site of approximately 14.4 ha at Llwydcoed Slopes and an addition approximate 8 ha of marshy grassland and devil's-bit scabious planting around attenuation ponds would ensure no net loss of marsh fritillary habitat (with aim of enhancing comparative quality of that lost) in the long term. This would include: • Suitable habitat turf translocation to mitigation areas; • Creating suitable and good habitat by planting devil's-bit scabious and implementing site specific management plans. • Implementation of grazing programme for long-term management. Planting around attenuation ponds in the proposed soft estate to benefit feeding adults and aid dispersal through the wider functional landscape.	High level of certainty – uncontroversial proposals using established themes of mitigation. Habitat creation for butterfly mitigation is a standard technique and has proved to be successful (Bickmore, 1992 and Spalding, 2005). Devil's-bit scabious is readily propagated from seed and plug planting of robust plants have shown to establish well (Flora Locale, 2012) and turf / devil's-bit scabious translocations have been successful in the local area. Successful habitat management programmes have occurred previously indicating there would be no effect on the integrity of the Blaen Cynon SAC.	Seed harvest and nursery grown devil's-bit scabious – process to start Summer / Autumn 2018. Works can begin on land acquired for mitigation after commencement of works – approx. November 2019. Soft estate habitats – Completion of construction – approx. 2022.	The site would contribute towards supporting a sustainable metapopulation of the marsh fritillary butterfly in the Penderyn / Hirwaun area. This would require a minimum of 50 ha of suitable habitat, of which at least 10 ha must be in good condition, although not all is expected to be found within the SAC. Some would be on nearby land within a radius of about 2 km. The population would be viable in the long-term, acknowledging the extreme population fluctuations of the species.	The loss of habitat does not affect the amount of suitable (50 ha) and good condition (10 ha) habitat present within 2 km of the SAC. The 14 ha mitigation site within the wider Upper Cynon functional landscape area will also increase availability of suitable habitat for the marsh fritillary butterfly metapopulation. Therefore the net gain of suitable habitat for the marsh fritillary metapopulation will contribute to the long term viability of the SAC and this considered not to significantly affect the integrity of the Blaen Cynon SAC.
Habitat fragmentation					
Habitat degradation					
Direct mortality of butterfly (adults) due to traffic collision				The population would be viable in the long-term, acknowledging the extreme population fluctuations of the species.	Acknowledging the uncertainty in the literature regarding the effects and impact of habitat fragmentation and roads on butterfly species, it is considered that the mitigation proposed minimising any fragmentation issues caused by barriers to movement by providing additional habitat that is free for colonisation by a species that is highly likely to cross the existing road.

Likely significant effect identified at screening stage	Proposed mitigation (how it would be implemented and by whom)	Certainty of mitigation success	Timescale for mitigation implementation	Relevant conservation objective	Consideration against relevant conservation objectives
	With the exception of seed collection and nursey grown devil's bit scabious which would be undertaken by Jacobs or appointed sub-contractors, the mitigation would be implemented by the Contractor / Special Purpose Vehicle (SPV) by means of contract documents (see Section 8.3)				Therefore it is considered that the viability of this metapopulation would not be compromised by any potential habitat fragmentation effects and this is considered not to adversely affect the integrity of the Blaen Cynon SAC.
Direct mortality of larval webs. Risk of destroying larval webs during site / vegetation clearance of the proposed	Translocation of webs and supporting devil's-bit scabious plants to mitigation area at Llwydcoed Slopes.	High level of certainty - larval webs are easy to locate and all individuals would be captured as it would be timed during the species gregarious phase. Successful translocations have occurred previously indicating there would be no effect on the integrity of the Blaen Cynon SAC.	Start of construction phase – November 2019.	The population would be viable in the long-term, acknowledging the extreme population fluctuations of the species.	The high certainty that the translocation of larval webs will be successful therefore this potential effect will not prevent the meta-population being viable in the long-term and therefore not adversely affect the integrity of the Blaen Cynon SAC.

9. Usk Bat Sites SAC

9.1 Likely significant effects in relation to conservation objectives

It is conceivable that there is some interaction between individual lesser horseshoe bats present within the zone of influence of the proposed scheme and those of the Usk Bats Sites SAC. Therefore, the following likely significant effects on the lesser horseshoe bat qualifying feature conservation objectives of the Usk Bat Sites SAC are considered possible:

- direct habitat loss (direct loss of roosts); and
- construction disturbance (noise and vibration).

The Taf Fawr and Taf Fechan areas are considered in this assessment only. Based on survey data (see Section 7 for survey results summary) the significant presence of lesser horseshoe bats in any other parts of the proposed scheme study area has been discounted. Additionally, the likely significant effects relate to hibernation roosts:

- Taf Fawr cave in the Taf Fawr gorge;
- 'Knuckleduster West' and 'Ogof Fforr y Blaeanau' in the Taf Fechan gorge; and
- Unknown hibernation roosts within both gorges.

Table 9.1 lists these likely significant effects and the specific conservation objectives of the Usk Bat Sites SAC that could be delayed or interrupted if the effects were realised.

Table 9.1 : Likely significant effect on the Usk Bat Sites SAC and corresponding conservation objectives

Likely significant effect of proposed scheme	Relevant conservation objectives
Habitat loss: • direct loss of roosts; and • construction disturbance	• The population would be viable in the long-term, acknowledging the population fluctuations of the species. • 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, or any decline in the extent or quality of breeding, foraging or hibernating habitat.

9.1.1 Habitat loss – loss of hibernation roosts

Of the twenty caves inspected the majority had evidence of lesser horseshoe bat presence. However, only three caves had hibernating bats. As such, it is assumed that these three caves had specific favourable conditions to permit hibernation and are, therefore, a particularly valuable resource to the local population.

The impact of the loss of roosts on bat populations is poorly understood and difficult to study, though it is believed to be an important factor in the decline of bat populations generally (Mitchell-Jones & McLeish, 2004).

9.1.1.1 Taf Fawr gorge

The Taf Fawr cave and confirmed hibernation roost for lesser horseshoe bat is located approximately 165 m north of the proposed structure crossing the Taf Fawr (see Figure 7). The cave is outside the construction footprint of the proposed scheme and, therefore, no direct effect on the structure of the roost is considered likely. No known caves would be directly affected by the proposed scheme, specifically the proposed widening of the existing structure crossing the Taf Fawr.

However, it is considered that there is potential for previously unidentified caves and other potential roost features to be present within the gorge and extend beneath and / or adjacent to the footprint of the proposed works. The provision of footings and foundation blocks within to support the proposed widened sections of the structure may result in the loss of unidentified roost features when they are constructed in the gorge walls. Two additional structures, of similar design to the existing Taf Fawr structure, would be constructed immediately to the north of the existing structure. Each new structure would be supported by a pair of piers in parallel to the existing structure; one pier located each side of the gorge. Each of the four new supporting piers would require the construction of a concrete foundation on both sides of the gorge. These would be located within sandstone geology, where there is limited potential for lesser horseshoe presence. A preliminary design for the proposed structure at Taf Fawr is presented in Appendix D – Drawing 2191100-JAC-SBR-SE-1600-2100.

9.1.1.2 Taf Fechan

The proposed scheme would involve symmetrical widening of the existing A465 Taf Fechan viaduct. This would involve the construction of additional supporting structures adjacent to both sides of the existing viaduct. The new structures would have abutments located adjacent to the existing structure's abutments at the top of the gorge. The new deck would be supported by two steel arches that would span the entire gorge parallel to the existing concrete arches. The steel arches would require the construction of large concrete foundation blocks into the limestone slopes at the top of the cliffs. A preliminary design is presented in Appendix D – Drawing 2191100-JAC-SBR-DE-SE-1600-2300.

This activity would result in the potential loss and reduction of suitable bat roosting habitat within Taf Fechan gorge (between ch. 11350-11600). Knuckleduster West cave, a confirmed lesser horseshoe bat hibernation roost extends underneath the existing and proposed A465 (see Figure 7) and has been identified as being potentially damaged by the proposed rock cutting activities to create the foundation blocks.

Ogof Ffordd y Blaenau is located approximately 25 m north of the existing A465 and approximately 65 m north of the proposed scheme. The extent of the cave was mapped (ES Volume 2, Appendix 11H) and it was found to not extend under the existing A465. It is unlikely that the proposed construction activities further south of the existing road would have a direct impact on this roost.

There is the additional potential for unidentified caves and other potential roost features to be present within the cliff face beneath and adjacent to the footprint of the proposed works that could be used by hibernating lesser horseshoe bats.

9.1.2 Construction phase disturbance (noise and vibration)

Noise and vibration disturbance to hibernation roosts during construction works could cause detrimental impacts on the population. Although it is normal for bats to periodically arouse from hibernation, additional human-caused disturbance may cause hibernating lesser horseshoe bats to abandon their roosts in adjacent caves, increasing the use of stored food reserves forcing individuals to forage for food at sub-optimal times of year for bat activity. Ultimately this could result in increased mortality of individuals and the reduced viability of the local population.

It should be noted that disturbance impacts are considered significant only at the population level, not for the individual; therefore, in this assessment noise disturbance would only be considered significant if it impacted upon maternity or hibernation roosts.

The initial phase of the foundation construction and rock cutting at both the Taf Fawr and Taf Fechan has the potential to cause disturbance impacts on hibernating bats roosting within the caves in the cliffs. Known bat roost presence would suggest this would affect the Taf Fawr cave in the Taf Fawr gorge and 'Knuckleduster West' and Ogof Ffordd y Blaenau in Taf Fechan gorge only.

However, it is considered possible that additional, as yet unidentified caves and roosting features could be present in both of the Taf gorges. In the Taf Fechan gorge, it is considered that the initial phase of the foundation block construction involving the rock cutting and excavation of the limestone would have the potential to cause disturbance impacts on any unidentified hibernation bat roosts in caves within approximately 250 m. This distance has been developed based on professional judgement and in agreement with nature conservation bodies, including a bat specialist from NRW during a Technical Working Group on 29 March 2016.

The single potential lesser horseshoe bat maternity roost identified in the study area is located at a distance from the proposed scheme where no impact from noise or vibration is deemed likely (approximately 500 m to the north of the proposed scheme).

9.2 Mitigation measures

9.2.1 Overall objectives of mitigation

The survival of lesser horseshoe bat populations is dependent upon:

- suitable available feeding and commuting habitat; and
- abundance and distribution of roosting sites.

In order to develop an effective mitigation strategy, the objectives of any mitigation should be clear. The term mitigation is taken to encompass a hierarchy of measures as follows:

- prevention of effects by avoidance;
- reduction of the magnitude adverse effects that cannot be avoided; and
- if progression to further stages of the AIES process is required (beyond Stage 2: Appropriate Assessment), measures to compensate any residual effects that cannot be remedied.

The objectives of the mitigation strategy for lesser horseshoe bat are to:

- limit potential impact on population viability by:
  - influencing the proposed scheme design and construction methods to limit loss of habitats known to support roosting lesser horseshoe bats; and
  - timing construction works to occur in the least disturbing season.
- ensure no reduction in extent of hibernating habitat by:
  - protect retained adjacent habitats suitable for roosting / feeding / commuting lesser horseshoe bats during construction; and
  - providing replacement and new, additional roosting opportunities.

9.2.2 Mitigation - habitat loss (roosts)

9.2.2.1 Design measures to minimise land take

The potential for impacts on lesser horseshoe bats has been minimised as far as is practicable during design by choosing structures designs with the least damage to existing features, including the limestone and caves within the Taf gorges. A significant amount of work has been done on the design and buildability solutions for the proposed new structures in the Taf Fawr and Taf Fechan gorges and it is considered that the optimum solution for each proposed structure has been found in terms of minimising the impacts on lesser horseshoe bats and other environmental features potentially affected. Both would retain their clear span character:

- Taf Fawr structure: potential impacts on nature conservation and specifically roosting bats in caves was reduced by utilising the existing bridge as the westbound off-slip to the new A470 junction. Impacts were further minimised through designing the mainline and the eastbound on-slip to cross the Taf Fawr as a single span structure, with the on-slip rising in gradient on the approach to the bridge.

- Taf Fechan structure: Three main options for the structure were considered including widening the existing bridge, reducing the carriageway width of the A465 to single carriageway for a short section (removing the need to widen the bridge) and a split option whereby one carriageway used the existing bridge with the other carriageway using a new structure. In combination with the need to avoid other environmentally sensitive features, risks to hibernating bats were minimised by choosing the preferred option: widen the existing Taf Fechan structure, but with two new anvils with a new span to the north and to the south. The new structures would be tied to the existing bridge.

See ES Volume 1 Chapter 4: Scheme Design Development and Alternatives Considered, for further detail.

9.2.2.2 Provision of a Karst protocol

A Karst protocol (a document detailing the necessary survey of geological features and process if unknown caves or geological features are unintentionally disturbed) would be developed during the construction phase in consultation with NRW to minimise effects on limestone features and define responses to unexpected findings during construction. The karst protocol would be an iterative, live document with a first draft compiled by the Contractor prior to construction as part of the CEMP.

The principals of the karst protocol would be to:

- Acknowledge that karst features would likely be encountered when working near or on structures that cross the Taf Fawr and Taf Fechan gorges;
- Undertake additional ground investigation ahead of construction works in these areas, including ground penetrating radar to identify any additional caves and other karst roosting features;
- Ahead of construction works, a detailed protocol would be fully developed and agreed between the Contractors team, Clients Supervising Engineers and NRW, that would include action necessary from discovery, inspection, verification, recording, treatment and closure or potential incorporation of karst features within the works; and
- Where a karst feature is encountered work would cease until the work had been assessed by an approved person.

An indicative approach on finding a feature would be prescribed, as described below:

- Identify the type of feature e.g. Caves – large enough for man entry, essentially horizontal;
- Specify the action on discovery e.g. Contractor's geological supervisors would notify NRW prior to any recording / treatment. Allow a fully risk assessed inspection and logging by experienced cave surveyors under 'controlled' conditions' where necessary;
- Verify e.g. Deem whether the cave is active in terms of drainage or has bat habitat value. Agree treatment required with Contractor's, Environmental Co-ordinator and NRW. Contractor's Designer to design necessary treatment requirements;
- Specify treatment e.g. Protect accordingly and incorporate to the works where possible. Treatment would depend on where exactly the cave presents itself within the work areas, and what form of cave it is for example:
    - in road formation – the creation of a spanning slab to support the highway would be necessary ahead of continuing construction
    - in a cut slope a suitable access will have to be formed potentially with a future access point for inspection.

An outline specification for the Karst protocol is provided in Appendix F.

This approach has been implemented in the construction of Section 2 of the A465 between Gilwern and Brynmawr, and has proven to be a successful approach to mitigating the potential impact on bats generally, and those potentially also associated with the Usk Bat Sites SAC.

9.2.2.3 Provision of alternative roosting opportunities

Although there are numerous natural alternative roosting sites within the natural range of these individuals (without significant effects on behaviour or energy balance), to mitigate the potential damage or destruction of lesser horseshoe bat hibernation roosts in the Knuckleduster West cave in the Taf Fechan gorge and any as yet unidentified hibernation roosts, replacement and additional roosting opportunities would be provided in the form of artificial pipe roosts. Twelve of these pipes would be incorporated into new embankments and into the proposed scheme's structures at the following locations (see Figure 10):

- Afon Cynon - western abutment (one pipe) at ch.3875;
- Nant Melyn – eastern abutment (one pipe) at ch. 5450;
- Nant Hir - eastern and western abutments of new structure (two pipes) at ch. 6650-6700;
- In north side of retaining wall (one pipe) at ch. 9900-10050;
- Nant Ffrwd – eastern and western abutment of both structures (four pipes) at ch. 10300-10375;
- Taf Fawr – eastern abutment (one pipe) of the new eastbound slip road structure to the north of the existing road at ch.10900; and
- Taf Fechan - eastern and western abutments of widened structure (two pipes) between ch. 11450 and 11600.

The provision of twelve pipes mitigates for the one known lesser horseshoe bat hibernation roost that would be potentially affected (Knuckleduster West in Taf Fechan). A temporary reduction in extent of hibernation habitat could occur if caves were damaged or lost before the new pipes were constructed. However, this is unlikely to be a significant effect as the Taf gorges provide a variety of alternative roosting opportunities. However, the draft construction programme (Plate 2.1) indicates that construction works would not begin in Taf Fechan until mid-2021, by which time the proposed bat pipe structures would be nearing completion at Afon Cynon.

The inquisitive nature of lesser horseshoe bats causes them to explore new potential roost opportunities (Schofield 2008). The proposed pipe structures would be located on or near structures that cross watercourses, a commonly used commuting feature for lesser horseshoe bat, increasing likelihood of encounter and subsequent roosting. An indicative pipe roost design is provided in Appendix E.

Provision of pipes to replicate loss of underground roosting sites for lesser horseshoe bat has been a successful approach by Jacobs on two railway bridge infill projects in the south west of England and on the South Bristol Link road scheme. Monitoring of these artificial roosting opportunities has recorded lesser horseshoe bats exploring or roosting within these features within the first year post-construction (unpublished Jacobs survey reports).

9.2.3 Mitigation – construction disturbance

The preferred form of mitigation is avoidance. There are detailed timing restrictions within the construction programme, which have also been carried through to the REAC, regarding the construction works at Taf Fawr and Taf Fechan structures. No construction work at the Taf Fawr or Taf Fechan structures would be permitted during the hibernation period: 1 December to 15 March, inclusive. This would avoid any potential disturbance effects on hibernating lesser horseshoe bats.

The indicative construction programme would also specify no working during dusk, dawn or night time. Therefore, no disturbance to commuting or foraging bats is anticipated.

No construction works are proposed within the specific location in the gorges or in the watercourses where most lesser horseshoe bat activity was recorded (ES Volume 2, Appendix 11H). Retention of dark commuting and foraging areas in the Taf gorges during the construction and operational phases, along with planting of woodland habitat in the proposed soft estate, would maintain unrestricted access to roosts or potential roosting features and would allow bats to move to other roosting opportunities if required.

9.2.4 Mitigation summary for lesser horseshoe bat

The breakdown of mitigation for each likely significant effect is summarised in Table 9.2. A net gain of roosting habitat would be provided and potential disturbance effects during construction would be avoided.

Table 9.2 : Summary of mitigation – lesser horseshoe bat

Impact	Likely Significant Effect	Mitigation provided
Loss of roosts	Potential damage or destruction of the Knuckleduster West Cave in Taf Fechan – a lesser horseshoe hibernation roost	• Provision of (no.) 12 bat roost pipes
	Potential damage or destruction of unknown hibernation roosting features in limestone cliffs in Taf Fawr and Taf Fechan within the proposed construction footprint	• Proposed design minimises rock cutting necessary into the limestone cliffs • Provision and implementation of a Karst protocol • Provision of (no.) 12 bat roost pipes
Construction disturbance (noise and vibration)	Disturbance on Taf Fawr cave in Taf Fawr; and Knuckleduster West Cave and Ogof Ffordd y Blaenau in Taf Fechan – known lesser horseshoe hibernation roosts	• No works permitted 1 December to 15 March
	Potential disturbance from proposed construction activities on unknown hibernation roosting features in limestone cliffs within 250 m of the proposed Taf Fawr and Taf Fechan structures	• No works permitted 1 December to 15 March • Provision and implementation of a Karst protocol

9.3 Summary of mitigation delivery

The mitigation for the proposed scheme for marsh fritillary and the Blaen Cynon SAC would be delivered as set out in Table 9.3. The mitigation commitments described in the SIAA have been compiled into the REAC.

Mitigation commitments would be submitted in support of Draft Orders and the implementation of such commitments would be fulfilled as a legal requirement of the Orders. The commitments would include actions, procedures and standards to avoid or mitigate likely significant effects; avoid offences; and demonstrate no adverse effects on the integrity of European sites.

The contract documents would explicitly require the Contractor to fulfil all commitments in the SIAA, ES and REAC. The REAC would include the requirements for consents and licences necessary post-confirmation of Orders, which would provide further mechanisms for ensuring impacts are avoided or mitigated as well as ensuring no offences would be committed. The REAC would also include commitments to the liaison and consultation with statutory environmental bodies required to ensure agreement on, and implementation of, management plans, method statements and protocols.

Table 9.3 : Summary of mitigation delivery pending agreement to proceed – lesser horseshoe bat

Key Stage	Phase	Estimated Date	Mitigation
Key Stage 3 (Development of outline design, ES, SIAA and Draft Orders)	Pre-construction	Oct 2015 - July 2017	Inform and influence detailed scheme design and construction areas to limit direct and indirect impacts on lesser horseshoe bats using baseline and survey data gathered to date by: • select and develop structure design with the least damage to existing roosting features and quickest methods of construction; • development of a Karst protocol in consultation with NRW; and • ground investigation including ground penetrating radar to identify any additional caves and other roosting features.
			Confirm timing restrictions on construction works at Taf Fechan and Taf Fawr.
			Develop a Register of Environmental Actions and Commitments (REAC) and Outline Construction Environmental Management Plan (CEMP)
Key Stage 4 (Public Local Inquiry and Minister 's Decision)	Pre-construction	July 2017 to April 2018	Pre-construction bat survey, as necessary to inform European Protected Species licence application and method statement.
Key Stage 5 (Procurement of the DBFO Contractor)	Pre-construction	May 2018 to Oct 2019	Acquire land for the proposed scheme (and integrated mitigation features in structures) under the Highways Act 1980 (as amended) process
Key Stage 6 (Construction phase)	Construction	Nov 2019 to Oct 2022	Establish early construction phase version of CEMP and implement REAC
			Secure European protected Species licence
			Protect retained habitats suitable for roosting, commuting and foraging bats immediately adjacent to construction works
			Provide tool box talks to all operatives on site
			Provide permanent presence of Ecological Clerk of Works (EcCoW) during the construction phase to monitor implementation of the mitigation
			Construct bat pipes in structure embankments
			Restrict working at Taf Fawr and Taf Fechan structures – no works permitted 1 Dec – 15 March, inclusive.
			Monitor mitigation structure and retained caves as part of the ongoing monitoring programme developed in consultation with NRW (in addition to existing sites shown in Figure 7).
5 year post construction phase (first five years of 30 year operational and maintenance phase)	Post construction	Nov 2022 to Nov 2027	Monitor mitigation structure and retained caves as part of the ongoing monitoring programme developed in consultation with NRW (in addition to existing sites shown in Figure 7).
30 year operational and maintenance phase	Post construction	Nov 2022 to Dec 2052	Review monitoring programme in consultation with NRW. Post 2052 the operational scheme would be handed to SWTRA or the relevant maintaining agent organisation in place at that time.

9.4 Effect on site integrity

Table 9.1 sets out the conservation objectives of the Usk Bat Sites SAC that could be compromised by the likely significant effects of the proposed scheme and Table 9.4 sets out the assessment of whether or not the likely significant effects will prevent the conservation objectives being achieved.

The relevant conservation objectives for the Usk Bats Sites SAC relate to continued population viability and no reduction in extent of hibernating habitat. By appropriately timing construction works to limit disturbance effects, the resulting ultimate impact on population viability can be avoided. Furthermore, the proposed over provision of artificial roosting features (bat pipes) to replace any hibernation caves directly impacted by the proposed scheme would result in a net gain in the extent of hibernation roosting habitat in the long term.

The mitigation for this proposed scheme is uncontroversial as it has been used elsewhere and has been found to be successful. No adverse effect on the site integrity would be anticipated as a result of the proposed scheme, as summarised in Table 9.4, with full implementation of the mitigation stated in this report.

No adverse effect on the site integrity of the Usk Bat Sites SAC would be anticipated as a result of the proposed scheme, as summarised in Table 9.4 with full implementation of the mitigation stated in this report.

Table 9.4 : SIAA summary table – Usk Bats Sites SAC

Likely significant effect identified at screening stage	Proposed mitigation (how it would be implemented and by whom)	Certainty of mitigation success	Timescale for mitigation implementation	Relevant conservation objective	Consideration against relevant conservation objectives
Direct loss of roosts could occur where land take is required on the cliff edge to construct the new bridge abutments.	The design of the new structures has focussed on minimising land take. Provision of additional roosting opportunities, a total of twelve pipe roosts proposed. A Karst protocol (including pre-construction surveys) would be implemented during the construction phase. The mitigation would be implemented by the Contractor through specification within the contract documents (See Section 9.3).	High level of certainty Use of pipe roosts as replacement roosts for underground caves have been proved successful on other Jacobs projects (see Section 9.2.2.2). Pre-construction surveys for and of caves and roosting features would identify the majority of features. Karst protocol has been successfully used during the construction phase of Section 2 of the A465, where the road within the Clydach Gorge was being constructed “over” caves used by lesser horseshoe bats.	During Construction phase (approx. 2019-2022). Pipe roost creation by completion of construction – 2022.	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.	No maternity roosts were recorded in any caves. Known and unknown hibernation roosts within the Taf Gorges could be affected by the proposed land take for bridge construction. However, there are numerous natural alternative roosting sites within the natural range of these individuals (without significant effects on behaviour or energy balance) and with provision of artificial roosting features, it is considered that the relevant conservation features would not be compromised. No adverse effect on the integrity of the Usk Bat Sites SAC is predicted.
Construction disturbance (noise and vibration) of hibernation roosts resulting in displacement could occur where roosts exist within 250 m of the construction area.	Appropriate timing of construction works to exclude works in the Taf Gorges 15 Dec – 31 Mar inclusive and no works at dawn, dusk and night time.	High level of certainty Avoiding disturbance by actively timing works to occur when lesser horseshoes are not present / less active in the potentially affected caves is certain of success.	Pre-construction – input into final construction programme During construction – implementation of timing restrictions on construction activities at Taf Fawr and Taf Fechan	The population would be viable in the long-term, acknowledging the population fluctuations of the species.	Potential disturbance impacts would be avoided. As such the conservation relating to population viability would not be affected. No adverse effect on the integrity of the Usk Bat Sites SAC is predicted.

10. Proposals for Monitoring and Reporting

10.1 Monitoring

Table 10.1 describes the draft proposed monitoring programme and reporting requirements for each of the qualifying feature species. Additional monitoring required as part of a condition for any European Protected Species derogation licencing is not discussed here.

The final monitoring programme would be agreed in consultation with relevant stakeholders, including NRW, in particular to define the success criteria and develop the monitoring programme to establish if these criteria would be met. All proposed monitoring would be undertaken annually during construction and over the immediate five year period post-construction. After this time, the monitoring programme would be reviewed and, in consultation with NRW and relevant nature conservation bodies, a decision made on any further monitoring required.

Monitoring is proposed with specified success criteria at the following phases:

- Pre-construction;
- During construction; and
- Post construction.

10.2 Reporting

Reporting would be undertaken at six monthly intervals in line with proposed ELG meetings during construction. This would provide an opportunity to review results, make an evaluation against the relevant success criteria and make alterations to the monitoring and / or mitigation plan if required.

The reporting would be issued to and ELGs involve participants representing the contractor, Welsh Government, NRW, Butterfly Conservation and local authority ecologists for the period of construction. Reporting would be extended to annual reports for five years from the end of construction.

Reports required in relation to European Protected Species licencing are not discussed here.

Table 10.1 : Monitoring proposals and related (draft) success criteria

Mitigation site / ecological resource	Monitoring aims	(Draft) success criteria	Monitoring proposals			
			Pre-construction	During construction	Years 1-5 of Operational and Maintenance period	Years 6-30 of Operational and Maintenance period
Llwydcoed Slopes – habitat mitigation	Monitor the success of the habitat translocation and planting in the mitigation area and establishment and continued management of habitat for marsh fritillary	The majority of land (90%) at Llwydcoed Slopes is in suitable condition for marsh fritillary by the end of the fifth summer post construction. Specifically there would be at least 3.39 ha of good quality habitat. A stable management regime at Llwydcoed Slopes would be established by the end of the fifth summer post construction.	Llwydcoed Slopes mitigation area, habitats potentially degraded by increased nitrogen deposition and habitats directly impacted by the proposed scheme outside of the established monitoring programme would be added into the existing marsh fritillary monitoring programme that Jacobs currently undertake annually of the behalf of the proponent, using the same methodology. Habitat suitability surveys for marsh fritillary would be undertaken in accordance with methods described by Fowles (2005) in September of each year. Adult and web counts would be undertaken at each site in May of each year.	• Provision of a watching brief. • Annual habitat condition, adult and web counts would continue as described during pre- construction.	Habitat condition, adult and web counts would continue as described during pre-construction. Monitoring would continue annually for a minimum of five years post-construction.	At 5 years post-construction, the monitoring programme and management plan would be reviewed, in consultation with NRW, the maintaining agent (SWTRA or equivalent organisation), and relevant nature conservation bodies, where appropriate.

Mitigation site / ecological resource	Monitoring aims	(Draft) success criteria	Monitoring proposals			
			Pre-construction	During construction	Years 1-5 of Operational and Maintenance period	Years 6-30 of Operational and Maintenance period
Llwydcoed Slopes - Marsh fritillary larval web receptor site	Monitor the success of the marsh fritillary larval web translocation	50% of translocated webs support live caterpillars after translocation after one week.	Detailed pre-construction survey of suitable habitats for marsh fritillary directly impacted by the proposed scheme. Survey of larval web presence and detailed GIS location recording.	Translocated larval webs should be monitored after: • one day; • three days; and • one week, post translocation to determine survival post the translocation period.	N/A	N/A

Mitigation site / ecological resource	Monitoring aims	(Draft) success criteria	Monitoring proposals			
			Pre-construction	During construction	Years 1-5 of Operational and Maintenance period	Years 6-30 of Operational and Maintenance period
Lesser horseshoe bat	Show that retained hibernation roosts are not disturbed during construction nor impacted by minor changes in extent of roosting habitat. Show use of bat pipes by roosting bats	The use of the monitored caves and new pipe roosts could be considered to be at a similar level as recorded during pre-construction surveys. No change to numbers of bats recorded at the known maternity roost at Dan-y-Darren viaduct than were recorded during pre-construction surveys.	• Pre-construction survey for geological features, including caves with roosting potential • Pre-construction surveys for horseshoe bat roosts would be undertaken in accordance with survey guidelines published in Collins ((ed.) 2016). Survey sites would include known caves with hibernation roosts and potential to be used as hibernation roosts.	During construction it is proposed to monitor the following to determine their use by bats through the construction period. <u>Caves – annually, one visit in winter and one during summer to confirmed hibernation roosts:</u> • Knuckleduster West • Ogof Ffordd y Blaenau • Taf Fawr cave • Plus any additional caves identified during pre-construction survey <u>Structure maternity roost in summer</u>: A470 Dan-y-Darren Viaduct	<u>Caves:</u> Year 1 – winter hibernation visit (caves listed to left) Year 3 – winter hibernation visit (caves listed to left) Year 5 – winter hibernation visit (caves listed to left) <u>Known maternity roost at Dan-y-Darren Viaduct</u>: Year 2 – summer visit Year 4 - summer visit <u>Pipe roosts</u>: Annual (Years 1 to 5 inclusive) checks in both summer and winter to record bat, particularly lesser horseshoe bat, species presence.	At 5 years post-construction, the monitoring programme and management plan would be reviewed, in consultation with NRW, the maintaining agent (SWTRA or equivalent organisation), and relevant nature conservation bodies, where appropriate.

11. In-combination Effects

A number of plans and projects for which cumulative impacts could potentially occur in tandem with the proposed scheme have been identified.

It should be noted that due to the outline nature of plans (rather than projects), the accompanying Environmental Assessments are often high level and do not provide sufficient detail to undertake a detailed in-combination assessment for the proposed scheme. Furthermore, the conclusions of plan level HRAs do not remove the requirement for project-level HRAs for specific projects associated with these plans. When these projects come forward, these will need to undertake specific, detailed assessments of the potential effects on European sites and include the proposed scheme (if relevant) as part of their in-combination assessment.

For projects where HRAs have not been undertaken a review of likely significant effects using professional judgement was undertaken using the available information.

Table 11.1 provides the in-combination assessment of all the identified plans and projects for their potential effect on the Blaen Cynon SAC and Usk Bats Sites SAC.

11.1 Blaen Cynon SAC

It has been assumed that if any plans and projects were not located within the 2 km SAC core metapopulation area, there is no reasonable pathway to in-combination effect as conservation objectives relate to this area only. The study area for the in-combination effect assessment covers a large proportion of the Upper Cynon Valley Landscape Functional Area. It should be noted that the vast majority of the Upper Cynon Valley Landscape Functional Area is entirely rural in nature where no plans or projects are proposed.

The majority of plans and projects identified are not located within the 2 km Blaen Cynon SAC metapopulation area. Those that are located within the 2 km Blaen Cynon SAC metapopulation area have either: no impact on marsh fritillary habitat; already had suitable habitat for marsh fritillary removed; or have a mitigation plan in place or planned. This is particularly in relation to the proposed NA8 Strategic Site allocation in Rhondda Cynon Taff, south of Hirwaun, where the local authority would enforce planning conditions on future applications such that "*Landscape, habitat restoration and protection and ecological mitigation including the protection and management of the areas of marsh fritillary butterfly habitat identified within the Strategic Site*" must be maintained.

No adverse in-combination likely significant effects on the integrity of the Blaen Cynon SAC have been identified. Furthermore, there is confidence that there would be no in-combination impact on the wider Upper Cynon Valley Functional Landscape Area.

11.2 Usk Bat Sites SAC

The likely significant effects of the proposed scheme on the Usk Bat Sites SAC were confined to the loss and construction disturbance of lesser horseshoe hibernation roosts. Therefore, in-combination effects were only considered to occur if these impacts were realised within the same timeframe by other plans or projects. If plans / projects did not involve the loss of or disturbance to lesser horseshoe roosts no in-combination effect was deemed possible.

The review of each plan and project identified showed that there was either: no recorded presence of lesser horseshoe bat in the plan or project; no suitable roosting or foraging habitat for lesser horseshoe bat within the reviewed areas; and / or there was no overlap in the timing of construction works to generate any in-combination effect.

As such, no adverse in-combination likely significant effects on the integrity of the Usk Bat Sites SAC have been identified.

Table 11.1 : Consideration of potential in-combination effects

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
Selar Opencast Coal Site	SN 886 054 Approximately 3 km south west of the proposed scheme.	Neath Port Talbot CBC approved planning application P2013/0720 in February 2014 for an extension to Selar Surface Mine (Selar Central Extension) for the phased extraction of some 800,000 tonnes of coal.	No – not located within the 2 km core SAC metapopulation area.	No – project site is further west than the proposed scheme in an area already undergoing surface mining. The closest lesser horseshoe bat record is approximately 8 km east of the mine.
Nant Llesg surface mine	SO 095 078 Approximately 0.8 km from the proposed scheme (east of Dowlais Top, south of A465).	Caerphilly County Borough Council (CBC) refused planning permission for the recovery of 6 million tonnes of coal by surface mining methods on 478 hectares of land. An appeal was submitted in December 2015.	No – not located within the 2 km core SAC metapopulation area.	No – the project area is predominantly open grassland devoid of roosting habitat for bats. With no pathway to effect for this project alone no in-combination effects with the proposed scheme can be assumed. Local records centre data suggests that the nearest lesser horseshoe record is nearly 3 km to the north.
Wind farm at Pen Bryn Oer	SO 121 095 Approximately 4 km east of Dowlais Top.	Planning permission (13/0483/FULL) refused by Caerphilly CBC but approved on appeal in August 2015 to build three wind turbines and construct associated infrastructure.	No – not located within the 2 km core SAC metapopulation area.	No - the project area is predominantly open grassland devoid of roosting habitat for bats. With no pathway to effect for this project alone no in-combination effects with the proposed scheme can be assumed. Local records centre data suggests that the nearest lesser horseshoe record is over 3 km to the north.

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
Hirwaun Power Station	SN 938 061 Adjacent to the proposed scheme (south of A465).	A gas-fired power station with a nominal generating capacity of up to 299 MW. Includes 5 stacks up to 35 m. A Nationally Significant Infrastructure Project which was approved in July 2015. Expected to enter commercial operation in 2019.Covers an area of 7.7ha.	No – although the project is located within the 2 km core SAC metapopulation area the Habitats Regulations Assessment (HRA) for the project did not predict any significant effects on the SAC alone or in combination.	No – The HRA for the project did not identify pathway to the Usk Bat Sites SAC and no lesser horseshoe bat evidence was recorded within the ES. Local records centre data suggests that the nearest lesser horseshoe records are associated with Dare valley Country Park and Cwm (5 km away).
Enviroparks	SN 937 067 0.2 km north of the proposed scheme.	A planning application is currently going through a consultation period (20 Jan to 20 Feb 2017) for metals recycling and anaerobic digestion. Covers an area of 8.54 ha.	No - although the project is located within the 2 km core SAC metapopulation area construction has already started with all required vegetation clearance undertaken. Although some sub-optimal marsh fritillary habitat was identified on the project site in ecological surveys of the ES (2008), the planning documentation concludes that the project site is unlikely to support the species.	No – the ecological survey for the ES (2008) for the project did not identify any roosting potential or records of activity for lesser horseshoe bat.
Former Tower Colliery Regeneration	SN 945 049 South of the proposed scheme, Hirwaun.	Extraction and land remediation (planning app ref: 10/0292/10) supported by an ES. Planning permission was approved stating that development must be commenced by December 2012 and was programmed to be completed within 8 years. The site covers over 250 ha.	No – although located within the 2 km core SAC metapopulation area the project has already implemented a marsh fritillary mitigation plan. No loss of suitable habitat for marsh fritillary butterfly.	No – habitats of the project are highly unlikely to be used by roosting or feeding/commuting lesser horseshoe bats. Local records centre data suggests that the nearest lesser horseshoe records are associated with the Dare River over 4 km to the east of the project.

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
Change of use of industrial unit to renewable energy generation facility at Hirwaun Industrial Estate	SN 942 061 Unit 43/44 Hirwaun Industrial Estate. Adjacent to the proposed scheme.	Planning permission (13/0416/10) was granted in October 2014 (to be commenced within 5 years) for installation and operation of renewable energy facility.	No – although located within the 2 km core SAC metapopulation area the project is planned for an area of existing hard standing and no suitable (or potentially suitable) marsh fritillary habitat would be effected.	No – the project is set within an area of existing hard standing with no suitable roosting habitat for lesser horseshoe bats.
Bryn Defaid Surface Coal mine	SO 007 068 Approximately 0.3 km south of the proposed scheme.	Planning permission (ref: 13/0421/10) was approved in August 2015 for the development of Bryn Defaid Surface Coal Mine for the extraction of coal and associated ancillary activities including restoration and subsequent aftercare of the full development site. The site covers an area of 104 ha of coniferous forestry and moorland.	No – not located within the 2 km core SAC metapopulation area.	No – ecological survey for the ES for this project did not identify any lesser horseshoe roost or activity within the project site.
Allocated land south of Hirwaun - Policy NSA 8 of the RCT CBC Local Development Plan (LDP)	SN 945 049 Adjacent to the proposed scheme, south of Hirwaun (Tower Colliery area).	Strategic site for the construction of 400 dwellings, 36 ha of employment, a new primary school, a retail store of 2000m^2 net floor space, medical /community centre and informal recreation contained in a landscape setting.	No – The HRA for the LDP identified a likely significant effect (LSE) due to habitat loss and fragmentation. It states "*there is potential for significant impacts to the integrity of Blaen Cynon SAC from development proposed in Policy NSA 8 alone and in-combination with the A465 dualling scheme. The development from the plan is not likely to have direct significant effects on the SAC but does have the potential to indirectly have significant effects on the SAC through the*	No – The HRA for the LDP identified no LSE.

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
			loss and fragmentation of surrounding suitable habitat. The magnitude of this impact would be greater during years when the metapopulation of Marsh Fritillary is high, as the ability of the butterfly to disperse would be restricted due to the loss of the potential habitat corridor between the Hirwaun Industrial Estate and Hirwaun itself, which allows access to marshy grassland in the south". The report later states that *"To ensure that the developments proposed by strategic allocations in the vicinity of Blaen Cynon do not have adverse effects on the conservation objectives of the site, the Council should ensure that detailed project level HRA is required to consider specific issues identified through this plan level HRA, in particular, the potential fragmentation of habitat and any possible changes to water supply*". The report concludes with *"…the risk of a significant effect on the integrity of the Blaen Cynon SAC was unlikely, when the avoidance and mitigation measures have been taken into account and the additional policy recommendations provided by the HRA for the LDP are in place. These conclusions reflect the consultation advice received from CCW throughout the HRA process*". In summary, although located within the 2	

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
			km core SAC metapopulation area a planning condition required by the council is that "*Landscape, habitat restoration and protection and ecological mitigation including the protection and management of the areas of marsh fritillary butterfly habitat identified within the Strategic Site*" must be maintained. At the project level both the proposed scheme and this site allocation will not result in the conservation objectives being compromised given the mitigation measures proposed.	
Allocated land at Robertstown / Abernant - Mixed use - Policy NSA 7 of the RCT CBC Local Development Plan	SO 006 033 Approximately 3.7 km south of the proposed scheme.	Allocates the site for the construction of 500-600 dwellings, 3.7 ha of employment / leisure, a new primary school, medical centre and associated informal amenity space in a parkland setting in the period 2006 to 2021. Planning application awaiting determination.	No – not located within the 2 km core SAC metapopulation area. The HRA for the LDP identified no LSE for this allocation.	No – The HRA for the LDP identified no LSE.
Allocated land south of Castle Park - Policy H9 of the Merthyr Tydfil LDP	SO 020 066 Approximately 0.6 km south of the proposed scheme.	Allocates 5.76 ha of land for 160 houses between 2017-2021. No planning application submitted to date.	No – not located within the 2 km core SAC metapopulation area. The HRA for the Merthyr Tydfil LDP states that " … *whilst the LDP area does not support any European sites, several sites are known to exist in neighbouring authority areas. Consequently, the LDP*	No – The HRA for the Merthyr Tydfil LDP states that " … *whilst the LDP area does not support any European sites, several sites are known to exist in neighbouring authority areas. Consequently, the LDP has been*
Allocated land at Goitre Lane -	SO 050 083 Adjacent to proposed scheme,	Allocates 6.7 ha of land for 190 houses between 2017-2021. Land		

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
Policy H19 of the Merthyr Tydfil LDP	south of A465.	is currently used as playing fields. No planning applications have been submitted to date.	*has been screened to ascertain whether there is likely to be any effect on those sites either as a direct result of the LDP itself or as a consequence of its cumulative impact with other development plans. The results of the screening exercise […] is considered the LDP will not give rise to any negative effects*".	*screened to ascertain whether there is likely to be any effect on those sites either as a direct result of the LDP itself or as a consequence of its cumulative impact with other development plans. The results of the screening exercise […] is considered the LDP will not give rise to any negative effects*".
Land at former Dowlais foundry – housing - Policy H23 of the Merthyr Tydfil LDP	SO 066 082 Approximately 0.2 km south of the proposed scheme.	Allocates 12.4 ha for 450 houses between 2012-2021. Outline planning permission has been approved for the site (renewed in September 2014 – P/14/0182).		
Land at Goats Mill Road - Policy E4 of the Merthyr Tydfil LDP	SO 061 070 Approximately 1.2 km south of the proposed scheme.	Allocates 9.98 ha for employment/industrial use between 2012-2021 on a brownfield site. No planning application has been submitted to date.		
Ffos-y-Fran – employment / industrial - Policy E5 of the Merthyr LDP	SO 068 071 Approximately. 1.2 km south of the proposed scheme.	Allocates 11.22 ha of land for employment development. The site is currently part of land reclamation works.		
Solar photovoltaic park, Cwmbargoed	SO 094 055 Approximately. 2.7 km south of the proposed scheme.	Planning permission was approved in September 2015 (P/15/0169) for Construction of solar photovoltaic park with associated infrastructure on a site measuring 15 ha.	No – not located within the 2 km core SAC metapopulation area.	No - the project area is predominantly open grassland devoid of roosting habitat for bats. Local records centre data suggests that the nearest lesser horseshoe record is over 4 km to the north..
Circuit of Wales motorsports	SO 138 118 Approximately. 5.5 km to the east	Planning permission approved.	No – not located within the 2 km core SAC metapopulation area.	No - . The ES did not consider that effects on the bat interest of

Project / plan name	Location – approximate grid reference and relation to proposed scheme	Summary of plan/project and status	In-combination effect with Blaen Cynon SAC	In-combination effect with Usk Bat Sites SAC
complex	of the proposed scheme.			the SAC would occur.
A465 Section 2 Gilwern to Brynmawr	SO 196 121 Approximately 12 km east of the proposed scheme.	Widening 8 km of the A465 between the Glanbaiden junction at Gilwern and the Brynmawr roundabout to 2 lanes in each direction. Construction began in 2014 and is likely to complete in 2019.	No – not located within the 2 km core SAC metapopulation area.	No – There is likely to be no overlap in construction timeframe and therefore no pathway to in-combination effect.
Cynon Valley Gateway	SN 973 055 Adjacent the proposed scheme.	The A4059 proposals are largely dependent on the proposed scheme progressing. The A4059 design is proposed to tie in with the proposed scheme.	No – not located within the 2 km core SAC metapopulation area.	No – The HRA for the LDP identified no LSE.

12. Consultation

12.1 Consultations to Date

In 2007, an initial ecology scoping report identifying important ecological features (Jacobs, 2007a) and a preliminary screening report documenting the potential for likely significant effects on the Blaen Cynon SAC (Jacobs, 2007b). Both these documents were issued for consultation with the (then) Countryside Council for Wales (CCW).

The consultation with stakeholders has been carried out for the proposed scheme since 2007 and has primarily been via Technical Working Group (TWG) and Environmental Liaison Group (ELG). ELG meetings comprised discussion relating to all environmental disciplines, of which nature conservation was a single element. TWG meetings were focused on specific ecological resources. Table 12.1 summarises the consultation undertaken and attendees have included:

- the proponent (Welsh Government);
- Jacobs;
- NRW;
- local authorities;
- local Wildlife Trusts;
- South Wales Trunk Road Agent (SWTRA); and
- Butterfly Conservation.

Table 12.1 : Summary of consultations

Date	Report / meeting	Summary of discussion points
19 November 2007	Review of initial Marsh Fritillary Butterfly Scoping Report (2007)	Agreed that a long-term monitoring programme, of marsh fritillary and suitable habitat for the species, was required to provide a robust baseline to make an assessment of likely significant effects. Start of dialogue with Butterfly Conservation to ensure that the work associated with the A465 was complimentary to the Butterfly Conservation aims in that area.
18 February 2008	Meeting between Jacobs and Countryside Council for Wales (now NRW)	Agreement on appropriate methodology for monitoring of the marsh fritillary population and the development of the proposed monitoring programme.
1 December 2015	ELG 1	Jacobs provided environmental constraints information for discussion. Potential impacts on Blaen Cynon SAC were discussed, including the potential impact on suitable habitat for marsh fritillary located outside of the SAC itself but used by linked metapopulations.
3 February 2016	TWG – nature conservation	Proposed habitat suitability assessment survey for marsh fritillary within areas 2 km from SAC. Mitigation to be based on provision of area for marsh fritillary to mitigate likely significant effects. Established principal of larger single block of mitigation land rather than multiple small, scattered areas. Agreement that no construction works to be carried out within the Taf Fechan gorge – all construction to be from existing road level reducing potential impacts on a number of ecological and cultural features including commuting and foraging bat habitats.

Date	Report / meeting	Summary of discussion points
9 March 2016	TWG – nature conservation	Review of latest academic literature regarding marsh fritillary. Management options for mitigation area discussed; turf translocation, plug planting of devil's-bit scabious, long term grazing management.
29 March 2016	ELG 2	Discussion of the likely effects and development of mitigation for marsh fritillary and lesser horseshoe bat in relation to the AIES.
29 March 2016	TWG – nature conservation	Discussion of the likely effects - marsh fritillary and lesser horseshoe bat in relation to the AIES. Agreement on potential disturbance distance of 250 m from the proposed rock cutting and excavation construction activities at Taf Fawr and Taf Fechan. Review of proposed mitigation for both species. Agreement on provision of bat pipes as alternative roosting habitat for lesser horseshoe bat. Further detail and process on selection of mitigation site discussed.
14 June and 10 August 2016	NRW Officer	Teleconferences to provide updates on lesser horseshoe bat survey results. Due to increased Health and Safety risks for surveyors identified during surveys to date, agreement on change of methodology for future lesser horseshoe bat surveys in the Taf Fawr and Taf Fechan gorges. Walked activity transects were restricted to safe walking routes along the top of the gorge with minimal recording of lesser horseshoe bat activity. It was agreed to cease walked activity transects and undertake static recording using Anabats at the water's edge on each watercourse.
23 November 2016	TWG – nature conservation	Agreement on approach of assessment in regards to marsh fritillary habitat and lesser horseshoe bat roosts was established. The potential for upcoming revision of the conservation objectives at Blaen Cynon SAC were highlighted by NRW. As literature reviews indicated that 100 ha of suitable habitat are required to maintain a viable marsh fritillary metapopulation, this would also inform the SIAA. The discussions also included agreeing a 250 m disturbance distance of the proposed works at Taf Fawr and Taf Fechan on lesser horseshoe bats (in the absence of academic literature and in consensus of experts). Agreement, in principal, to the proposed mitigation for both marsh fritillary and lesser horseshoe bat.
28 February 2017	ELG 3	Review mitigation provision. Agreement that provision of additional 'stepping-stone' habitats for marsh fritillary would be beneficial, to provide connectivity to the wider landscape and between existing breeding sites. These would be generated by seeding land around attenuation ponds with devil's-bit scabious.

12.2 Future Consultation

There would be continued future consultation with NRW, RCTCBC, MTCBC and other stakeholders regarding the mitigation measures described in this assessment throughout the future project stages (see section 2.5).

See also Table 10.1, which sets out the proposed monitoring proposals at the key future project stages.

13. Conclusions

13.1 Site integrity checklist

DMRB HD44/09 guidance (Highways Agency, 2009) recommends that, for the purposes of Regulation 61 of the Conservation of Habitats and Species Regulations 2010, answers to the following four questions (13.1.1 to 13.1.4) should be provided (based on the information presented) when concluding a SIAA. These are addressed in turn here.

13.1.1 Is the proposal directly connected with or necessary to site management for nature conservation?

The proposed scheme is neither connected with nor necessary to site management for any of the European sites considered within this document.

13.1.2 Is the proposal likely to have a significant effect on the features of the sites of European importance, alone or in-combination with other plans and projects?

The proposed scheme Stage 1: Screening and subsequent review concluded that likely significant effects could not be ruled out on the following qualifying features of the following European sites (summarised in Section 4 of this SIAA).

The proposed scheme is likely to have the following significant effects on the marsh fritillary qualifying feature of the Blaen Cynon SAC via:

- habitat loss;
- habitat degradation:
- habitat fragmentation;
- direct mortality (larval webs); and
- direct mortality (adult butterfly).

The proposed scheme is likely to have the following significant effects on the lesser horseshoe bat qualifying feature of the Usk Bat Sites SAC:

- habitat loss (direct loss of roosts); and
- construction disturbance (noise and vibration).

It was therefore necessary for a Stage 2: Appropriate Assessment to be carried out for the proposed scheme on these qualifying feature species. In line with DMRB HD44/09 guidance, it is therefore necessary to provide answers to questions 13.1.3 and 13.1.4 below.

13.1.3 What are the implications of the effects of the proposal on the sites' conservation objectives and will it delay or interrupt progress towards achieving the objectives?

It has been concluded that, assuming the implementation of the mitigation measures outlined in Section 8.2 and 9.2 of this report, the proposed scheme (proposal) would not adversely affect the conservation objectives nor delay or interrupt progress towards achieving these.

13.1.4 Can it be ascertained that the proposal will not adversely affect the integrity of the sites beyond reasonable scientific doubt?

As detailed above, the implementation of the mitigation measures outlined within this report would ensure that the proposed scheme (proposal) would not adversely affect the integrity of the sites beyond reasonable scientific doubt.

13.2 Overall conclusion

This Stage 2: Appropriate Assessment report demonstrates that the proposed scheme would not have an adverse effect on the integrity of the Blaen Cynon SAC or Usk Bat Sites SAC, either alone or in-combination with other projects or plans. This has been concluded based on the information provided which shows that progress towards achieving the relevant conservation objectives of the qualifying features will not be interrupted or delayed. The proposed scheme would not disrupt the factors which help maintain favourable condition and interfere with the balance, distribution and density of key indicator species of favourable condition these European sites.

For the purposes of Regulation 61 (5) of the Conservation of Habitats and Species Regulations 2010, it is concluded that the proposed scheme would not adversely affect the integrity of the European sites (Blaen Cynon SAC and Usk Bat Sites SAC) considered in this SIAA.

14. References

Barnett, L. K. & Warren, M. S., (1995) Species Action Plan - Marsh fritillary, s.l.: www.butterfly-conservation.org/files/marsh-fritillary-action-plan.doc

Bat Conservation Trust (2017) Lesser horseshoe bat trends for Wales. [Online] Available at: http://www.bats.org.uk/pages/lesser_horseshoe_bat_trends_wales.html

Bickmore, C. J. (1992) M40 Waterstock-Wendlebury:planning, protection and provision for wildlife. *Proceedings from the Institute of Civil Engineers*. 93 pp75-83.

Borsje, H.J. (2005) *The marsh fritillary butterfly in the Avalon Marshes, Somerset: A study on habitat restoration and the re-establishment potential.* English Nature Report number 632.

Botham, M. S., Ash, D. Aspey, N., Bourn, N. A. D., Bulman, C. R., Roy, D. B., Swain, J., Zannese, A. and Pywell R. F. (2011) The effects of habitat fragmentation on niche requirements of the marsh fritillary, Euphydryas aurinia, (Rottemburg, 1775) on calcareous grasslands in southern UK. *Journal of Insect Conservation*. **15** (1) pp269-277.

Bristol University (2017) Lesser Horseshoe Bat. [Online] Available at: http://www.bio.bris.ac.uk/research/bats/britishbats/batpages/lesserhorseshoe.htm

Bulman C.R., Wilson, R.J., Holt, A.R., Bravo, L.G., Early, R.I., Warren, M.S. and Thomas. C.D. (2007) Minimum viable metapopulation size, extinction debt and the conservation of a declining species. *Ecological Applications* **17**: 1460-1473.

Bulman, C.R. (2001) *Conservation Biology of the Marsh Fritillary Butterfly.* PhD Thesis – University of Leeds.

Butterfly Conservation Wales (2017) The Status of the Marsh Fritillary in Wales: 2016, s.l.: www.butterfly-conservation.org/files/wales-marsh-fritillary-feedback-2017fin.pdf.

Capita Symonds (2010) Cyfarthfa Leat & Tramway Bat Surveys. Unpublished survey report.

Charles, P. & Edwards, P., (2015) Environmental good practice on site guide (C741D). 4th Edn ed. s.l.:CIRIA.

Countryside Council for Wales (2008) *Core Management Plan Including Conservation Objectives For Blaen Cynon Special Area of Conservation (SAC).* Version: 1. Date: 28th February 2008.

Countryside Council for Wales (2008a) *Core Management Plan Including Conservation Objectives For Usk Bat Sites Special Area of Conservation (SAC).* Version: 1. Date: 28th March 2008.

Davies, R. D. (u.d.) LBAP 15 Modelling of the permeability of the landscape associated with the marsh fritillary metapopulation. Marsh fritillary connectivity mapping – Summary report [http://old.amdro.org.uk/English/environment/planning/Planning%20Policy%20and%20Development%20Plans/Local%20Development%20Plan/Documents/method_report.pdf]

Dietz, C., Helversen, O. & Nill, D (2011) Bats of Britain, Europe & Northwest Africa. A&C Black Publishers Ltd. London.

European Commission (2001) Assessment of plans and projects significantly affecting Natura 2000 sites.

Evans, P. (2014) A465 Heads of the Valley Dualling Section 2: Gilwern to Brynmawr. Proof of Evidence – Noise and vibration document [https://a465gilwern2brynmawr.files.wordpress.com/2014/02/wg12-noise-vibration-f.pdf]

Fischer, S.J, Williams, E.H., Brower, L.P. and Palmiotto, P.A. (2015) Enhancing monarch butterfly reproduction by mowing fields of common milkweed. *The American Midland Naturalist* **173**(2) pp229-240

Flora Locale (2012) M3 Twyford Down, Hampshire [https://www.floralocale.org/page23875]

Fowles A.P. (2004) *Conservation objective for Marsh Fritillaries on marshy grassland*. CCW internal document.

Fowles A.P. (2005) *Habitat quality mapping for marsh fritillary populations*. Staff Science Report. 05/5/1. Countryside Council for Wales.

Gustafson E.J. and Gardner R.H. (1996) The effect of landscape heterogeneity on the probability of patch colonization. *Ecology* **77**: pp 94-107.

Hanski, I. (1999) *Metapopulation Ecology*. Oxford university Press, Oxford.

Highways Agency *et al*. (2009) Design Manual for Roads and Bridges Volume 11 Environmental assessment Section 3 Environmental Assessment techniques Part 1 HA 207/07 Air Quality [http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf]

Highways Agency *et al*. (2009a) Design Manual for Roads and Bridges *Assessment of implications (of highways and / or roads projects) on European Sites (including appropriate assessment)*. DMRB Volume 11, Section 4, Part 1, HD 44/09.

Jacobs (2007) A465 Abergavenny to Hirwaun Dualling: Section 6: A470 Junction to Hirwaun - Ecology Scoping Report. Consultancy Report to Welsh Assembly Government.

Jacobs (2007a) *A465 Abergavenny to Hirwaun Dualling - Blaen Cynon SAC Appropriate Assessment, Stage 1, Screening: Finding of Significant Effects.* Consultancy Report to Welsh Assembly Government.

Jacobs (2016) *A465 Heads of the Valleys Dualling Section 5 and 6 - Assessment of Implications on European Sites: Screening.* Revision 2. Consultancy Report for Welsh Government.

Jacobs (2017) *A465 Abergavenny to Hirwaun Dualling Sections 5 & 6; Blaen Cynon Special Area of Conservation Marsh Fritillary Monitoring Programme Year 9 (2016).* Consultancy Report to Welsh Government.

Jacobs (2017a) *A465 Heads of the Valleys Dualling Section 5 and 6 – Environmental Statement.*

Jacobs, (2017) A465 Heads of the Valleys Dualling Section 5 and 6 - Constructability and Phasing Report

Joint Nature Conservation Committee (2016) Blaen Cynon SAC [http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030092]

Joint Nature Conservation Committee (2016a) Usk Bat Sites SAC [http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK00 14784]

Jones, L. (2015) Understanding the ecology of *Succisa pratensis* Moench to inform conservation of marshy grassland for the *Euphydryas aurina* Rottemburg butterfly. MPhil research project.

Mathews, J. E. & Halliwell, E. C (2009) Lesser Horseshoe Bat Summer Roost Surveillance 20 May to 17 June 2003 - 2007, s.l.: CCW Staff Scientific Report No. 06/9/1.

Mitchell-Jones, A. J. & McLeish, A. P. (2004). Bat Workers' Manual 3rd Edition. s.l.:Joint Nature Conservation Committee.

Moilanen A. and Hanski I. (1998) Metapopulation dynamics: effects of habitat quality and landscape structure. *Ecology* 79: 2503–2515.

Morris, M. (2017) Northumbrian Water's Pertnership with Flexigraze - Helping to get hooves onto the ground for the benefit of wildlife. In Practice - Bulletin of the Chartered Ecology and Environmental Management, Volume 96, pp. 31-33.

Munguira, M.L. and Thomas, J.A. (1992) Use of road verges by butterfly and burnet populations, and the effect of roads on adult dispersal and mortality. *Journal of Applied Ecology* 29, pp 316-329.

Porter, K and Ellis, S. (2011) Securing viable metapopulations of the marsh fritillary butterfly in Northern England. *Journal of insect Conservation* 15: pp 111-119.

Preston, J.S., McEvoy, P. & Reid, N. (2008) *Monitoring of Devil's-bit scabious as a likely means of assessing the conservation status of the Marsh Fritillary butterfly.* Report prepared by Quercus for Environment & Heritage Service, Northern Ireland, UK.

River Restoration Centre (2013) *Manual of River Restoration Techniques.* [Online]
Available at: http://www.therrc.co.uk/manual-river-restoration-techniques

Schofield, H.W. (2008) *The Lesser Horseshoe Bat Conservation Handbook*. Vincent Wildlife Trust, UK.

Skórka, P., Lenda, M., Moroń, D., Kalarus, K. and Tryjanowski, P. (2013) Factors affecting road mortality and the suitability of road verges for butterflies. *Biological Conservation* 159 pp.148-157.

Skórka, P., Lenda, M., Moroń, D., Martyka, R., Tryjanowski, P. and Sutherland, W. (2015) Biodiveristy collision blackspots in Poland: Separation causality from stochasticity in road kills of butterflies. *Biological conservation* 187 pp 154-163.

Smee, M.R. (2011) *Population Ecology and genetics of the marsh fritillary butterfly.* PhD Thesis – University of Exeter.

Smith, P. & Morgan P. (2004) Radio Tracking of Lesser Horseshoe Bats from Agen Allwedd Cave (Craig y Cilau NNR), Spring 2003. Unpublished report to Countryside Council for Wales.

Smith, R.G. (2005) *Strategic Assessment of the Marsh Fritillary Butterfly and its Habitat in Rhondda Cynon Taf.* Report prepared for Rhondda Cynon Taff County Borough Council, Welsh Development Agency and Countryside Council for Wales.

Spalding, A. (2005) The butterfly handbook. General advice note on mitigating the impacts of roads on butterfly populations including a case study on mitigation for the Marsh Fritillary butterfly along the A30 Bodmin to Indian Queens road improvement scheme. English Nature, UK.

Thomas J.A., Bourn N.A.D., Clarke R.T., Stewart K.E., Simcox D.J., Pearman G.S., Curtis R. and Goodger B. (2001) The quality and isolation of habitat patches both determine where butterflies persist in fragmented landscapes. *Proc. Roy. Soc.,* London (B) 268: pp 1791–1796.

Thomas, C.D. (1994) Extinction, colonization and metapopulations – environmental tracking by rare species. *Conservation Biology* 8: pp 373-378.

Thomas, J.A., Snazell, R.G. & Ward, L.K. (2002) Are roads harmful or potentially beneficial to butterflies and other insects? In Sherwood, B., Cutler, D. & Burton, J.A. *Wildlife and Roads. The Ecological Impact*. Imperial College Press. London.

Trueman, I. C., Mitchell, D. & Besenyei, L. (2007) The Effects of Turf Translocation and Other Environmental Variables on the Vegetation of a Large Species-Rich Mesotrophic Grassland. *Ecological Engineering,* 31(2), pp. 79-91

Warren, M. S. (1994) The UK status and suspected metapopulation structure of a threatened European butterfly, the marsh fritillary Eurodryas aurina. *Biological Conservation* 67 pp.239-249.

Welsh Government (2008) Interim Advice Note 116/08 (W) - Nature conservation advice in relation to bats [http://gov.wales/docs/det/publications/100519ian11608w.pdf]

Welsh Government (2009) *Planning Policy Wales Technical Advice Note 5: Nature Conservation and Planning*.

Figures

[4] Please note that this Figures is confidential as it contains sensitive information regarding protected species. Should you require an electronic copy of this document then please make your request to Welsh Government.

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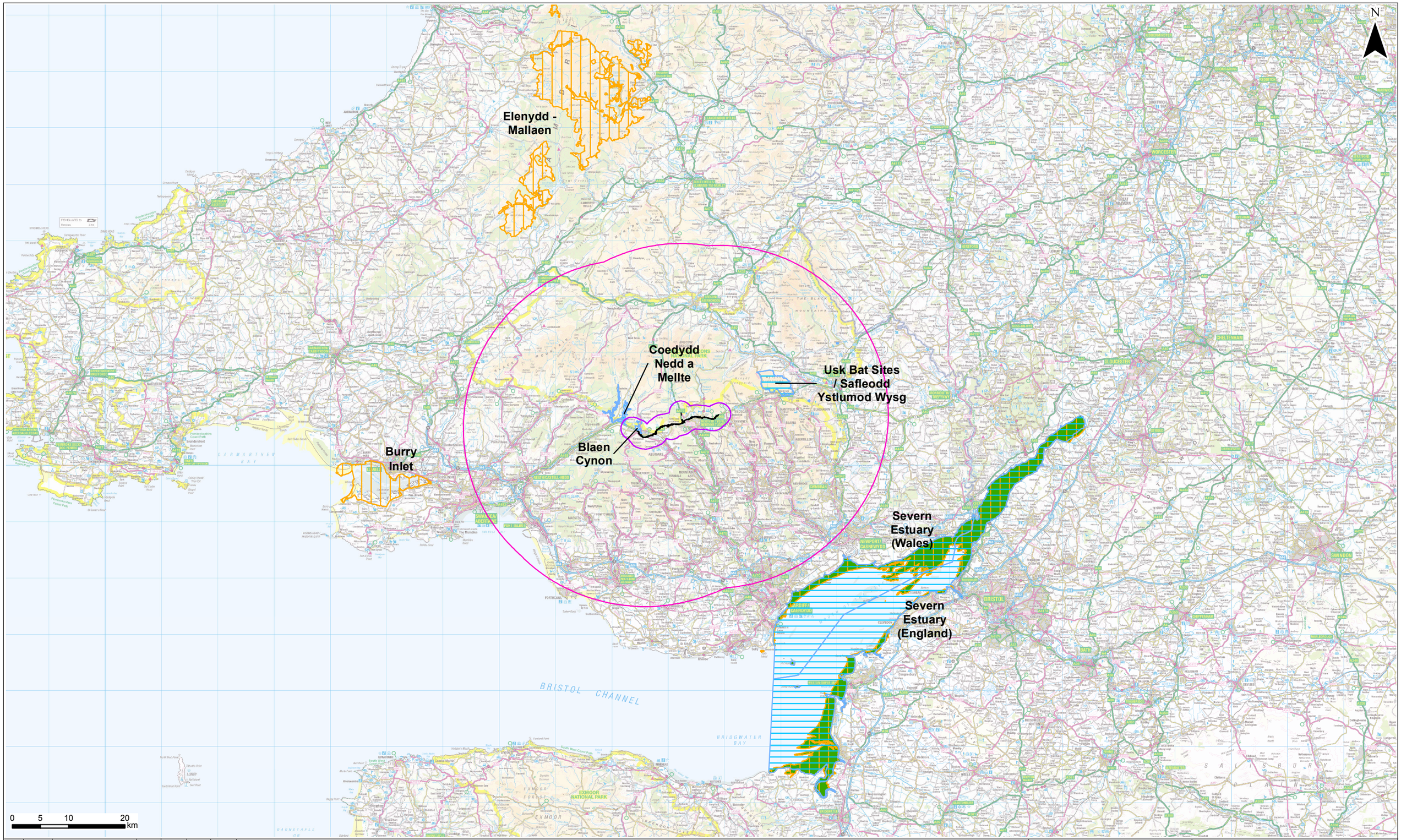

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
- 2km study area
- 30km study area
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Ramsar

Llywodraeth Cymru
Welsh Government

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Status	FINAL	
Project	A465 HEADS OF THE VALLEYS SECTIONS 5 AND 6 DOWLAIS TOP TO HIRWAUN	
Title	European sites and proposed scheme	
Scale	1:600,000 @A3	DO NOT SCALE
Drawing No.	Figure 1	Rev 0

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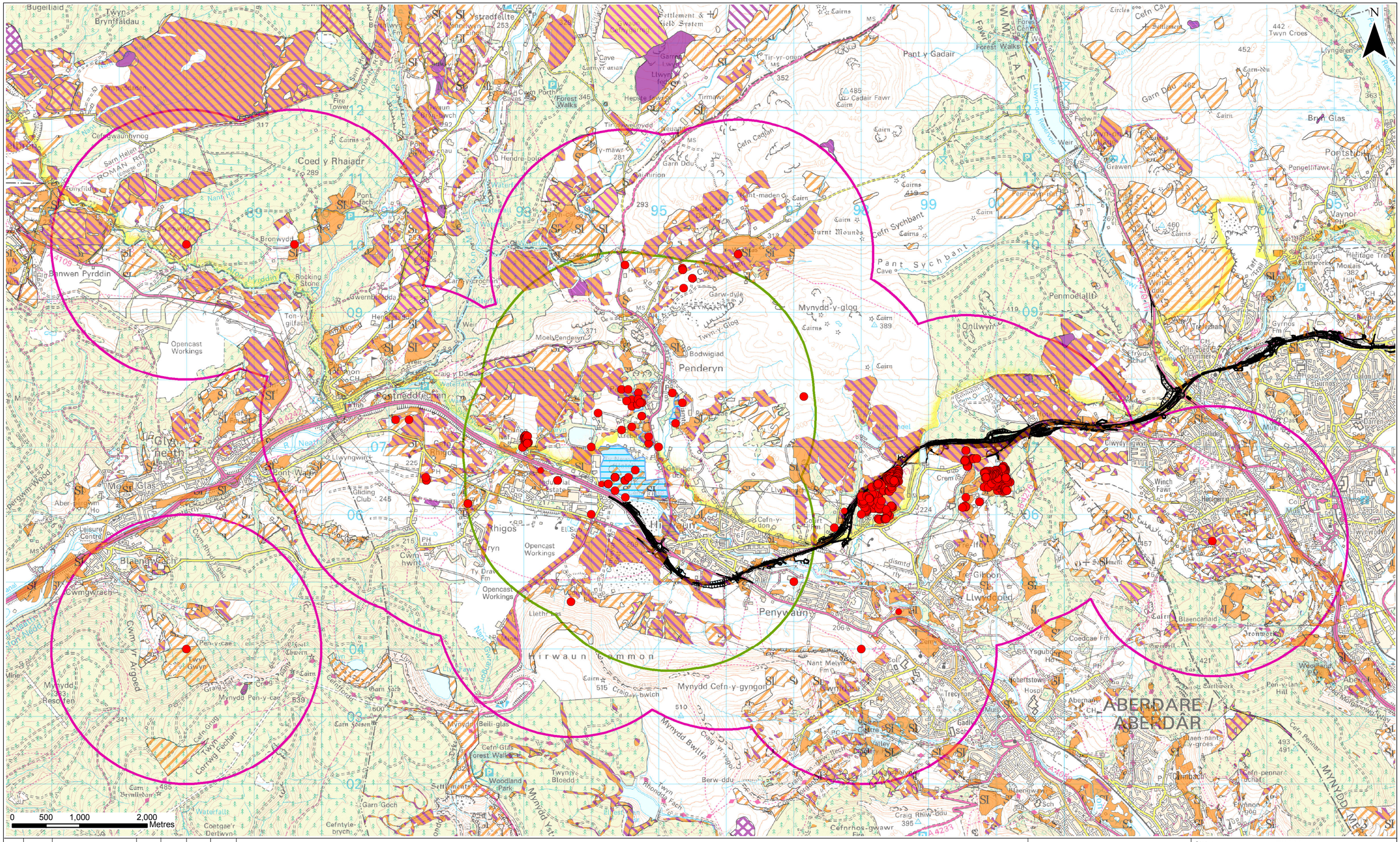

Legend

- Scheme design
- Blaen Cynon Special Area of Conservation (SAC)
- 2km SAC core metapopulation area
- 2km Upper Cynon Valley Functional Landscape Area
- Marsh fritillary record
- Unimproved acid grassland
- Semi-improved acid grassland
- Semi-improved neutral grassland
- Marshy grassland
- Wet dwarf shrub heath
- Wet heath/acid grassland
- Blanket sphagnum bog
- Wet modified bog
- Dry modified bog
- Valley fen
- Basin mire

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

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Status	FINAL
Project	A465 HEADS OF THE VALLEYS SECTIONS 5 AND 6 DOWLAIS TOP TO HIRWAUN
Title	Marsh fritillary - core landscape and functional areas
Scale	1:50,000 @A3 — DO NOT SCALE
Drawing No.	Figure 2 — Rev 0

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N

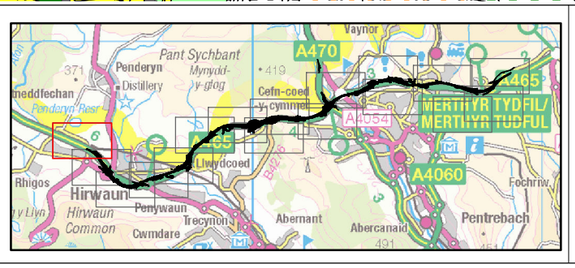
0 125 250 500 Metres

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
- 500m survey area
- No access at time of survey

Please see separate figure 3A for full legend



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Title	Phase 1 habitat survey results	
Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 1 of 17	Rev 0

N

0 125 250 500 Metres

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0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
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- No access at time of survey

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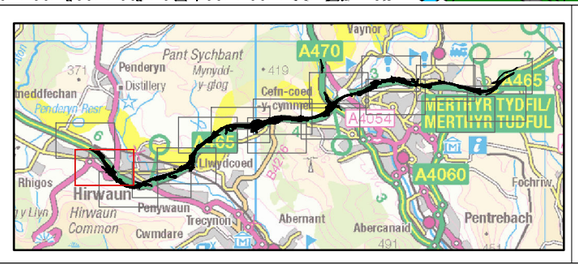

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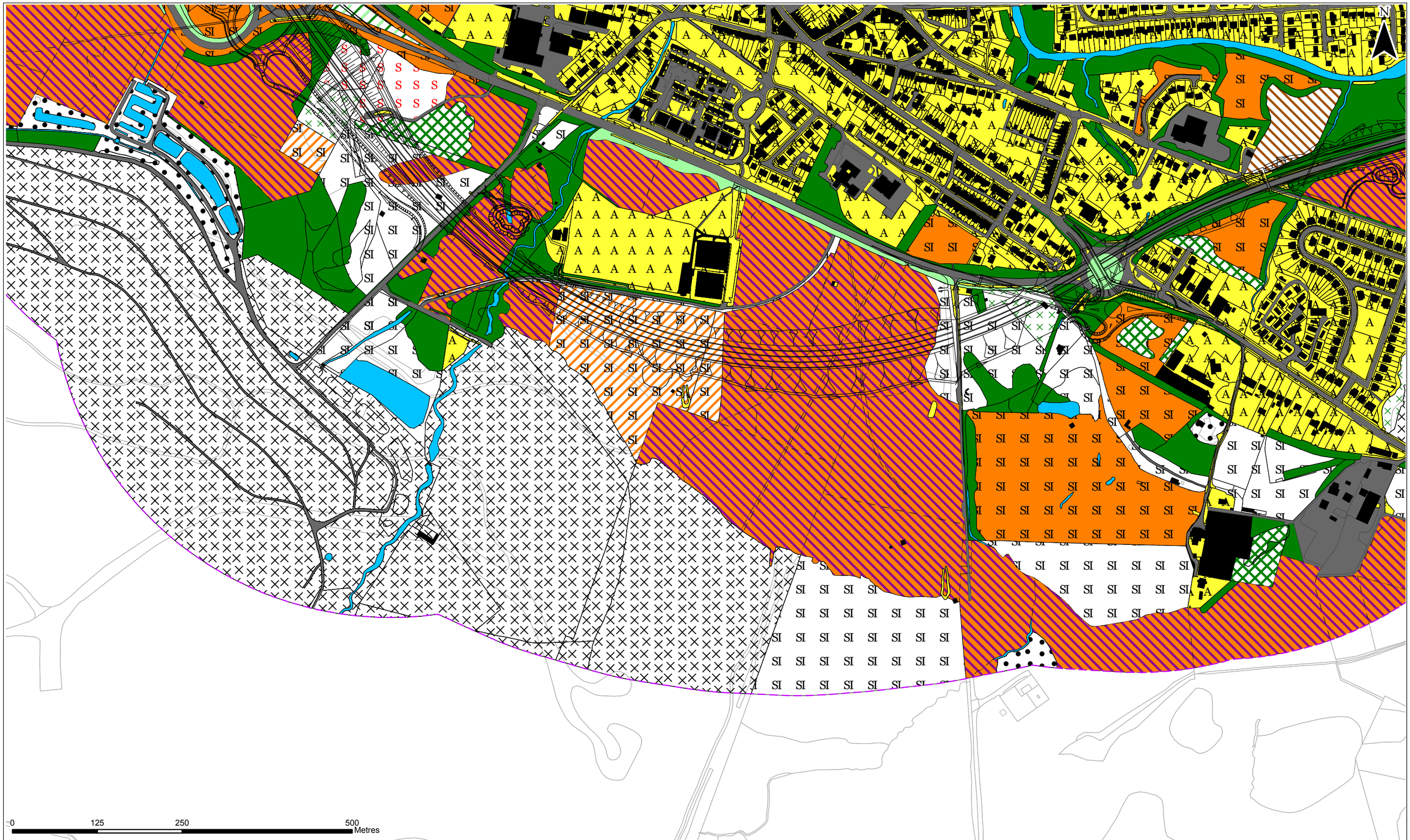
Title	Phase 1 habitat survey results	
Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 2 of 17	Rev 0



0	JULY17	FINAL	FL	LG	LG	WB
Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd

Legend

- Scheme design
- 500m survey area
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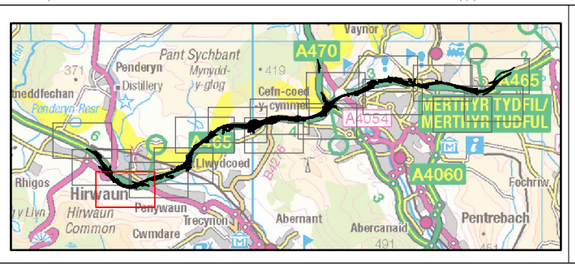

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Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 3 of 17	Rev 0

0 125 250 500 Metres

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
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Legend

- Scheme design
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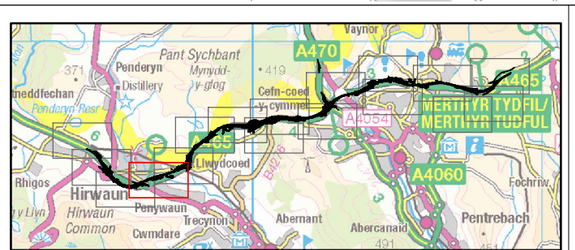

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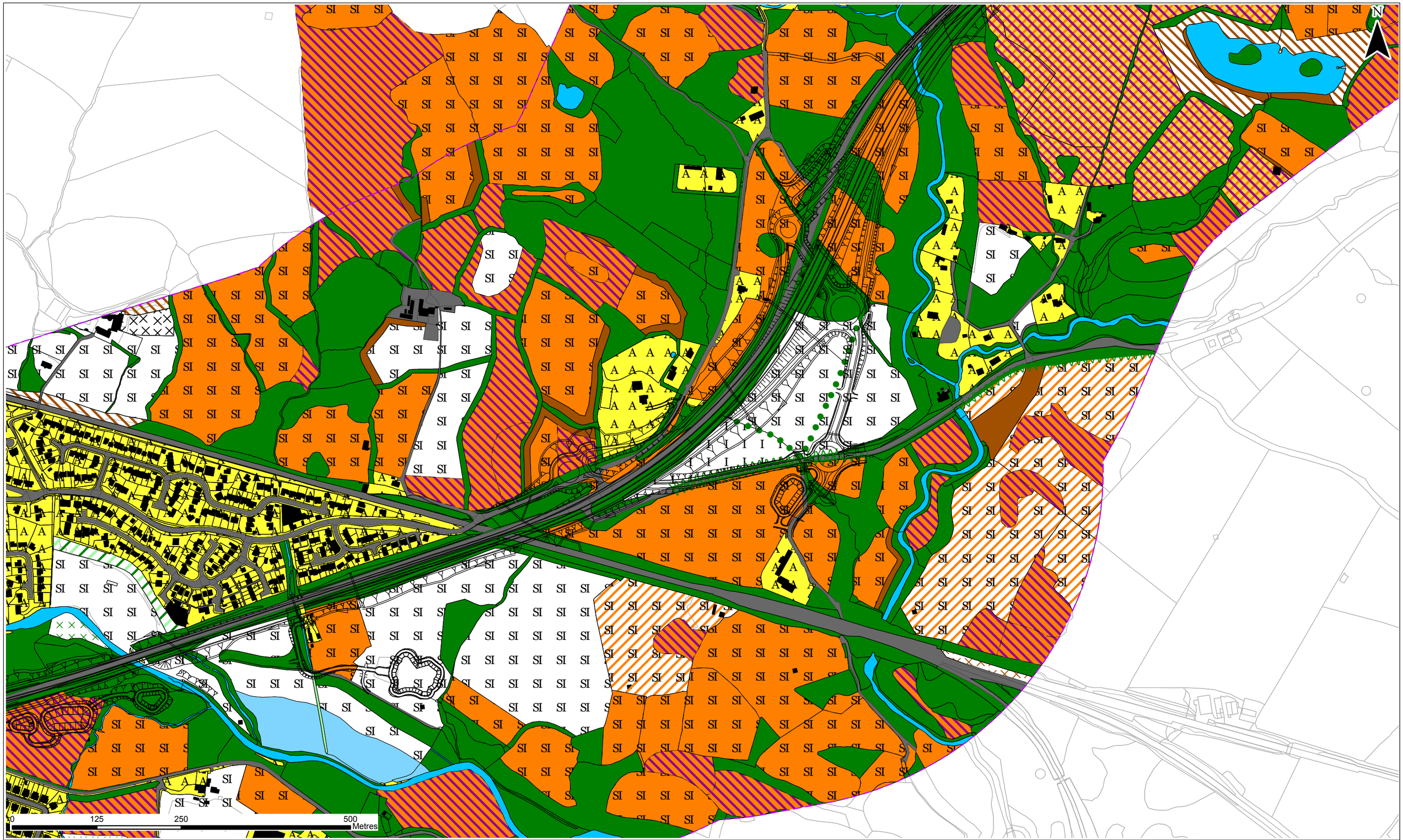
Drawing No.	Figure 3 Page 4 of 17	Rev 0



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Legend

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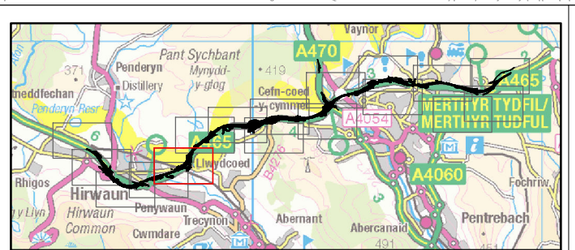

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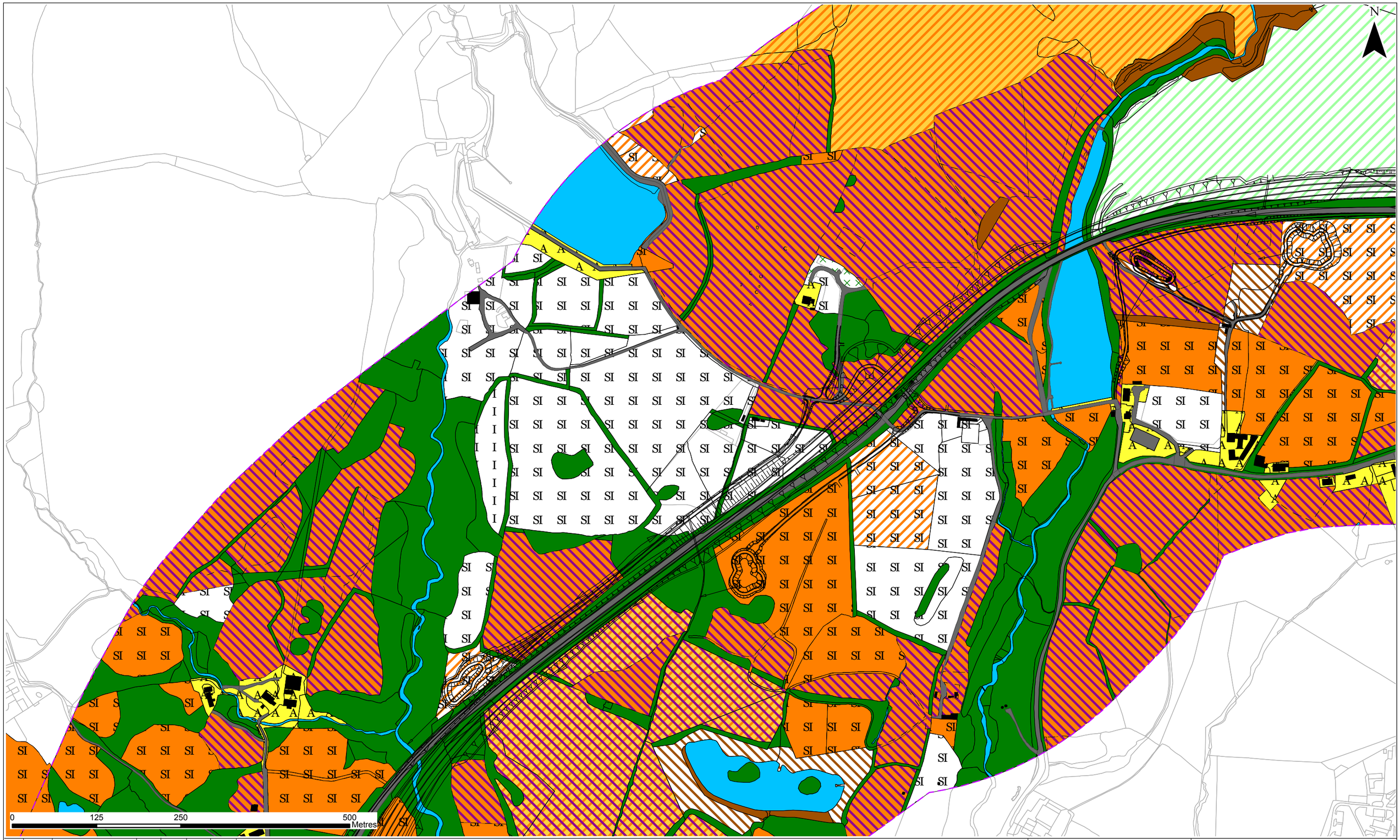
Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 5 of 17	Rev 0



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Legend

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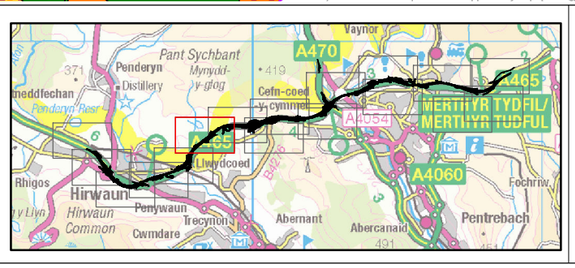

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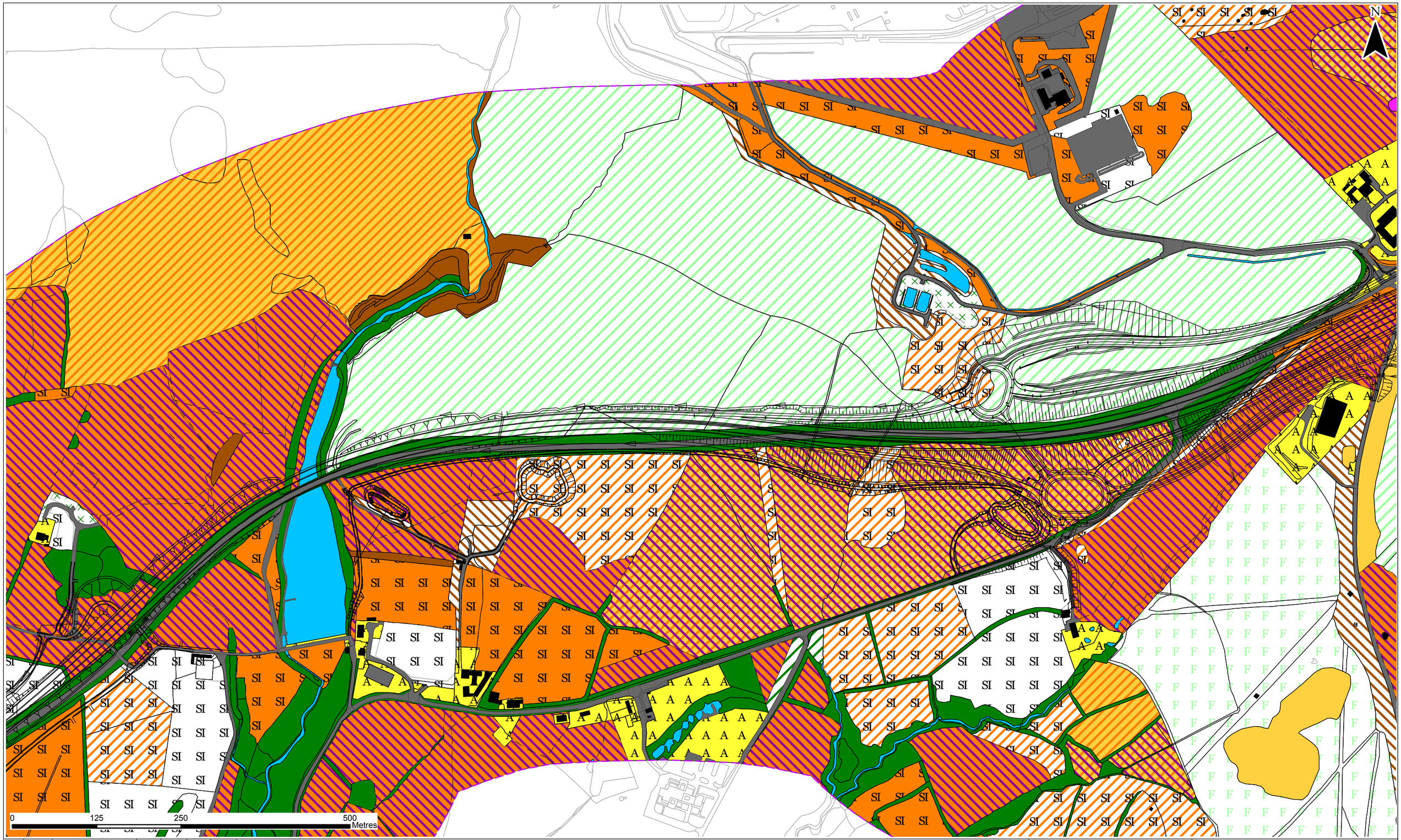
Drawing No.	Figure 3 Page 6 of 17	Rev 0



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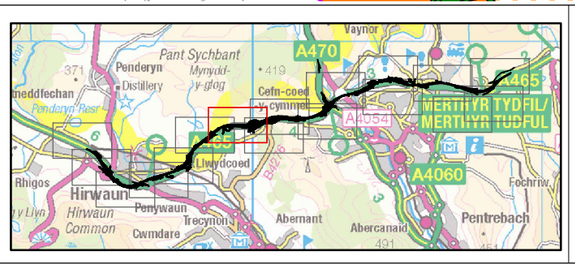

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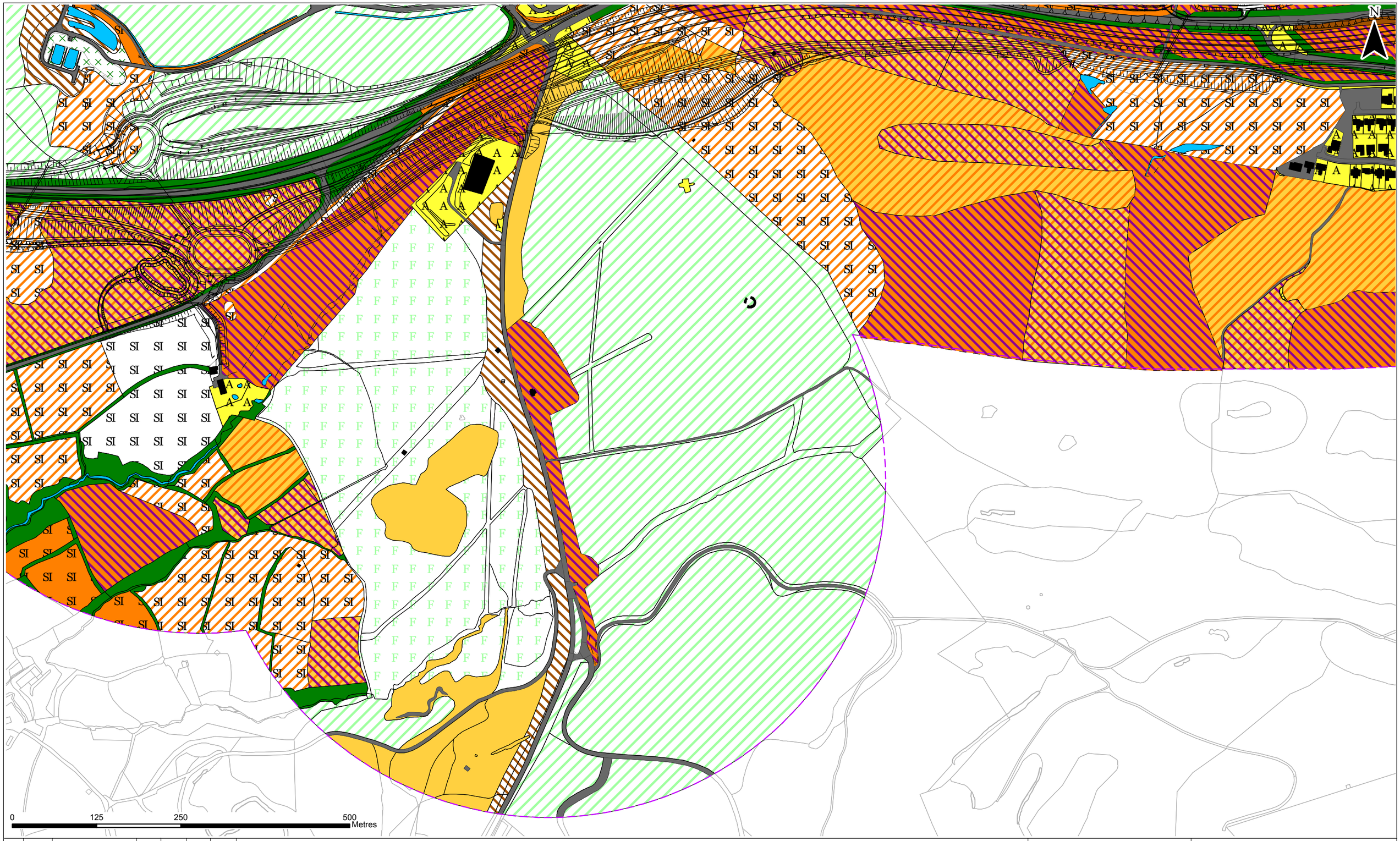
Drawing No.	Figure 3 Page 7 of 17	Rev 0



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Legend

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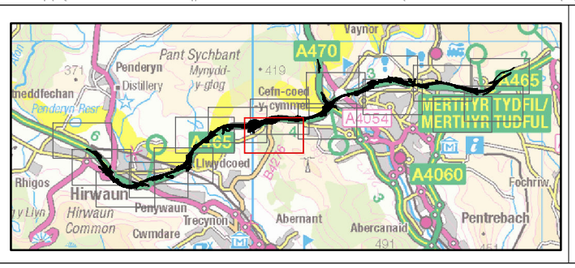

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Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 8 of 17	Rev 0

N

0 125 250 500 Metres

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0	JULY17	FINAL	FL	LG	LG	WB

Legend

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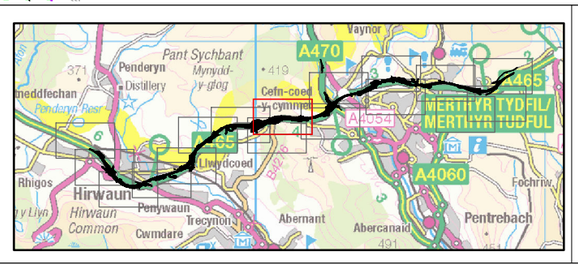

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Drawing No.	Figure 3 Page 9 of 17	Rev 0

0	JULY17	FINAL	FL	LG	LG	WB
Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd

Legend

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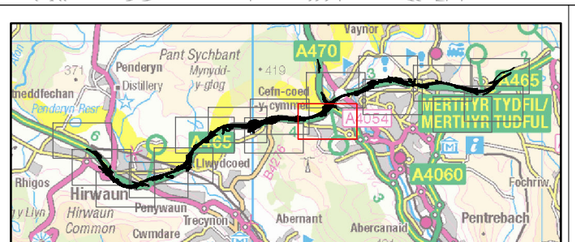

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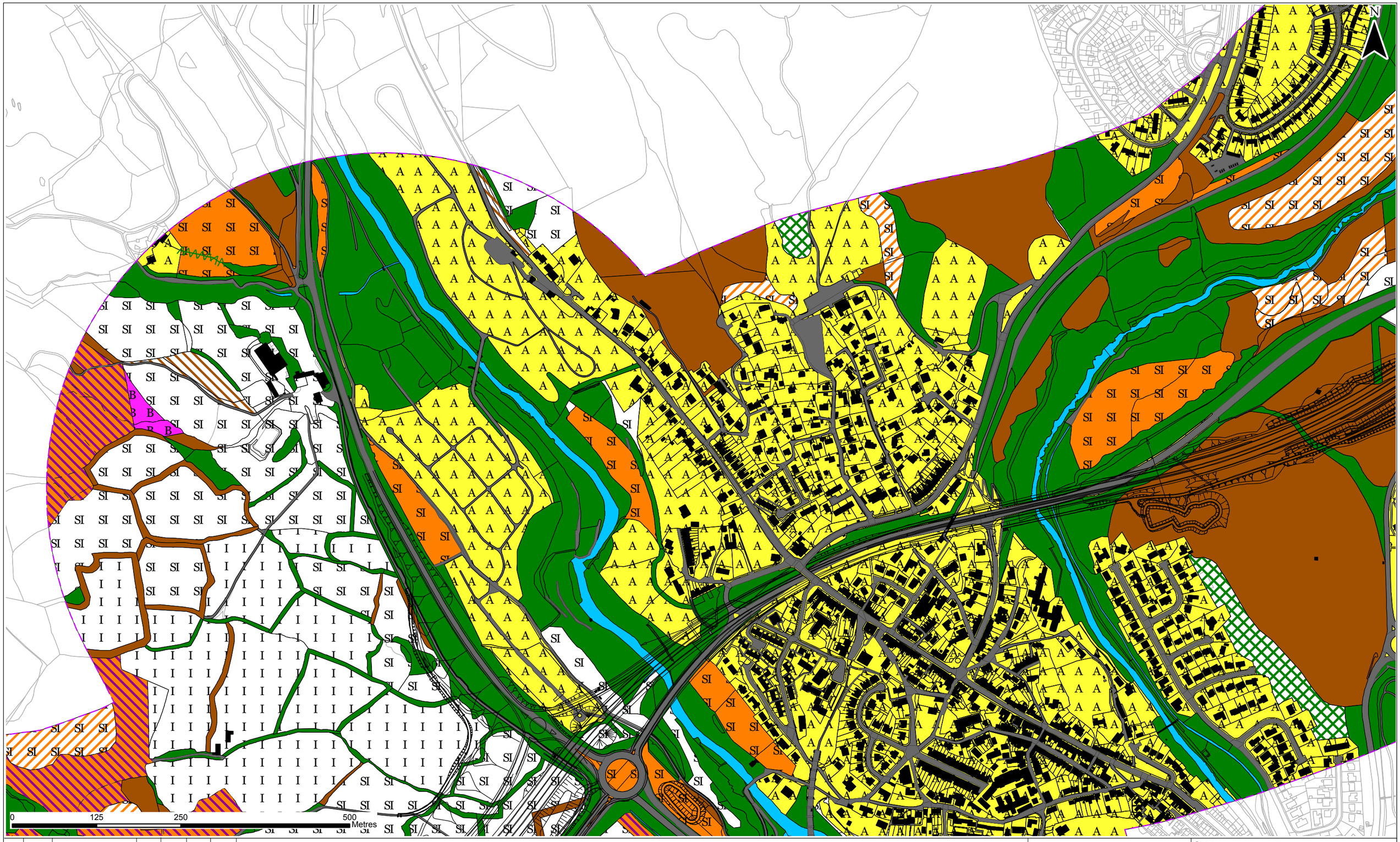
Drawing No.	Figure 3 Page 10 of 17	Rev 0



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Legend

- Scheme design
- 500m survey area
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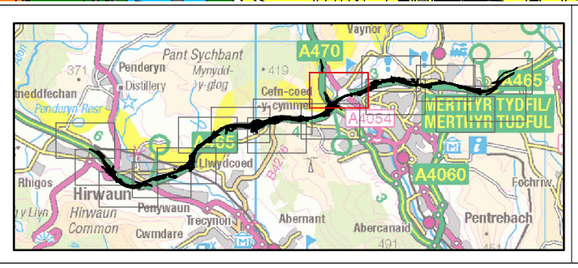

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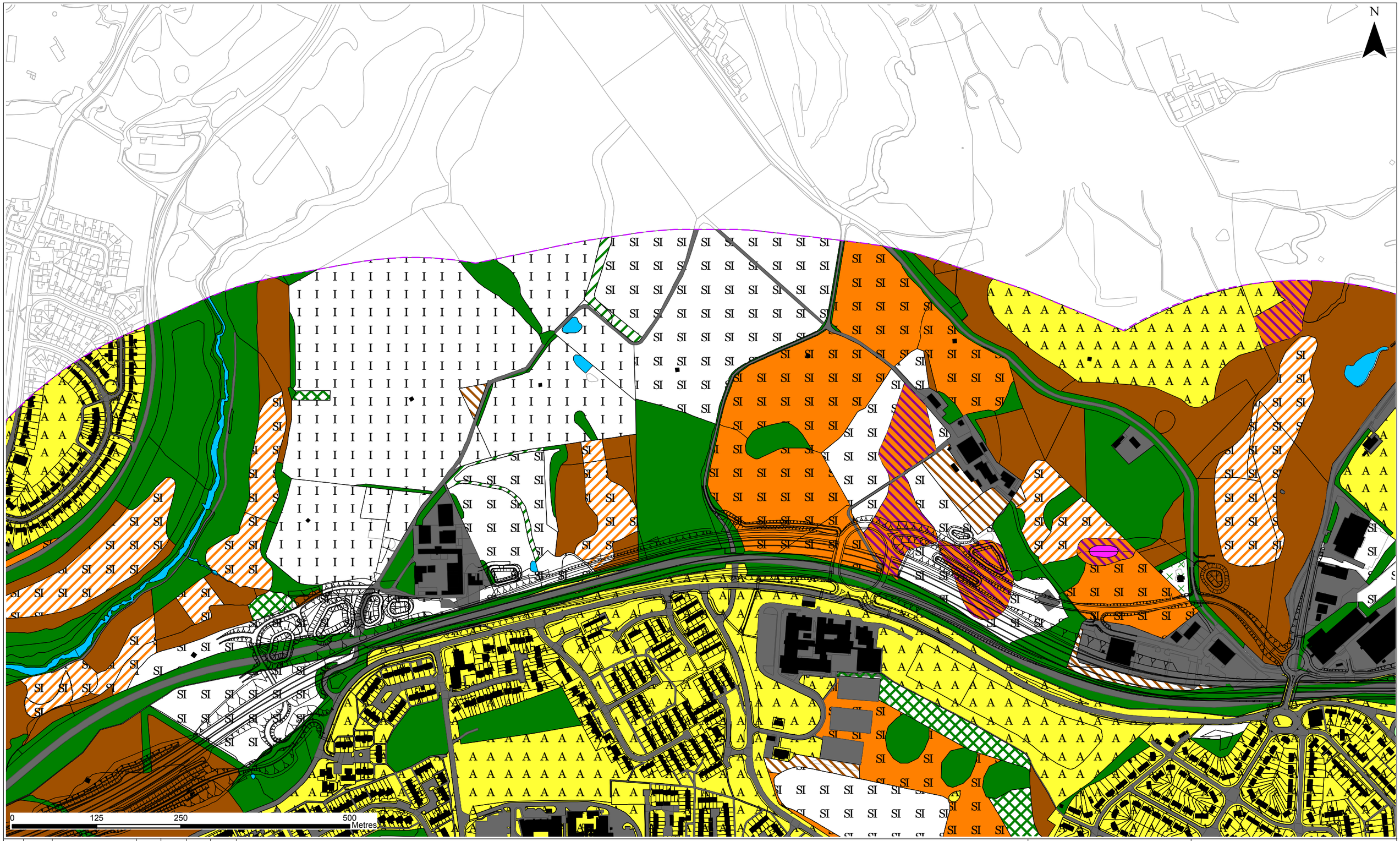
Drawing No.	Figure 3 Page 11 of 17	Rev 0



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Legend

- Scheme design
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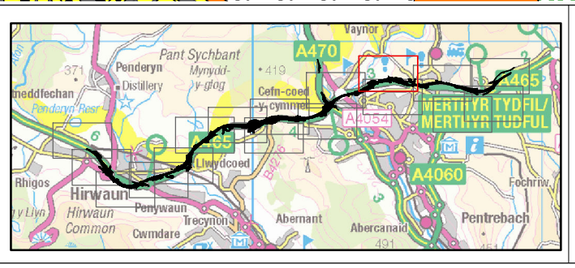

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Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 12 of 17	Rev 0

N

0 125 250 500 Metres

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
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Legend

- Scheme design
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- No access at time of survey

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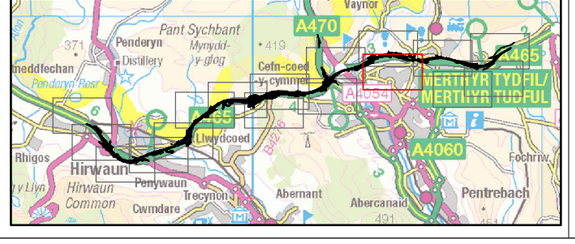

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Title	Phase 1 habitat survey results
Scale	1:5,000 @A3 — DO NOT SCALE
Drawing No.	Figure 3 Page 13 of 17 — Rev 0

N

0 125 250 500 Metres

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Legend

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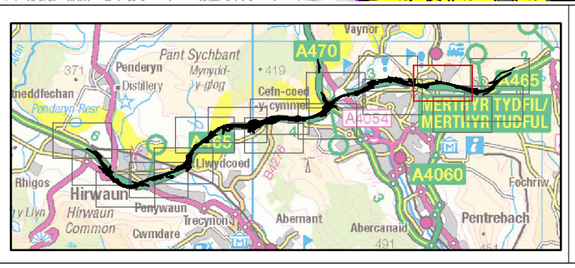

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Drawing No.	Figure 3 Page 14 of 17	Rev 0

N

0 125 250 500 Metres

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Legend

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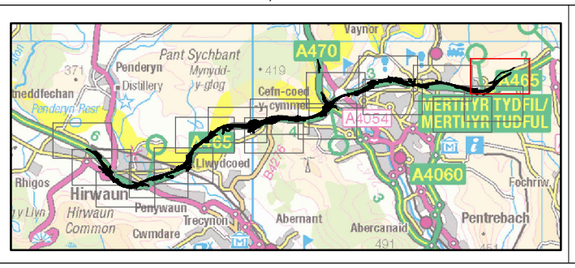

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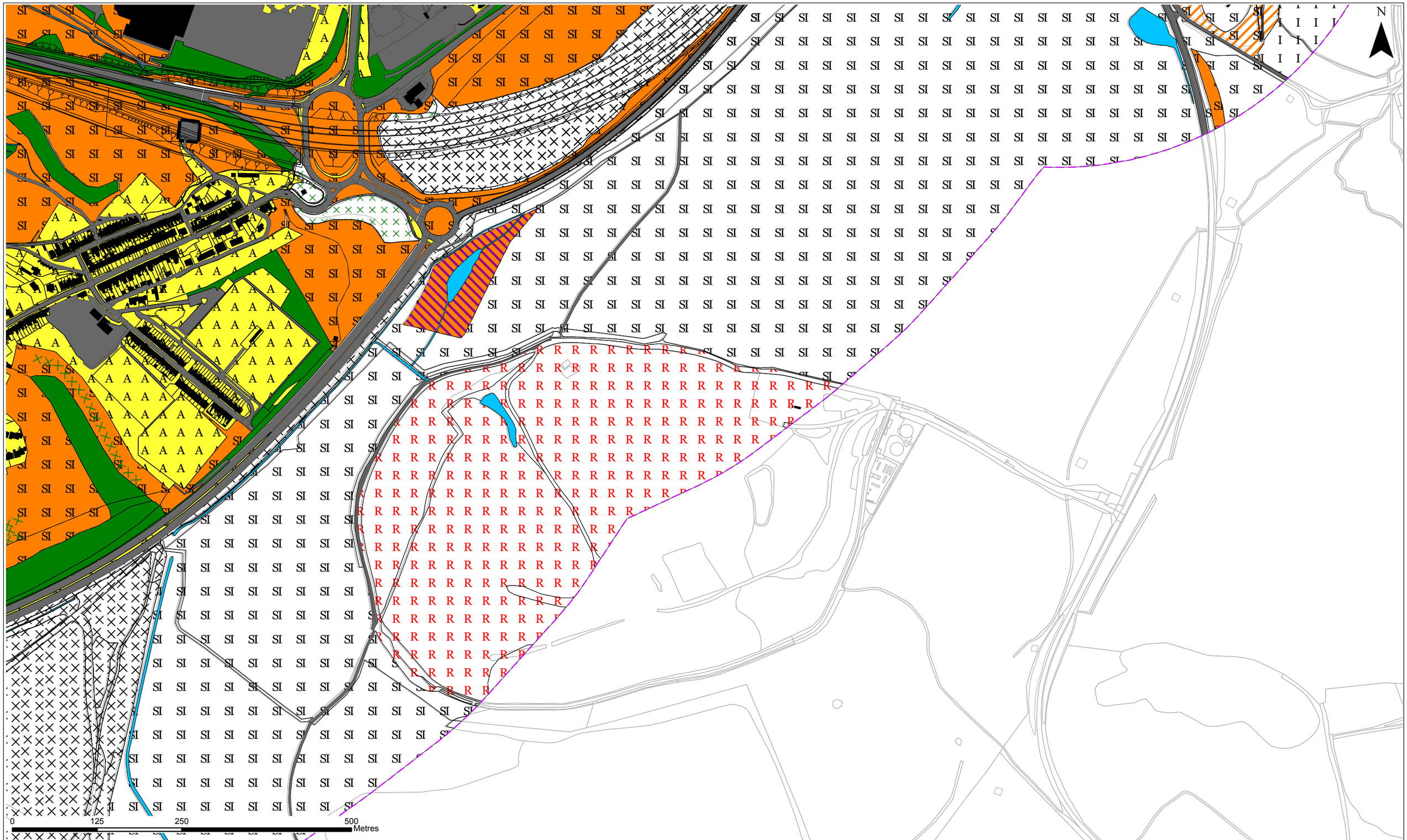
Drawing No.	Figure 3 Page 15 of 17	Rev 0



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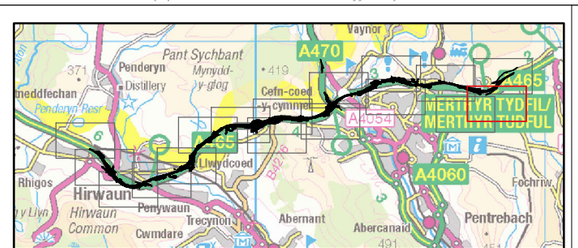

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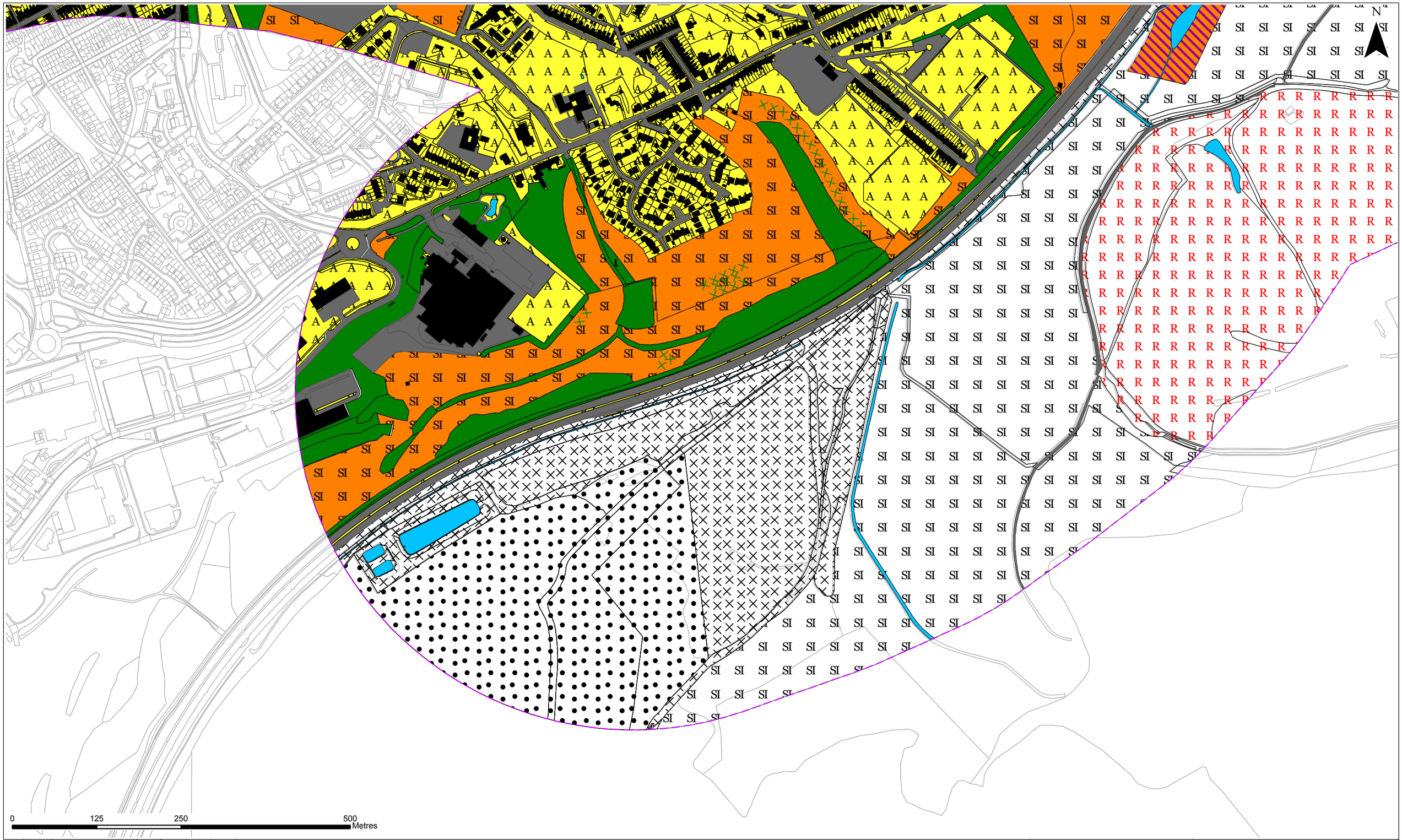
Drawing No.	Figure 3 Page 16 of 17	Rev 0



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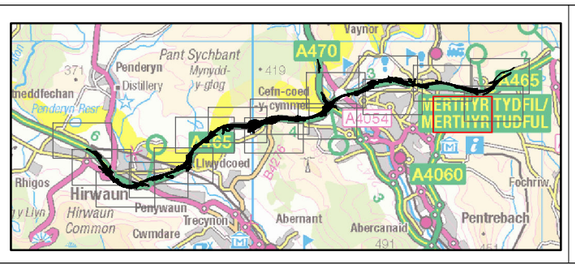

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Scale	1:5,000 @A3	DO NOT SCALE
Drawing No.	Figure 3 Page 17 of 17	Rev 0

Legend

- Target notes
- A2.2 Scrub - scattered
- A3.1 Scattered trees - broadleaved
- J2.1.1 Intact hedge - native species-rich
- A1.1.1 Broadleaved woodland - semi-natural
- A1.1.2 Broadleaved woodland - plantation
- A1.2.1 Coniferous woodland - semi-natural
- A1.2.2 Coniferous woodland - plantation
- A1.3.2 Mixed woodland - plantation
- A2.1 Scrub - dense/continuous
- A2.2 Scrub - scattered
- A4.2 Coniferous woodland - recently felled
- B1.2 Acid grassland - semi-improved*
- B2.2 Neutral grassland - semi-improved*
- B4 Improved grassland
- B5 Marsh/marshy grassland*
- B6 Poor semi-improved grassland
- C1.1 Bracken - continuous
- C1.2 Bracken - continuous
- C3.1 Other tall herb and fern - ruderal
- D1.1 Dry dwarf shrub heath - acid
- D5 Dry heath/acid grassland
- D6 Wet heath/acidic grass mosaic*
- E2.1 Acid/neutral flush
- E2.2 Basic flush
- F1 Swamp
- G1 Standing water
- G2 Running water
- I2.1 Quarry
- I2.2 Spoil
- I2.4Refuse tip
- J1.2 Cultivated/disturbed land - amenity grassland
- J1.3 Cultivated/disturbed land - ephemeral
- J3.6 Buildings
- J3.7 Track
- J4 Bare ground
- Hardstanding

* = potentially suitable habitat for marsh fritillary

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	SS	WB

Legend to be used in conjunction with figure 3

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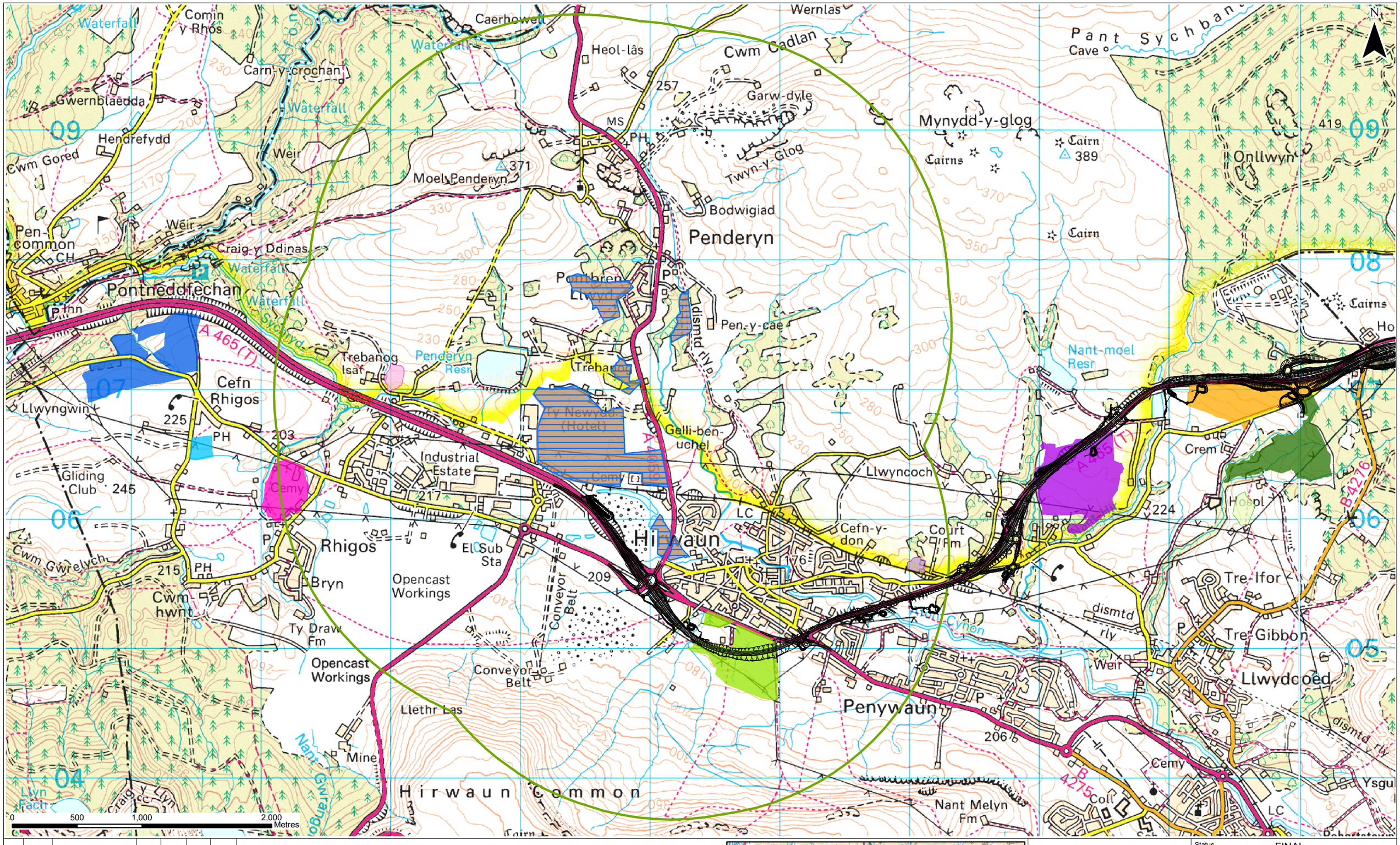
Project	A465 HEADS OF THE VALLEYS SECTIONS 5 AND 6 DOWLAIS TOP TO HIRWAUN
Title	Phase 1 habitat survey results legend
Scale	@A3 DO NOT SCALE
Drawing No.	Figure 3A Rev 0



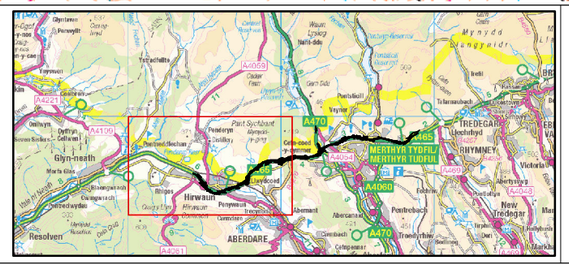
Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
- Blaen Cynon Special Area of Conservation (SAC)
- 2km SAC core metapopulation area

Monitoring Programme Sites

- Site 1
- Site 2
- Site 2a
- Site 3
- Site 4
- Site 4a
- Site 5
- Site 6
- Site 6a
- Site 7
- Site 7a



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Status	FINAL	
Project	A465 HEADS OF THE VALLEYS SECTIONS 5 AND 6 DOWLAIS TOP TO HIRWAUN	
Title	Jacobs' monitoring sites for marsh fritillary	
Scale	1:26,000 @A3	DO NOT SCALE
Drawing No.	Figure 4	Rev 0

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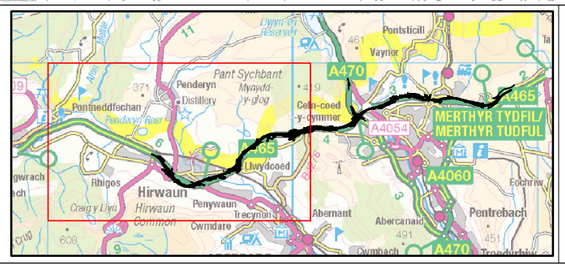
0 0.25 0.5 1 km

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
- Blaen Cynon Special Area of Conservation (SAC)
- 2km SAC core metapopulation area
- Good quality habitat
- Suitable (undergrazed) habitat
- Suitable (overgrazed) habitat
- Suitable (sparse) habitat
- Potential (rank) habitat
- Not suitable



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Project	A465 HEADS OF THE VALLEYS SECTIONS 5 AND 6 DOWLAIS TOP TO HIRWAUN
Title	Marsh fritillary habitat suitability assessment
Scale	1:26,000 @A3 — DO NOT SCALE
Drawing No.	Figure 5 — Rev 0

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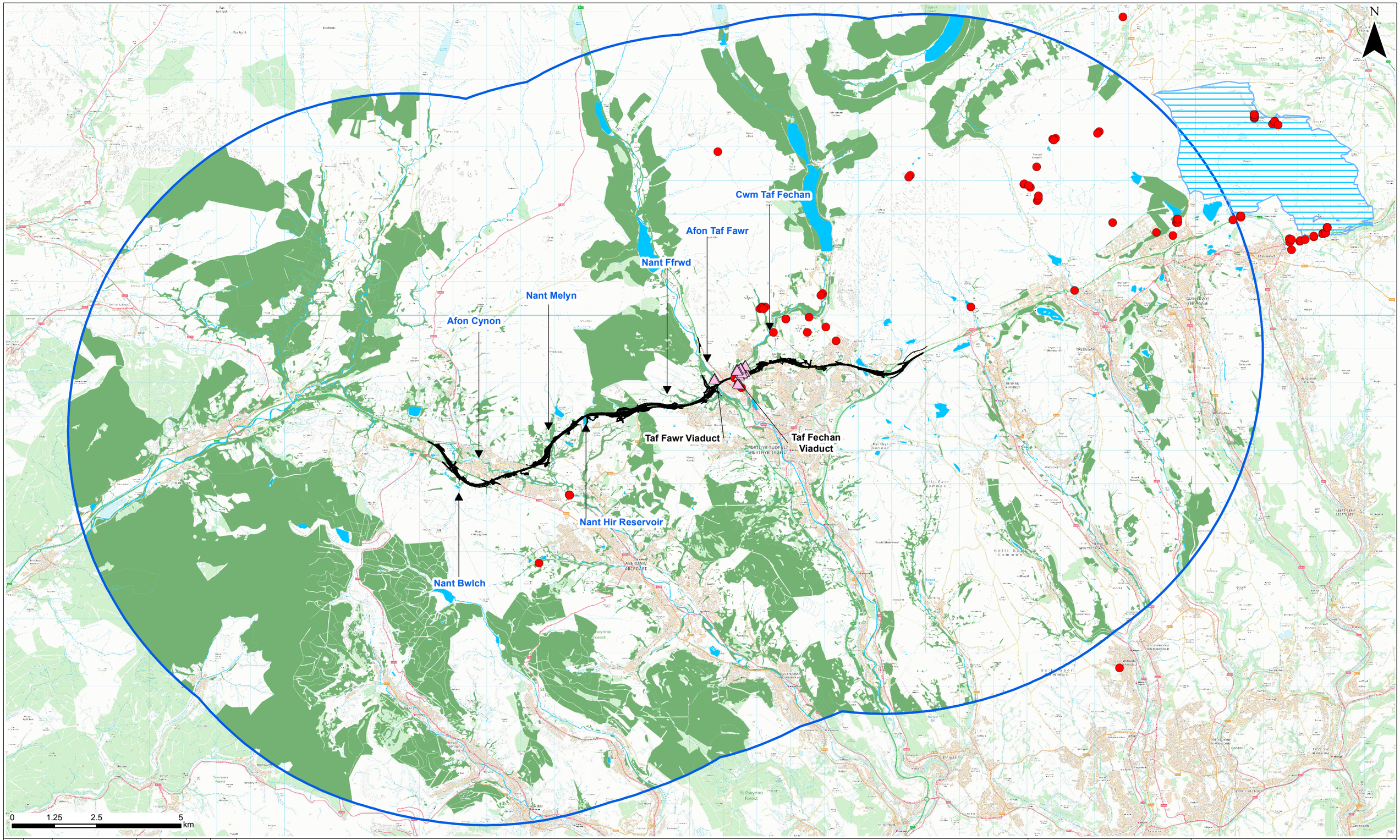

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
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Legend

- Scheme design
- 10km study area
- Usk Bat Sites Special Area of Conservation
- Woodland
- Waterbodies and watercourses
- Known cave locations
- Local records centre data - Lesser horseshoe bat record

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Title	Lesser horseshoe bat desk study results		
Scale	1:100,000 @A3	DO NOT SCALE	
Drawing No.	Figure 6	Rev 0	

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Figure 7 Lesser Horseshoe (LHS) Bat Field Survey Results

CONFIDENTIAL

Please note that this figure is confidential as it contains sensitive information regarding protected species. Should you require an electronic copy of this document then please make your request to Welsh Government.

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N

0 250 500 1,000 m

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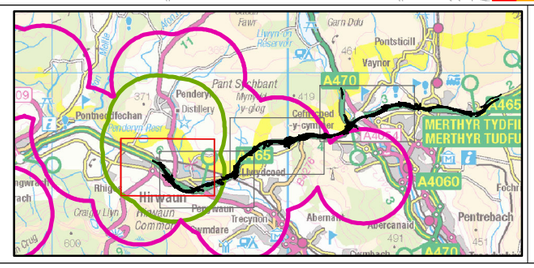
Legend

- Scheme design
- Blaen Cynon Special Area of Conservation
- 2km Upper Cynon Valley Functional Landscape
- 2km SAC core metapopulation area

Marsh fritillary habitat

- Good condition
- Suitable
- Marsh fritillary habitat loss
- Assumed habitat loss due to fragmentation

Suitable habitat in this figure is classified as the combined coverage of 'suitable undergrazed', 'suitable overgrazed', 'suitable sparse', and 'potential rank' sub-categories



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Title	Marsh fritillary habitat loss	
Scale	1:10,000 @A3	DO NOT SCALE
Drawing No.	Figure 8 Sheet 1 of 4	Rev 0

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Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
- Blaen Cynon Special Area of Conservation
- 2km Upper Cynon Valley Functional Landscape
- 2km SAC core metapopulation area

Marsh fritillary habitat

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- Suitable
- Marsh fritillary habitat loss
- Assumed habitat loss due to fragmentation

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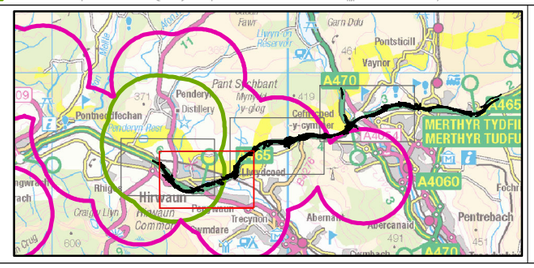

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Drawing No.	Figure 8 Sheet 2 of 4	Rev 0

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0 250 500 1,000 m

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

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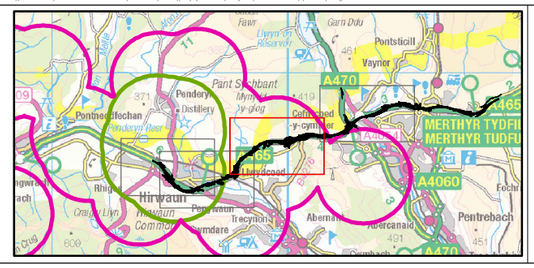

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Drawing No.	Figure 8 Sheet 3 of 4	Rev 0

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Legend

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- 2km SAC core metapopulation area

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- Marsh fritillary habitat loss
- Assumed habitat loss due to fragmentation

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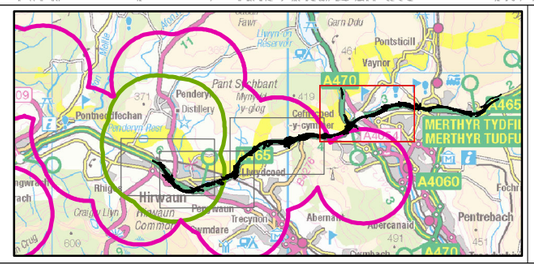

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Scale	1:10,000 @A3	DO NOT SCALE
Drawing No.	Figure 8 Sheet 4 of 4	Rev 0

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Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

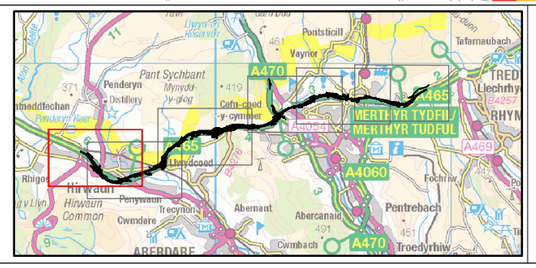
- Scheme design
- Blaen Cynon Special Area of Conservation (SAC)
- Marsh fritillary record

Marsh fritillary habitat

- Good condition
- Suitable
- Llywdcoed Slopes - mitigation site

Proposed landscape planting

- Neutral grassland
- Acid grassland
- Marsh and wet grassland
- Seeding with Devil's-bit scabious



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0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
- Blaen Cynon Special Area of Conservation (SAC)
- Marsh fritillary record

Marsh fritillary habitat

- Good condition
- Suitable
- Llywdcoed Slopes - mitigation site

Proposed landscape planting

- Neutral grassland
- Acid grassland
- Marsh and wet grassland
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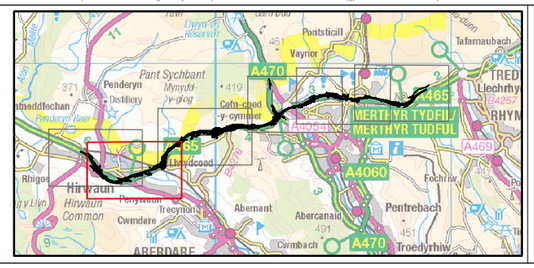

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Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
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Legend

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- Suitable
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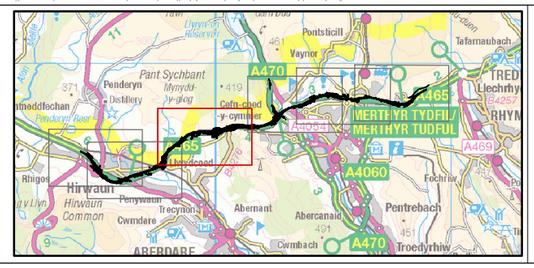

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Legend

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Marsh fritillary habitat

- Good condition
- Suitable
- Llywdcoed Slopes - mitigation site

Proposed landscape planting

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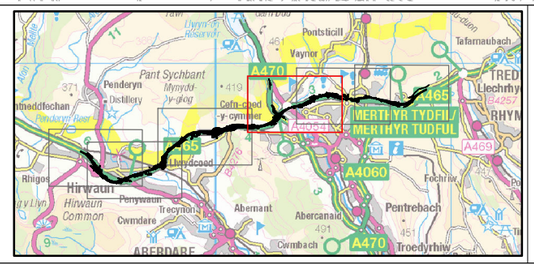
- Acid grassland
- Marsh and wet grassland
- Seeding with Devil's-bit scabious



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Legend

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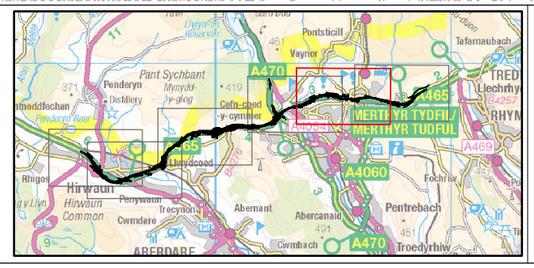

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Drawing No.	Figure 9 Sheet 5 of 6	Rev 0

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0 250 500 1,000 m

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	WB

Legend

- Scheme design
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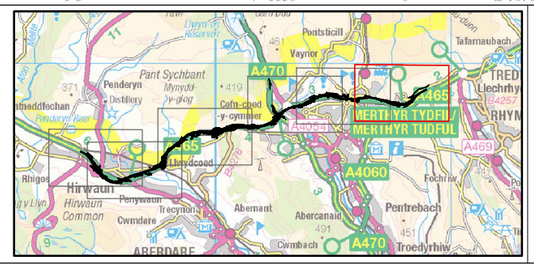

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Title	Marsh fritillary mitigation	
Scale	1:10,000 @A3	DO NOT SCALE
Drawing No.	Figure 9 Sheet 6 of 6	Rev 0

N

Afon Cynon

Afon Cynon - western abutment

Nant Bwlch

0 250 500 1,000 m

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	GP

Legend

- Scheme design
- Watercourses and waterbodies
- Existing woodland

Local records centre data

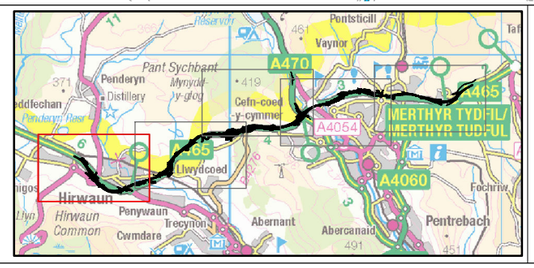
- Lesser Horseshoe Bat
- Lesser Horseshoe Bat roost

Jacobs survey records

- LHS found present in cave
- Activity detector - LHS recorded
- LHS recorded along transect
- LHS maternity roost
- Bat activity recorded

Proposed landscape planting

- Woodland
- Woodland edge
- Scrub
- Retained existing woodland
- Artificial bat pipe roost built into structure



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Title	Lesser horseshoe (LHS) bat mitigation	
Scale	1:10,000 @A3	DO NOT SCALE
Drawing No.	Figure 10 Sheet 1 of 5	Rev 0

Nant Hir - eastern and western abutments (of new structure)

Nant Melyn

Nant Hir Reservoir

Nant Melyn - eastern abutment

Afon Cynon - western abutment

N

0 250 500 1,000 m

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	GP

Legend

- Scheme design
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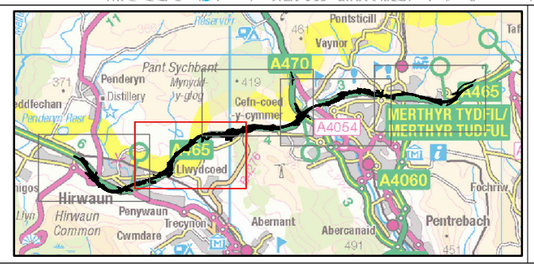

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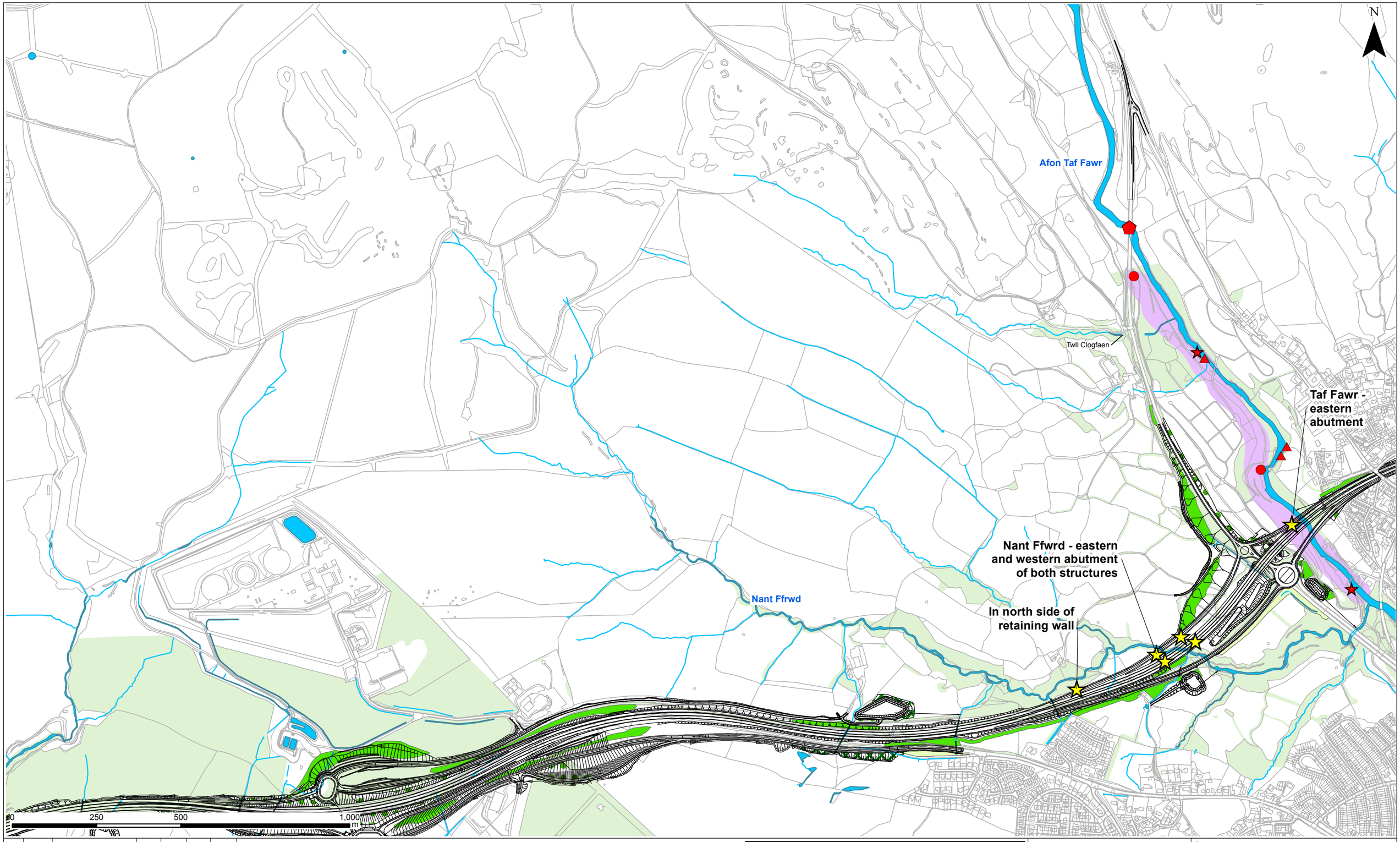
Drawing No.	Figure 10 Sheet 2 of 5	Rev 0



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Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd

Legend

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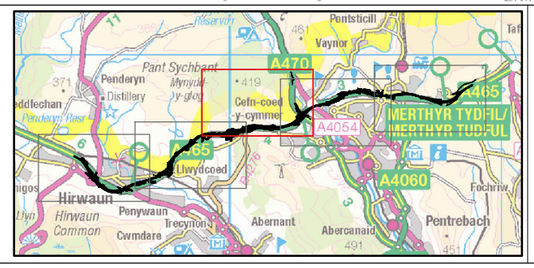

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Scale	1:10,000 @A3	DO NOT SCALE
Drawing No.	Figure 10 Sheet 3 of 5	Rev 0

Afon Taf Fawr

Cwm Taf Fechan

N

Twll Clogfaen

Taf Fechan - eastern and western abutments

Taf Fawr - eastern abutment

Leat

Nant Ffwrd - eastern and western abutment of both structures

In north side of retaining wall

0 250 500 1,000 m

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	GP

Legend

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- Watercourses and waterbodies
- Existing woodland

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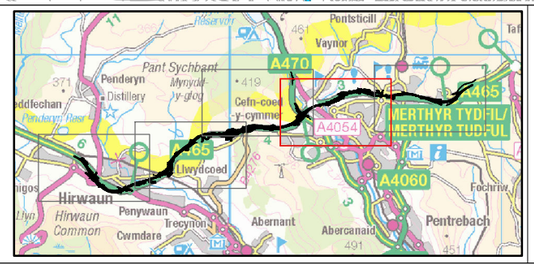
- Woodland edge
- Scrub
- Retained existing woodland
- Artificial bat pipe roost built into structure



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Status	FINAL	
Project	A465 HEADS OF THE VALLEYS SECTIONS 5 AND 6 DOWLAIS TOP TO HIRWAUN	
Title	Lesser horseshoe (LHS) bat mitigation	
Scale	1:10,000 @A3	DO NOT SCALE
Drawing No.	Figure 10 Sheet 4 of 5	Rev 0

N

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Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprv'd
0	JULY17	FINAL	FL	LG	LG	GP

Legend

- Scheme design
- Watercourses and waterbodies
- Existing woodland

Local records centre data

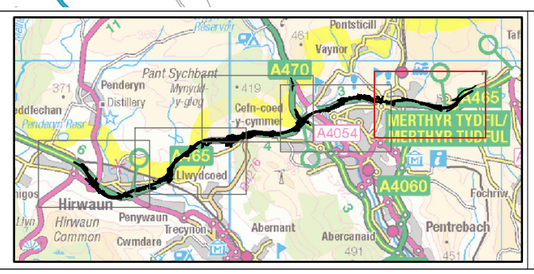
- Lesser Horseshoe Bat
- Lesser Horseshoe Bat roost

Jacobs survey records

- LHS found present in cave
- Activity detector - LHS recorded
- LHS recorded along transect
- LHS maternity roost
- Bat activity recorded

Proposed landscape planting

- Woodland
- Woodland edge
- Scrub
- Retained existing woodland
- Artificial bat pipe roost built into structure



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Appendix A. Screening Matrices (Jacobs, 2016)

The following matrices are extracts from the Stage 1 Screening Report (Jacobs, 2016). These were reviewed in 2017, as detailed in Section 4 of the main report, in light of design change and newly available scientific literature.

A.1 Blaen Cynon SAC

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Blaen Cynon SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Description of Project:		
• Size and scale (road type and probable traffic volume)	Approximately 17.7 km of widening of three lane highway to dual carriageway. Minor areas of off-line development.	
• Land-take	The proposed scheme does not involve land-take within the SAC. The proposed scheme would result in land-take of habitats used by and suitable for marsh fritillary. Loss of habitats could also limit dispersal through the wider functional landscape for the species, a feature is it dependent on by nature of it metapopulation dynamics.	
• Distance from the European site or key features of the site (from edge of the project assessment corridor)	Blaen Cynon SAC lies approximately 55 m to the north of the proposed scheme at Hirwaun.	
• Resource requirements (from the European site or from areas in proximity to the site, where of relevance to consideration of impacts)	The proposed scheme would not require any resources from the SAC or in proximity to the SAC.	
• Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution)	<u>Air</u> Implementation of published guidance (e.g. CIRIA, BRE etc.) on control of dust during construction should limit any potential emissions. No plausible link between vehicle emissions during the operational phase of the proposed scheme on the functionality of the habitat for marsh fritillary within and outwith the SAC has been identified. <u>Water</u> No direct discharge of water to the SAC is proposed. Implementation of published guidance (e.g. CIRIA, BRE etc.) on control of pollutants entering watercourses should limit any uncontrolled discharges.	
• Excavation requirements (e.g. impacts of local hydrogeology)	No excavation would be required within or adjacent to the SAC. The closest excavation work would be at Hirwaun which would be predominantly within the existing highways boundary. Excavation required for off-line sections of the proposed scheme could affect subsurface water flows to habitats outside of the SAC that support marsh fritillary, but this is unlikely to affect the functionality of the habitats to support marsh fritillary.	
• Transportation requirements	Not known. Unlikely to be significant in the context of an existing trunk road.	

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Blaen Cynon SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
• Duration of construction, operation, etc.	Construction is anticipated to begin in November 2018. The opening year of the completed project would be 2020, when both Section 5 and 6 would open to traffic.	
• Other.	N/A	
Description of avoidance and / or mitigation measures Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on:		
• Nature of proposals	• The proposed scheme has been designed to minimise impact upon habitats suitable for marsh fritillary. Temporary works areas, storage compounds would all be sited away from sensitive habitats. • Scheme design has reduced fragmentation and isolation of marsh fritillary habitats. • Best practice construction guidance including CIRIA Industry published reports would restrict potential for uncontrolled discharges (volume and quality) to water and air that could affect the habitat which the marsh fritillary is dependent upon. • Protection of retained habitats during construction phase using appropriate signage and fencing. • Provision of tool box talks to all personnel on site.	
• Location	Plainly established and uncontroversial mitigation measures, as discussed above, would be implemented throughout the proposed scheme where required.	
• Evidence for effectiveness	All proposed mitigation measures are plainly established and uncontroversial and described in industry standard best practice guidance. These techniques have been used in other road schemes and have been proven successful for preventing impact on a variety of sensitive ecological features.	
• Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations)	Commitments to environmental mitigation will be submitted in support of Draft Orders. Delivery of such commitments must be fulfilled as a legal requirement of the implementation of the Orders. The commitments will be described in the ES and its appendices and will be comprehensively compiled into the Register of Environmental Actions and Commitments (REAC). The commitments include actions, procedures and standards to avoid or mitigate likely significant effects; avoid offenses; and demonstrate no adverse effects on the integrity of European sites. The REAC will form part of the Construction and Environmental Management Plan (CEMP), which describes the policies and procedures that will be carried out by the Contractor to provide effective planning, management and control during the construction of the scheme to implement the commitments within the REAC. The contract documents will explicitly require the Contractor to fulfil all commitments in the ES and REAC as part of its CEMP, thus providing a mechanism for transferring the commitments of WG to its contractor. The REAC includes the requirements for consents and licenses necessary post-confirmation of Orders, which will provide further mechanisms for ensuring impacts are avoided or mitigated and no offences will be committed. The REAC also includes commitments to the liaison and consultation with statutory environmental bodies required to ensure agreement on, and implementation of, management plans, method statements and protocols as will be required to fulfil the commitments made by WG.	

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Blaen Cynon SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Characteristics of European site(s) A brief description of the European site should be produced, including information on:		
• Name of European site and its EU code	Blaen Cynon SAC UK0030092	
• Location and distance of the European site from the proposed works	Blaen Cynon SAC lies 55 m to the north of the proposed scheme at Hirwaun.	
• European site size	Blaen Cynon SAC: 66.83 ha	
• Key features of the European site including the primary reasons for selection and any other qualifying interests	Blaen Cynon SAC: 1065 Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*	
• Vulnerability of the European site – any information available from the standard data forms on potential effect pathways	The marsh fritillary butterfly population is threatened in some parts of the site by a lack of grazing, inappropriate tree planting and burning.	
• European site conservation objectives – where these are readily available	• The site will contribute towards supporting a sustainable metapopulation of the marsh fritillary in the Penderyn / Hirwaun area. This will require a minimum of 50 ha of suitable habitat, of which at least 10 ha must be in good condition, although not all is expected to be found within the SAC. Some will be on nearby land within a radius of about 2 km. • The population will be viable in the long term, acknowledging the extreme population fluctuations of the species. • A minimum of 30% of the total site area will be grassland suitable for supporting marsh fritillary. (As the total area of the SAC is 66.62 ha, 30% represents approximately 20 ha.) • At least 40% of the suitable habitat (approximately 8 ha) must be in optimal condition for breeding marsh fritillary. Suitable marsh fritillary habitat is defined as stands of grassland where devil's-bit scabious (*Succisa pratensis)* is present and where scrub more than 1 metre tall covers no more than 10% of the stands. • Optimal marsh fritillary breeding habitat will be characterised by grassland where the vegetation height is 10-20 cm, with abundant purple moor-grass (*Molinia caerulea)*, frequent "large-leaved" devil's-bit scabious suitable for marsh fritillary to lay their eggs and only occasional scrub. In peak years, a density of 200 larval webs per hectare of optimal habitat will be found across the site.	
Assessment Criteria Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European site.		
• Habitat loss or fragmentation due to land-take – marsh fritillary butterfly • Direct mortality of qualifying feature– marsh fritillary butterfly		

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Blaen Cynon SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Initial Assessment The key characteristics of the site and the details of the European site should be considered in identifying potential impacts. Describe any likely changes to the site arising as a result of:		
• Reduction of habitat area	There would be no direct habitat loss of the SAC. The offline sections between Nant Hir Reservoir and Hirwaun are within the core SAC marsh fritillary metapopulation area and would result in loss of habitat used by/suitable for marsh fritillary. The amount of suitable habitat likely to be lost is likely to approximate 12.5 ha, although final design has not been finalised. It is considered there would be a likely significant effect on two of the species' vulnerabilities i.e. available habitat and fragmentation.	
• Disturbance to key species	Marsh fritillary is not considered sensitive to disturbance.	
• Habitat or species fragmentation	There would be no fragmentation of the SAC itself. The offline sections between Nant Hir Reservoir and Hirwaun are within the core SAC marsh fritillary metapopulation area and could result in severance of habitat used by marsh fritillary.	
• Reduction in species density	There would be potential for reduction in species density due to habitat loss, severance and mortality of larval webs as a result of the proposed scheme.	
• Changes in key indicators of conservation value (water quality, etc.)	<u>Air</u> During construction, there is the potential for dust emissions to effect local air quality and subsequently on habitats which could support marsh fritillary. However implementation of published guidance on reducing dust levels, should prevent any likely significant effect on the habitats within Blaen Cynon SAC or the habitats outside of the SAC which are suitable to support marsh fritillary. The assessment of air quality as part of the environmental statement will take account of forecast traffic growth in the wider area as a result of planned development during the operational phase. Even with increased emissions to air, no impact on devil's-bit scabious and subsequently on marsh fritillary is anticipated. The elevated nitrogen deposition is already experienced at the proposed scheme location and does not appear to have the level of impact as currently experienced by the more primary functional role of grazing and scrub management. <u>Water</u> No water collected or generated by the construction or operational phases of the proposed scheme would be discharged directly into any watercourse. By following best practice guidelines and adherence to discharge consents, no silt or contaminants associated with the proposed scheme would enter any watercourse during either the construction or operational phases. It is considered that there would be no changes to the water quality that could significantly affect the habitat used by/suitable for the marsh fritillary.	
• Climate change	No exacerbation of likely adverse effects from climate change. MONARCH (Modelling Natural Resource Responses to Climate Change) predicts that marsh fritillary would gain substantial potential "climate space", i.e. an increase their potential range due to a northward shift of suitable habitat, suggesting that the species would not be adversely affected by climate change.	

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Blaen Cynon SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Describe any likely impacts on the European site as a whole in terms of:		
• Interference with the key relationships that define the structure of the site	The structure of the Blaen Cynon SAC and of the habitats that support marsh fritillary outside of the SAC are dependent upon appropriate long term management, specifically prescribed cattle grazing. This is a function that would not be affected by the proposed scheme. Therefore there is no interference with key relationships that define the structure of the site.	
• Interference with key relationships that define the function of the site	The function of the site and the habitats that support marsh fritillary within the core landscape area could be affected by: • Direct habitat loss of suitable habitat for marsh fritillary outside of the SAC; • Fragmentation of suitable habitats for marsh fritillary outside of the SAC; and • Direct mortality of marsh fritillary larval webs during the construction phase.	
Indicate the significance as a result of the identification of impacts set out above in terms of:		
• Reduction of habitat area	Likely Significant Effect - potential for land-take of areas of habitat used by/suitable for metapopulations.	
• Disturbance to key species	No likely significant effect - marsh fritillary not considered sensitive to disturbance	
• Habitat or species fragmentation	Likely Significant Effect - potential for fragmentation of habitat patches within the metapopulation area outside of the SAC boundary	
• Loss	Likely Significant Effect - potential loss of marsh fritillaries due to direct mortality of larval webs during site clearance	
• Fragmentation	Likely Significant Effect - potential fragmentation of metapopulations outside of the SAC boundary	
• Disruption	No likely significant effect - marsh fritillary not considered sensitive to disruption	
• Disturbance	No likely significant effect - marsh fritillary not considered sensitive to disturbance	
• Change to key elements of the site (e.g. water quality, hydrological regime etc.)	No likely significant effect - *de minimis* air quality impact on habitats. No likely significant effect – no adverse effects anticipated due to plainly established and uncontroversial measures. Potential for improvement to quality of surface water discharge.	
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.		
Likely significant effects associated with the proposed scheme are: • Habitat loss; • Fragmentation; and • Direct mortality (larval webs) during construction. In-combination effects will be addressed in Stage 2 – Appropriate Assessment.		

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Blaen Cynon SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Outcome of screening stage (delete as appropriate).	**Significant Effects are Likely**	
Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence).	Consultation to be completed	

A.2 Usk Bats Sites SAC

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Usk Bat Sites SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Description of Project:		
• Size and scale (road type and probable traffic volume)	Approximately 17.7 km of widening of three lane highway to dual carriageway. Minor areas of off-line development.	
• Land-take	The proposed scheme does not involve land-take within the SAC	
• Distance from the European site or key features of the site (from edge of the project assessment corridor)	Usk Bat Sites lies approximately 9.2 km north east of the proposed scheme.	
• Resource requirements (from the European site or from areas in proximity to the site, where of relevance to consideration of impacts)	The project would not require any resources from the SAC or land/water in proximity to the SAC.	
• Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution)	<u>Air</u> Implementation of published guidance (e.g. CIRIA, BRE etc.) on control of dust during construction should limit any potential emissions. No plausible link between vehicle emissions during the operational phase of the proposed scheme on the functionality of the habitat for bat species within and outwith the SAC has been identified. <u>Water</u> No direct discharge of water to the SAC is proposed. Implementation of published guidance (e.g. CIRIA, BRE etc.) on control of pollutants entering watercourses should limit any uncontrolled discharges.	
• Excavation requirements (e.g. impacts of local hydrogeology)	No excavation would be required within or adjacent to the SAC. Excavation required for off-line sections of the proposed scheme could affect subsurface water flows to habitats outside of the SAC but this is highly unlikely to impact woodland habitats used as foraging and commuting habitats.	
• Transportation requirements	Not known. Unlikely to be significant in the context of an existing trunk road.	
• Duration of construction, operation, etc.	Construction is anticipated to begin in November 2018. The opening year of the completed project would be 2020, when both Section 5 and 6 would open to traffic.	
• Other.	n/a	

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Usk Bat Sites SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Description of avoidance and / or mitigation measures Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on:		
• Nature of proposals	Large culverts / clear span bridges at all watercourse locations to avoid severance effects on mobile species; no night time work; settlement of site run-off prior to discharge; noise fencing and/or low noise surfacing; flight line fencing during construction; maintaining dark corridors and open flyways during construction; and control of site lighting. Pre-construction inspection of caves and structures; and a Karst protocol would be adhered to for the duration of works. Best practice construction, including following CIRIA Industry guidance.	
• Location	Plainly established and uncontroversial mitigation measures would be implemented throughout the proposed scheme where appropriate.	
• Evidence for effectiveness	All proposed mitigation measures are plainly established and uncontroversial and described in industry standard best practice guidance. These techniques have been used in other road schemes and have been proven successful for preventing impact on a variety of sensitive ecological features.	
• Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations)	Commitments to environmental mitigation will be submitted in support of Draft Orders. Delivery of such commitments must be fulfilled as a legal requirement of the implementation of the Orders. The commitments will be described in the ES and its appendices and will be comprehensively compiled into the Register of Environmental Actions and Commitments (REAC). The commitments include actions, procedures and standards to avoid or mitigate likely significant effects; avoid offenses; and demonstrate no adverse effects on the integrity of European sites. The REAC will form part of the Construction and Environmental Management Plan (CEMP), which describes the policies and procedures that will be carried out by the Contractor to provide effective planning, management and control during the construction of the scheme to implement the commitments within the REAC. The contract documents will explicitly require the Contractor to fulfil all commitments in the ES and REAC as part of its CEMP, thus providing a mechanism for transferring the commitments of WG to its contractor. The REAC includes the requirements for consents and licenses necessary post-confirmation of Orders, which will provide further mechanisms for ensuring impacts are avoided or mitigated and no offences will be committed. The REAC also includes commitments to the liaison and consultation with statutory environmental bodies required to ensure agreement on, and implementation of, management plans, method statements and protocols as will be required to fulfil the commitments made by WG.	
Characteristics of European site(s) A brief description of the European site should be produced, including information on:		
• Name of European site and its EU code	Usk Bat Sites SAC UK0030141	
• Location and distance of the European site from the proposed works	Usk Bat Sites SAC lies 9.2km north east of the proposed scheme at Merthyr Tydfil.	
• European site size	1686.4 ha	

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Usk Bat Sites SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
• Key features of the European site including the primary reasons for selection and any other qualifying interests	1303 Lesser horseshoe bat (Scoped out features: 4030 European dry heaths; 7120 Degraded raised bogs still capable of natural regeneration; 7130 Blanket bogs (* if active bog); 8210 Calcareous rocky slopes with chasmophytic vegetation; 8310 Caves not open to the public; 9180 *Tilio-Acerion* forests of slopes, screes and ravines * Priority feature)	
• Vulnerability of the European site – any information available from the standard data forms on potential effect pathways	Minimal disturbance is required within the lesser horseshoe bat cave hibernacula. The population has been satisfactorily safeguarded from disturbance for many years, where necessary by gating cave entrances, providing access by permit only and promoting a code of conduct. The Annex I feature Caves not open to the public is also supported, all species being subject to the safeguards above. The maternity roost occupies a large coach-house, which is leased by a conservation body and has been renovated specifically to safeguard the bats. The remaining SAC features are almost entirely located on common land with grazing rights. Control of grazing levels is presently difficult to achieve on common land and some reduction in grazing levels and / or change of grazing patterns appears desirable.	
• European site conservation objectives – where these are readily available	The conservation objectives for lesser horseshoe bat of the SAC are: The site will support a sustainable population of lesser horseshoe bats in the River Usk area. The population will be viable in the long term, acknowledging the population fluctuations of the species. Buildings, structures and habitats 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. 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. There will be no loss or decline in quality of linear features (such as hedgerows and tree lines) which the bats use as flight lines - there will be no loss of foraging habitat use by the bats or decline in its quality, such as due to over-intensive woodland management All factors affecting the achievement of the above conditions are under control.	

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Usk Bat Sites SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**

Assessment Criteria

Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European site.

There is no connection between the proposed scheme and the qualifying habitat features of the site and these are therefore not considered any further.

It is possible that if lesser horseshoe bats affected by the proposed scheme are part of the SAC population that the following affects could occur on the SAC:

- Habitat loss (loss of roosts) - lesser horseshoe bat; and
- Disturbance due to noise, vibration and lighting– lesser horseshoe bat.

Initial Assessment

The key characteristics of the site and the details of the European site should be considered in identifying potential impacts.

Describe any likely changes to the site arising as a result of:

• Reduction of habitat area	No land-take within the SAC is required. Lesser horseshoe bat roosts are present in the footprint of the proposed scheme at Taf Fawr and Taf Fechan; these are likely to be lost. It is conceivable that lesser horseshoe bats present in these locations are associated with the SAC.
• Disturbance to key species	Lesser horseshoe bats are particularly sensitive to noise, vibration and light. Therefore, construction disturbance from the proposed scheme is likely to significantly affect lesser horseshoe bats which could be associated with the SAC.
• Habitat or species fragmentation	Although there would be some temporary loss of foraging and commuting habitat this would be temporary with significant and targeted landscape planting to re-establish bat flight-lines post construction. A wide extent of available foraging and commuting habitat would remain in situ in the landscape around the proposed scheme. Significant commuting routes along watercourses, along gorges and via culverts that cross the existing A465 and the proposed scheme would remain available throughout the construction and operation phases. No likely significantly affect is anticipated on the SAC.
• Reduction in species density	The loss of roosts has the potential to affect species density.
• Changes in key indicators of conservation value (water quality, etc.)	There would be no changes in key indicators of conservation value.
• Climate change	MONARCH (Modelling Natural Resource Responses to Climate Change) predicts that lesser horseshoe bats would gain substantial potential “climate space”, i.e. an increase their potential range due to a northward shift of suitable habitat suggesting that the species would not be adversely affected by climate change.

Project Name:	**A465 Section 5 and 6**	
Natura 2000 site under consideration:	**Usk Bat Sites SAC**	
Date: 18/04/16	**Author: Laura Gore MCIEEM CEnv**	**Verified: Russell Cryer**
Describe any likely impacts on the European site as a whole in terms of:		
• Interference with the key relationships that define the structure of the site	The structure of the Usk Bat Sites SAC is dependent upon the long term security of designated roosts. This is a function that would not be affected by the proposed scheme. Therefore there is no interference with key relationships that define the structure of the site.	
• Interference with key relationships that define the function of the site	The function of the site and the habitats that support lesser horseshoe bats could be affected by: • Direct habitat loss – loss of roosts (outside of the SAC); and • Disturbance of roosts during construction.	
Indicate the significance as a result of the identification of impacts set out above in terms of:		
• Reduction of habitat area	Likely Significant Effects	
• Disturbance to key species	Likely Significant Effects	
• Habitat or species fragmentation	No Likely Significant Effects	
• Loss	No Likely Significant Effects	
• Fragmentation	No Likely Significant Effects	
• Disruption	No Likely Significant Effects	
• Change to key elements of the site (e.g. water quality, hydrological regime etc.)	No Likely Significant Effects	
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.		
Likely significant effects associated with the proposed scheme are: • Habitat loss (loss of roosts); and • Disturbance to roosts during construction. In-combination effects will be addressed in Stage 2 – Appropriate Assessment.		
Outcome of screening stage (delete as appropriate).	**Likely Significant Effects**	
Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence).	Consultation to be completed	

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Appendix B. Blaen Cynon SAC – Performance Indicators

Taken directly from Blaen Cynon SAC Core Management Plan (CCW, 2008).

Performance indicators for feature condition		
Attribute	***Attribute rationale and other comments***	***Specified limits***
A1. Density of larval webs	Larval web density in a 'good' year for marsh fritillary has been identified as a measurable performance indicator of the population. During peaks in the population cycle a density of 200 webs per hectare of suitable habitat is an appropriate target to set as defining favourable condition for strong populations. Wide fluctuations in abundance occur, with dramatic crashes in population size occurring every ten years or so. Recovery from these crashes may take 4 or 5 yrs.	*Upper limit:* not required *Lower limit:* in one year in six the number of larval webs is estimated to be 200 per hectare of Good Condition habitat.

Factor	***Factor rationale and other comments***	***Operational Limits***
F1. Extent and quality of the marshy grassland as habitat for marsh fritillary	The marsh fritillary is a highly localised and sedentary butterfly that inhabits unimproved *Molinia* grassland in the lowlands. It has an annual life-cycle and feeds as a larva on *Succisa pratensis*, especially on large-leaved plants that are growing amongst vegetation that is between 10 and 20 cms tall in late summer/autumn. The larvae over-winter communally amongst litter in such situations and the shelter provided by leaf litter and tussocks is considered to be important. Approximately 50ha of habitat is required to maintain the population in the long term, with at least 10ha is good condition. Not all is expected to be within the SAC. The operational limits reflect the minimum contribution of the Blaen Cynon SAC towards the favourable conservation status of the species in the Hirwaun/Penderyn area.	20 hectares of Available marshy grassland, including: 8 hectares of Good Condition marsh fritillary habitat Within Areas 1, 2, 3 and 4 50% of the vegetation meets the following criteria: Within a 50cm radius: *Molinia* is present *AND* The cover of *Succisa* is 10% or greater *AND* The vegetation height is between 10-20cm when measured using a Boorman's disc. **AND** The cover of *Juncus* spp. does not exceed 50%

	Definition of Good Condition marsh fritillary habitat Grassland, with *Molinia* abundant where, for at least 80% of sampling points, the vegetation height is within the range of 10 to 20 cm (when measured using a Boorman's disc) and *Succisa pratensis* is present within a 1 m radius. Scrub (>0.5 metres tall) covers no more than 10% of area **Definition of Suitable marshy grassland** Stands of grassland where *Succisa pratensis* is present at lower frequencies but still widely distributed (>5% of sampling points) throughout the habitat patch and in which scrub (>0.5 metre tall) covers no more than 25% of area. Alternatively, *Succisa* may be present at high density in close-cropped swards. **[note: Available habitat is the total of Good Condition and Suitable habitat]**	

Appendix C. Usk Bat Sites SAC – Performance Indicators

Performance indicators for feature condition		
Attribute	*Attribute rationale and other comments*	*Specified limits*
A.1 Pre-parturition population in the maternity roost	The is the target for the number of adult bats required each year during early summer, when females gather to give birth and numbers are likely to be at their highest. The figure of 320 bats is based on the lowest number of bats at Buckland between 2000 and 2006.	On at least one occasion between 29th May and 17th June of every year, there will be: • 320 or more bats at Buckland Coach House and 600 bats to be recorded at Buckland Coach House in at least one year during the six year monitoring cycle
A.2 Population in hibernation roost	There are a large number of hibernation sites within the SAC, and also a number outside the SAC, which all contribute towards maintaining the SAC population of lesser horseshoe bats. For the performance indicators for the SAC, counts will therefore be undertaken at five key sites. Buckland Ice House, closely associated with the maternity roost, is the easiest	During at least one surveillance visit between 1st January and 28th February of every year, there will be: • 270 or more lesser horseshoe bats at Agen Allwedd cave, and 500 (this figure may need revising as 500 is close to the maximum recorded, although current trends show an increasing

	site to count. The numbers in the performance indicators are based on maximum counts between 2000 and 2006, and have been devised using the same rationale as for the maternity site. However, there are some difficulties in timing of counts at Buckland Ice House. The site is used by large numbers of bats during relatively mild winters. In cold weather the ice house becomes unsuitable, and the bats relocate to another site not within the SAC, (Ogof Cynnes). For this reason counts for this hibernaculum will be accepted between 1st November and 28th February. Counts at cave sites are technically very difficult. Bats are often difficult to see and also frequently move hibernation site, within the cave and between caves. They may use parts of the cave inaccessible to humans. There are also specific problems at the Usk Bat Sites hibernation sites. Agen Allwedd is a large cave system with a number of passages. One section particularly favoured by bats is known as Angel's Roost. However, it is occasionally impossible to survey this section, because bats are hibernating in the passage to it, and it cannot be reached without disturbing these bats. The Clydach Gorge sites consist of more than 10 caves, not all of which are continually used, but which collectively support a significant part of the wintering bat population. Foxwood is a drift cave with holes in the cave roof. This allows warm air in the cave to escape during the winter. As a result, bats frequently leave this site when it becomes too cold. The internal temperature when the site is surveyed is therefore critical to gaining an accurate picture of the importance of this site for lesser horseshoe bats. The numbers of bats expected at each site have been calculated using the same rationale as that used for the maternity site. An alternative lower number is provided for situations in which the Angel's Roost section of Agen Allwedd cannot be accessed. This count should	population) or more present at least once during the six year monitoring cycle OR 220 or more lesser horseshoe bats at Agen Allwedd Cave excluding the Angel's roost section (see rationale below), AND • A total of 18 or more lesser horseshoe bats at the Clydach Gorge cave sites, and 47 to be recorded at least once during the six year monitoring cycle, AND During at least one surveillance visit between 1st November and 28th February of each year, • 280 or more lesser horseshoe bats at Buckland Ice House and 470 to be recorded at least once during the six year monitoring cycle AND During at least one surveillance visit between 1st November and 28th February of each year, when the internal temperature of the cave is 6°C or above there will be: • 60 lesser horseshoe bats at Foxwood cave AND There is continued use by lesser horseshoe bats at Siambre Ddu (data collected from this site requires further examination in order to devise population limits).

	not be used in years when Angel's Roost is accessible. Siambre Ddu is another large roost. Data recently collected from this site requires further examination in order to devise population limits. It is expected that the lower limit would be in the region of several 10s of bats. The performance indicator for this site at present requires only that bats be present. Droppings will not be used to make assumptions about bats using the site. Once more data is collected, it is possible that a moving (6yearly) average could be calculated, such that a fall in numbers of say 10% could flag up a potential decline in health of the population.	
Performance indicators for factors affecting the feature		
Buckland House Maternity Roost (may also apply to other non-SAC maternity roosts)		
Factor	*Factor rationale and other comments*	*Operational Limits*
F.1 Site security	Derived from Common standards Monitoring advice.	Access to the site under the control of the owner/occupier or site secured against unauthorised access. Doors, gates or security fences in sound condition and able to resist unauthorised access attempts
F.2 External condition of building	As above.	Fabric of building sufficient to maintain roost conditions internally with: • Weatherproof roof. The roof covering materials (slates, tiles etc.) in weatherproof condition with no significant gaps, slippage or damage. • No holes large enough to allow soaking of roof timbers, excessive heat loss or high light levels in the roost area • Walls sound, rainwater goods in adequate condition. The building is structurally stable. No significant deterioration in overall condition of the building
F.3 Roost entrance – buildings and underground	As above.	• Unobstructed roost entrance large enough for bats to fly through unimpeded. Normal minima: 300 x 200 mm

sites		No artificial lights shining on access or associated flight paths
F.4 External Disturbance	As above.	Disturbance levels acceptable to bats with: • No increase since previous visit Human access to roost controlled and limited
F.5 Internal condition of building/ underground site in roost area	As above.	• Low light levels with no through draught. No toxic substances present, which would adversely affect the health of the bats (e.g. chemical timber treatment within inappropriate substances).
F.6 Temperature of roost area	As above.	• Range of temperatures available to bats with mean temperature in July greater than 20°C
F.7 Internal disturbance	As above.	• Human access to roost area controlled and limited Disturbance is kept to a minimum
Hibernation Sites		
F.8 Site entrance	As above.	• Existing entrances unobstructed. • No human-influenced new entrances causing a change to ventilation. No change in size sufficient to affect airflow and internal temperature.
F.9 External conditions of site	As above.	• Vegetation present close to entrance (s) but not obstructing it (them). No artificial lights shinning on entrance(s).
F.10 Internal conditions	As above.	• The temperature should remain constantly cool (8-12°C) and dark, once beyond the entrance zone • No significant man-induced changes to ventilation or temperature regime. No toxic substances present (dumping of oil or other substances).
F.11 Internal disturbance	As above.	• Human access to roost area controlled and limited (at Agen Allwedd the number of visitors is already controlled) Disturbance is kept to a minimum.

Foraging areas and links to roosts		
F.12 Habitat Quality	The bats mainly feed along the edges of woodland, large hedges and tree-lined rivers within and around the SAC areas and land situated between the SSSIs in the Usk valley area between Llangorse and Abergavenny.	There should be no nett loss of suitable woodland, scrub and hedgerows within the SAC or adjoining areas used by the bats.
F.13 Connectivity	The bats appear to prefer not to like crossing large areas of open ground and therefore retaining or providing new cover would be beneficial. Links between foraging areas, maternity roosts and hibernacula, are provided by hedgerows, woodland, scrub and lines of trees. There are quite a few maternity roosts in buildings in the Usk valley area that are not within in the SAC, so connectivity is important here too.	Major gaps in the continuity of these habitats should not be created. See also F12 above.
The extent of these habitats shown on aerial photographs taken in 2006 forms a baseline to measure habitat cover.		

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Appendix D. Structures Design

Taf Fawr - Drawing 219110-JAC-SBR-DE-SE-1600-2100

Taf Fechan - Drawing 219110-JAC-SBR-DE-SE-1600-2300

See following page.

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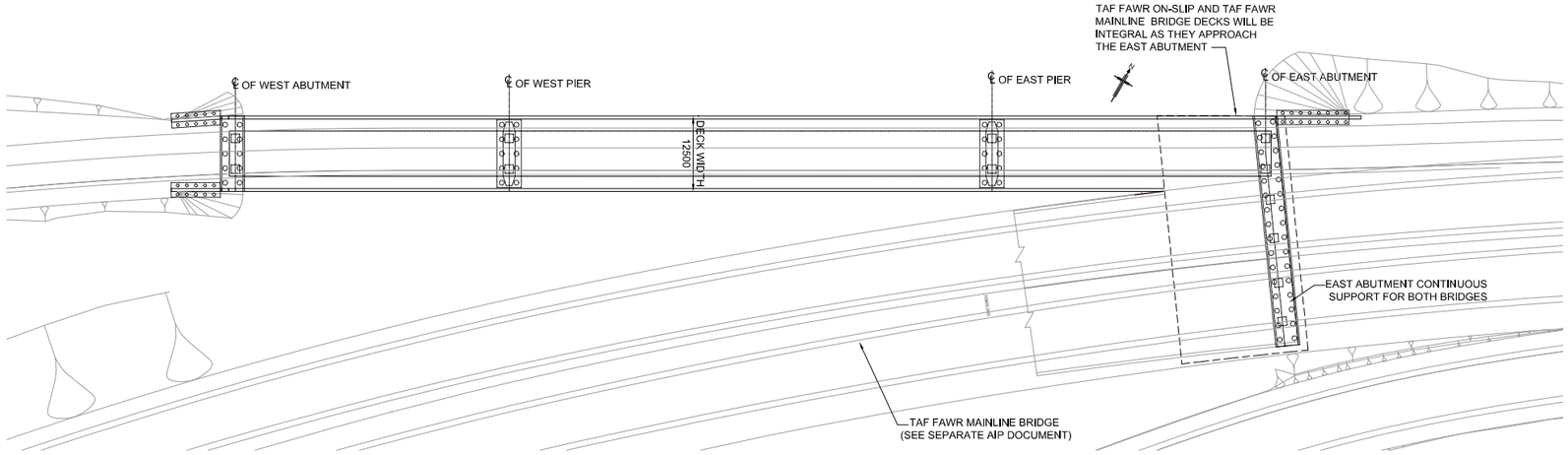
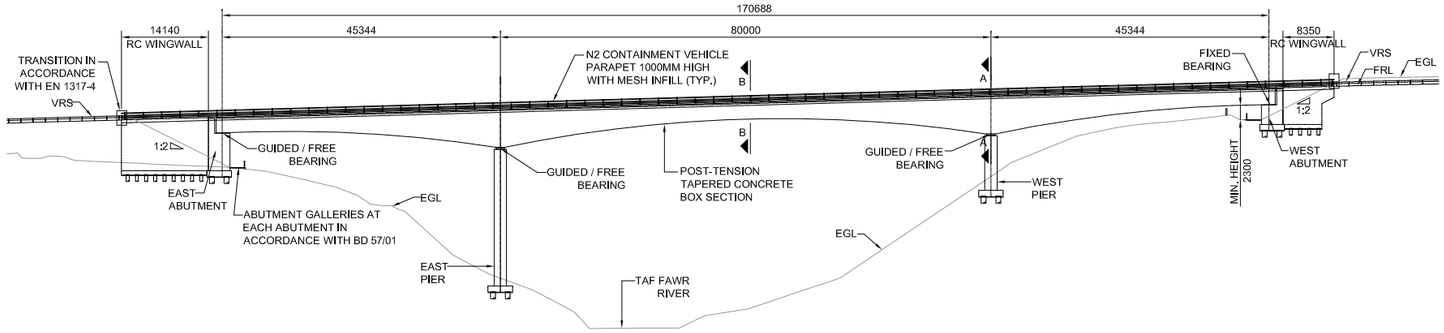
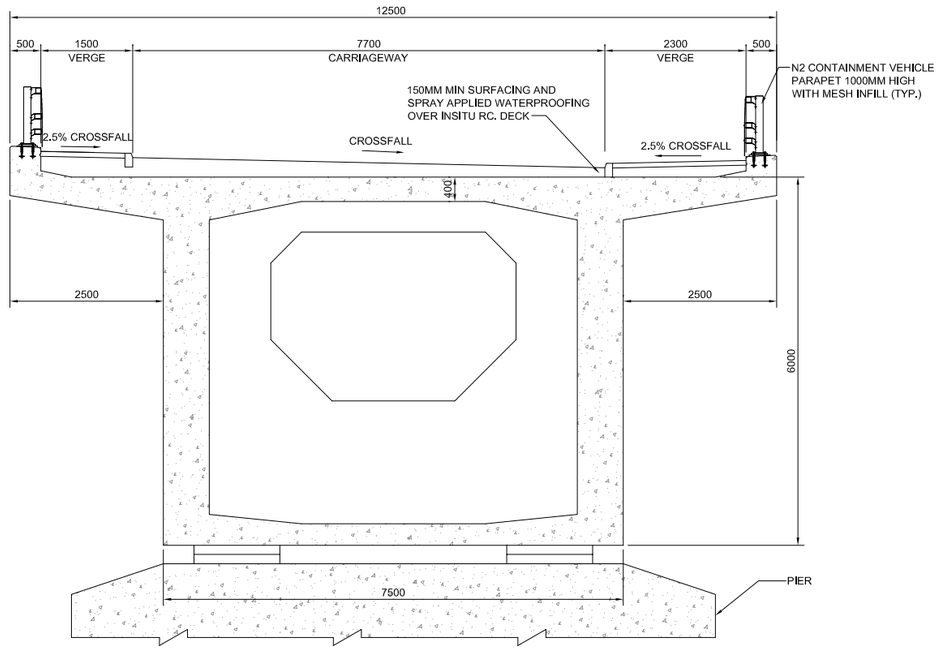


PLAN
SCALE 1:500



NORTH ELEVATION
SCALE 1:500



SECTION A - A
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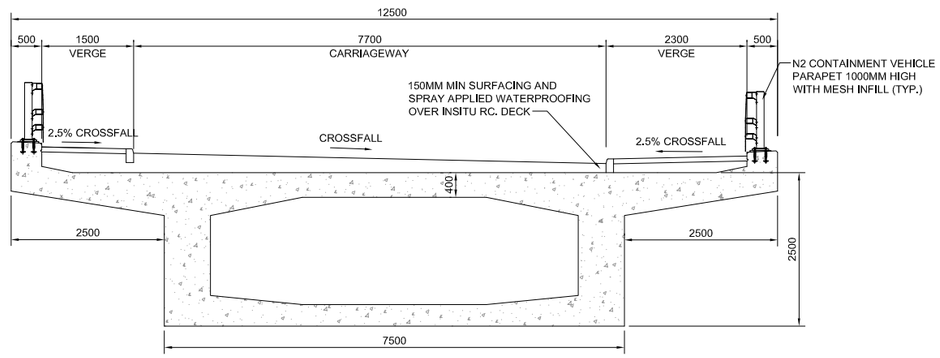
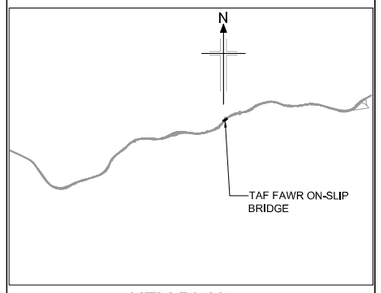


SECTION B - B
SCALE 1:50

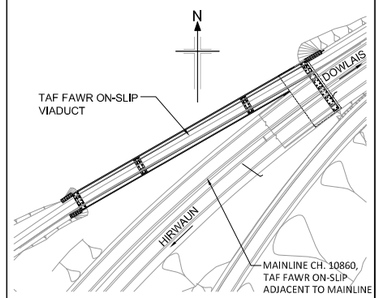
SAFETY, HEALTH AND ENVIRONMENTAL BOX	
KEY: ⚠	IT IS ASSUMED THAT ALL WORKS ON THE DRAWING ARE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPLICABLE, TO AN APPROVED METHOD STATEMENT. IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THIS TYPE OF WORK DETAILED ON THE DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS:-
HAZARD LOG REF	CONSTRUCTION
	OPERATION/USE
	MAINTENANCE
	ACCESS TO BE PROVIDED INTO THE VOID OF THE STRUCTURE, TO ALLOW THE INSPECTIONS OF THE POST TENSIONED DUCTS
	DEMOLITION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL EXPOSED ARRISES TO HAVE 25X25 CHAMFERS UNLESS NOTED OTHERWISE.
3. ALL BURIED SURFACES OF THE REINFORCED CONCRETE ELEMENTS ACCESSIBLE AFTER CASTING SHALL BE PAINTED WITH 2 COATS OF BITUMEN TO A LEVEL OF 150MM BELOW FINISHED GROUND LEVEL.
4. PAVED VERGES AND KERBS OVER BRIDGE TO EXTEND TO END OF WINGWALLS.
5. ALL INFORMATION RELATING TO THE EXISTING GROUND LEVEL IS BASED ON THE TOPOGRAPHICAL SURVEY AND SHOULD BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.



KEY PLAN



LOCATION PLAN
SCALE 1:2000

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P01	02/08/2016	ISSUED FOR TAA REVIEW	JS	SK	TN	GP

JACOBS
8th Floor, Churchill House, 17 Churchill Way, Cardiff, CF10 2HH

Client: Llywodraeth Cymru Welsh Government

Project: A465 SECTIONS 5 & 6

Drawing title: TAF FAWR ON-SLIP VIADUCT GENERAL ARRANGEMENT

Drawing status: DRAFT

Scale	AS SHOWN @ A1
Jacobs No.	B2191100

DO NOT SCALE FROM THIS DRAWING

Drawing number: 2191100-JAC-SBR-DE-SE-1600-2100 Rev P01

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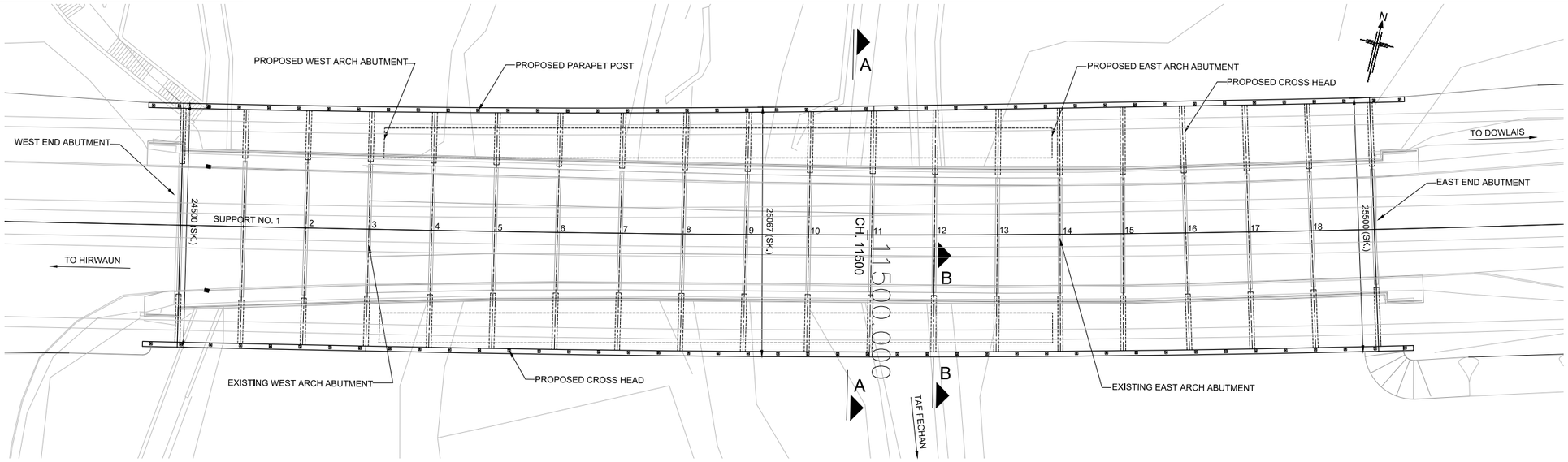
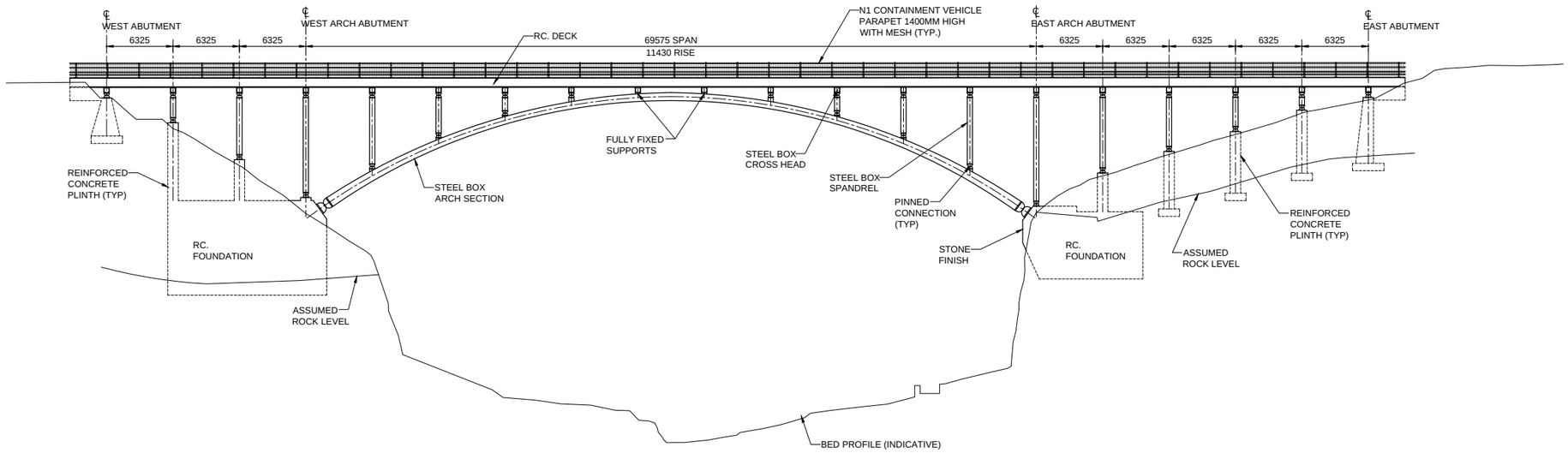
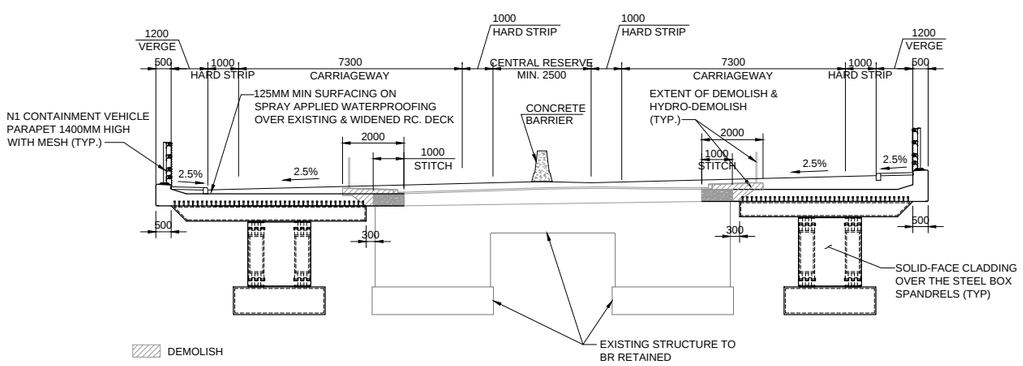


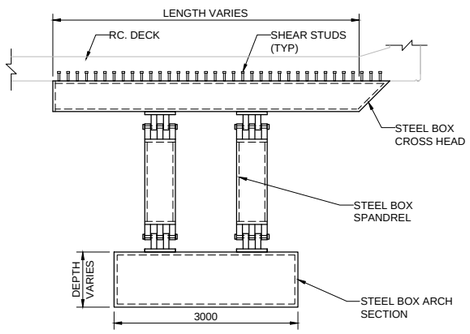
PLAN
SCALE 1:250



ELEVATION
SCALE 1 : 250



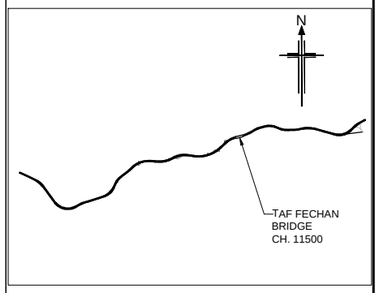
SECTION A - A
SCALE 1 : 100



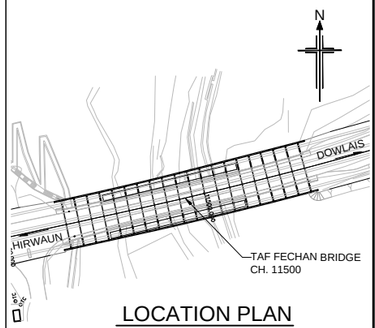
SECTION B-B
TYPICAL CONNECTION DETAIL
(REFER NOTE 6)
SCALE 1 : 50

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL EXPOSED ARRISES TO HAVE 25X25 CHAMFERS UNLESS NOTED OTHERWISE.
3. ALL BURIED SURFACES OF THE REINFORCED CONCRETE ELEMENTS ACCESSIBLE AFTER CASTING SHALL BE PAINTED WITH 2 COATS OF BITUMEN TO A LEVEL OF 150MM BELOW FINISHED GROUND LEVEL.
4. PAVED VERGES AND KERBS OVER BRIDGE TO EXTEND TO END OF WINGWALLS.
5. ALL INFORMATION RELATING TO THE EXISTING GROUND LEVEL IS BASED ON THE TOPOGRAPHICAL SURVEY AND SHOULD BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
6. THE CONNECTIONS BETWEEN THE STEEL SPANDRELS TO THE STEEL ARCHES & STEEL CROSS HEADS TO BE TYPICALLY PINNED EXCEPT FOR THE CONNECTIONS TO THE TWO SUPPORTS NEAR THE CROWN, WHICH ARE TO BE FIXED.



KEY PLAN



LOCATION PLAN
SCALE 1:1500

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd
P01	13/04/2016	ISSUED FOR TAA REVIEW	JS	SK	FK	GP

SAFETY, HEALTH AND ENVIRONMENTAL BOX

KEY: IT IS ASSUMED THAT ALL WORKS ON THE DRAWING ARE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPLICABLE, TO AN APPROVED METHOD STATEMENT. IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THIS TYPE OF WORK DETAILED ON THE DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS:-

HAZARD LOG REF	
	CONSTRUCTION
	OPERATION/USE
	MAINTENANCE
	DEMOLITION

JACOBS
8th Floor, Churchill House, 17 Churchill Way, Cardiff, CF10 2HH

Client: Llywodraeth Cymru Welsh Government

Project: A465 SECTIONS 5 & 6

Drawing title: TAF FECHAN VIADUCT GENERAL ARRANGEMENT

Drawing status: PRELIMINARY

Scale	AS SHOWN @ A1
Jacobs No.	B2191100

DO NOT SCALE FROM THIS DRAWING

Drawing number: 2191100-JAC-SBR-DE-SE-1600-2300 Rev P01

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Appendix E. Indicative Pipe Roost Design

See following page.

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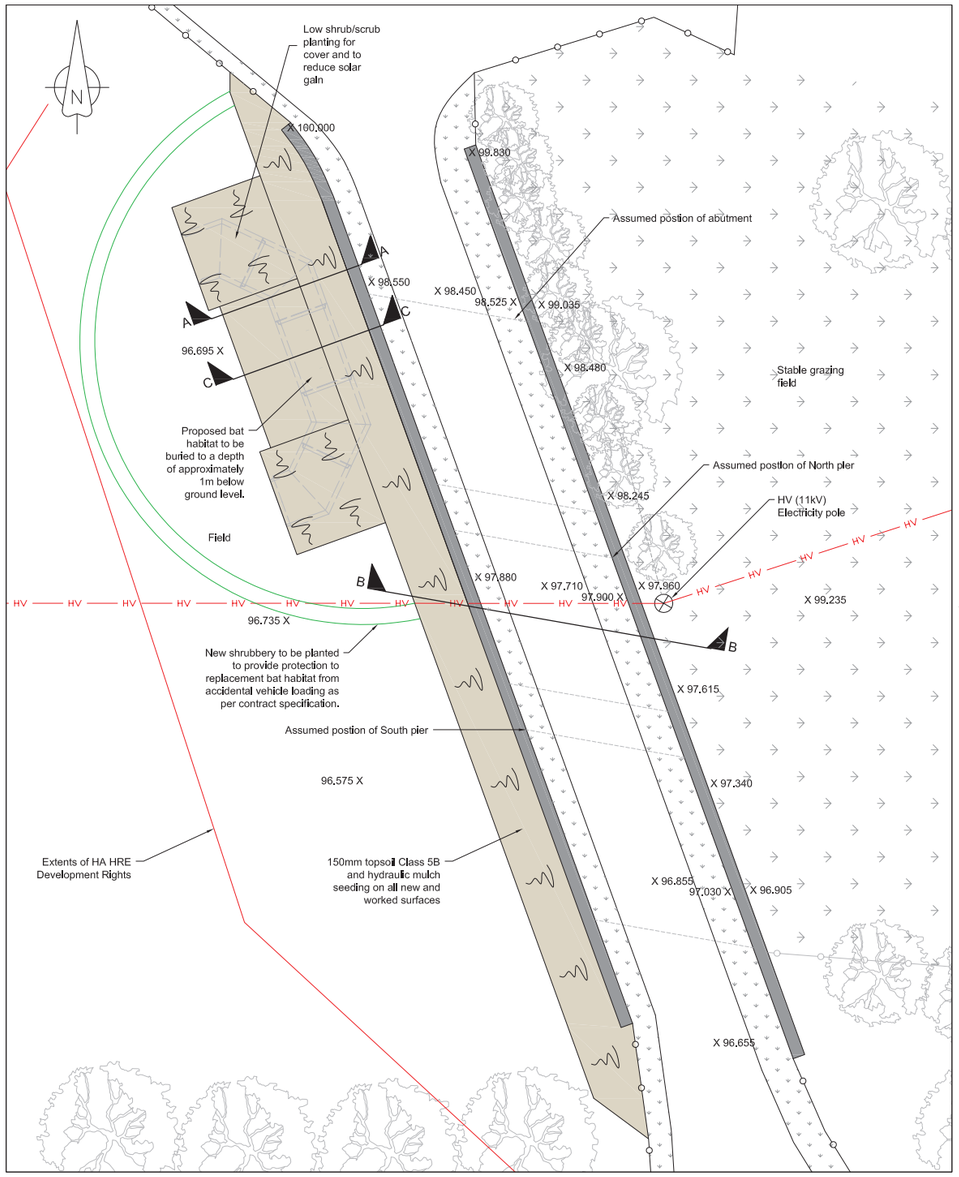
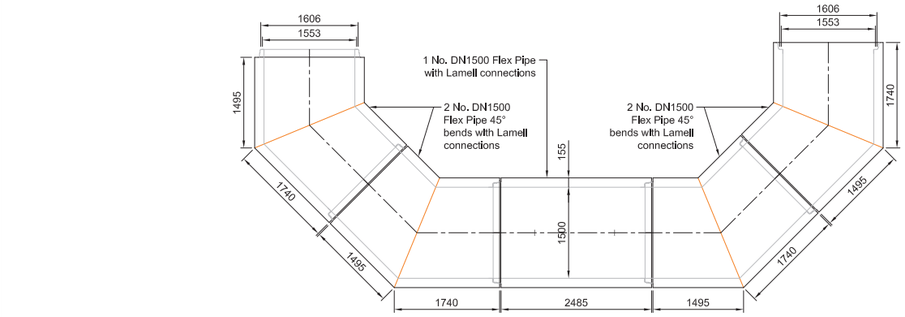
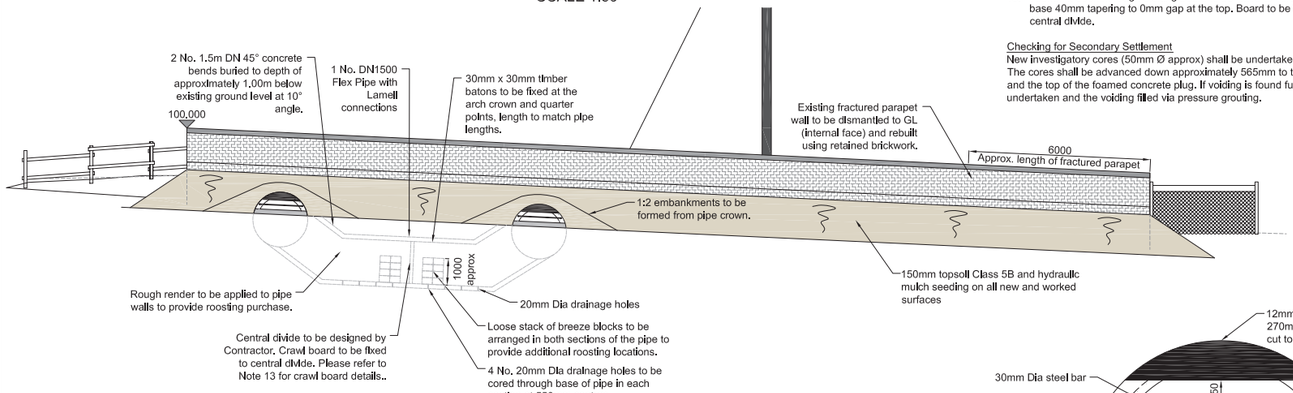


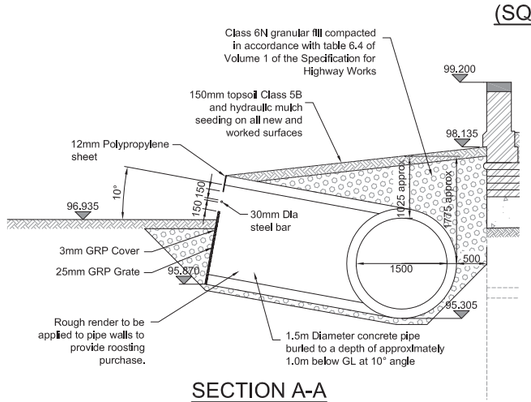
PLAN
SCALE 1:100



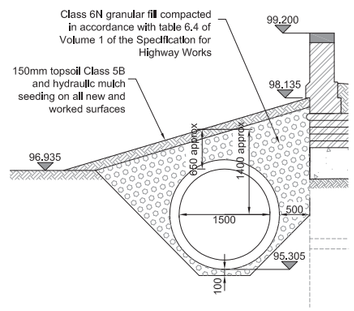
PROPOSED BAT HABITAT
(PLAN VIEW)
SCALE 1:50



WEST ELEVATION
(SQUARE TO BRIDGE FACE)
SCALE 1:100



SECTION A-A
SCALE 1:50

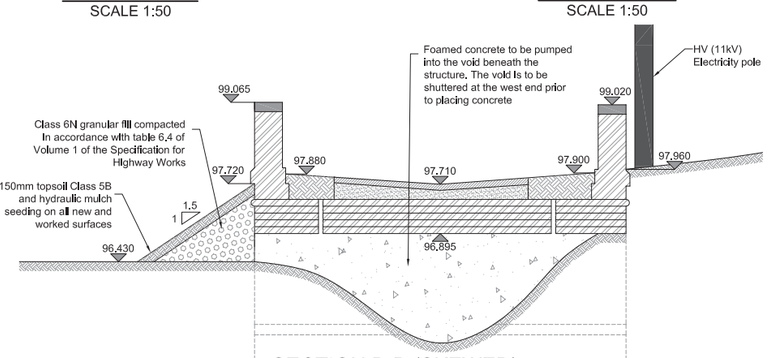


SECTION C-C
SCALE 1:50

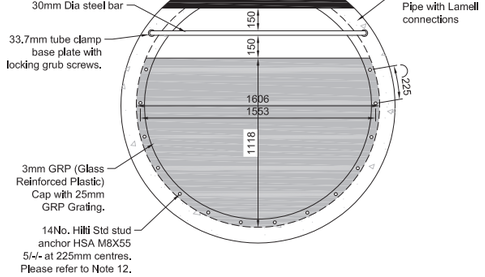
Refer to 'Checking for Secondary Settlement' note for details of Phase 1 and Phase 2 works.

Arch soffit positions to be accurately located and tied in to a point at road level prior to coring the soffit.

CORING PLAN
(VIEWED FROM ABOVE)
SCALE 1:100



SECTION B-B (SKEWED)
SCALE 1:50



DETAIL A - BAT HABITAT END DETAIL
SCALE 1:20

Notes

1. This drawing is not to be used in whole or part other than for the intended purpose and project, as defined on this drawing. Refer to the Contract for the full terms and conditions.
2. All dimensions are in millimetres unless stated otherwise.
3. All levels are in metres unless stated otherwise. TBM value of 100.000 situated on the top of the north end of the west parapet.
4. Locations and extent of services are indicative only and not exhaustive. Contractor to confirm exact location, nature and owner of any services within the area affected by the permanent or temporary works.
5. Thickness and positions of piers are approximate only.
6. Trees within footprint of the Infill to be removed.
7. Contractor to detail and provide temporary works protection to the electricity pole to the east of the parapet whilst infilling to ensure stability during the works.
8. Isolated areas of the parapet to be de-vegetated and re-pointed where necessary.
9. Reproduction from the ordnance survey map with the permission of the controller of Her Majesty's Stationery Office Crown Copyright Reserved licence no. al 100019980.
10. Bat habitat to be buried within western embankment. Protective hedge to be planted following installation to surround perimeter of the buried structure.
11. Stage lifts to be undertaken within each arch. No more than 0.5m lifts to be completed in consecutive arches.
12. GRP cap fixing detail is suitable for both male and female pipe connections.
13. 750mm x 500mm rough sterling board to be fitted to vertical tapering wedge opening at base 40mm tapering to 0mm gap at the top. Board to be fitted as high as possible to the central divide.

Checking for Secondary Settlement
New investigatory cores (50mm Ø approx) shall be undertaken as part of the Phase 2 works. The cores shall be advanced down approximately 565mm to the interface between the soffit and the top of the foamed concrete plug. If voiding is found further cores of similar depth will be undertaken and the voiding filled via pressure grouting.

CONSTRUCTION

REV	REVISION DATE	PURPOSE OF REVISION	DRAWN	CHECKED	APPROVED
03	30/07/2015	CONSTRUCTION	EK	JCW	NR
02	26/02/2015	FORM B	OG	JCW	NR
01	22/10/2013	FORM A	MTW	JCW	NR

JACOBS
1st FLOOR, NORTHERN HOUSE, 9 ROUGIER STREET, YORK, YO1 6HZ, ENGLAND
TEL:+44(0)1904 661 700 FAX:+44(0)1904 661 801
WEBSITE: WWW.JACOBS.COM

CLIENT
HIGHWAYS AGENCY

PROJECT
MAJOR WORKS PROGRAMME 2012-15

DRAWING TITLE
STRUCTURE CMZ 4m 1ch
BAT LICENCE APPLICATION
FIGURE E.3 MITIGATION

DRAWING STATUS
CONSTRUCTION

SCALE:	AS NOTED @ A1	DO NOT SCALE
JACOBS No.	B18280BI	
CLIENT No.	CMZ 4m 1ch	

DRAWING NUMBER: B18280-BI-0002 REV: 03

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Appendix F. Outline Proposal for Karst Protocol

The karst protocol will be an iterative, live document with a first draft compiled by the Contractor prior to construction as part of the detailed design and construction phase of the proposed scheme. The requirement to deliver a Kars Protocol and work in line with its requirements is part of the REAC. An outline proposal is provided below and is based on the successfully implemented Karst Protocol used during the construction of A465 Section 2 Gilwern to Brynmawr in the Clydach Gorge.

1) Introduction

a) History – Work to date:

This would set out the known information with regards to the locations and dimension of caves within the construction works area and the levels of use by lesser horseshoe bats and may include:

- ecology survey reports;
- geological reports; and
- Physical Dimensional Surveys and Digital Photographic Records.

b) Design - production to date, ground investigations to date and geological considerations (including figures)

c) Design – future work to be undertaken:

- As the construction of the scheme moves forward, and the ground conditions are exposed at each structure location, changes to the design may be necessary to deal with the exposed conditions should they differ from those assumed at previous project stages.

2) Outline Description of Protocol, Verification and Treatment:

- Karst features could be encountered during the excavation works in limestone throughout the areas of the construction site known as the Taf Fawr and Taf Fechan Gorges. Ahead of construction a detailed protocol would be fully developed and agreed between the Contractors team, the Client's Supervising Engineer and Natural Resources Wales (NRW), this would include action necessary from discovery, inspection, verification, recording, treatment and closure or potential incorporation of features within the works.

3) Anticipated Programme of Work in Karst Area:

- The construction works within the Taf Gorges would not occur between 1 December and 15 March.

4) Statement of Ecological Considerations:

- Known and unknown karst features are likely to be encountered during excavation works in limestone throughout the Taf Fawr and Taf Fechan areas. Ecology survey reports would be consulted to understand the present and potential usage of the karst systems.

5) Availability of Specialist Advice and Attendance:

- Arrangements would need to be in place to provide a retained specialist resource during the periods when there was a heightened expectancy that an issue or event impacting on the karst system could occur. This resource would need to be capable of mobilising in the event of a 'karst event' that required immediate attention (including specialist bat ecologist).

6) Approach to Excavation and grouting

- Specific Risk Assessments and Method Statements will be compiled to cover the temporary and permanent works constructed in all areas of, and in any areas likely to affect, the karst system.
- Karst Features Encountered During Construction – A465 Toolbox Talk would be provided for Supervisors and Engineers
- Karst Features Encountered During Construction – Toolbox Talks would be provided for Operatives Supervisors and Engineers

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