

# LLANBRYNMAIR WIND FARM

Supplementary Environmental Information February 2014

Volume II - Main Document, Supporting Appendices and Supporting Figures



## PREFACE

This Supplementary Environmental Information (SEI) has been prepared in support of an application for Section 36 consent under the Electricity Act 1989 that was submitted by RES UK & Ireland Ltd ('RES') to the Department of Energy and Climate Change (DECC) in March 2009 for a wind energy development on land between the villages of Llanbrynmair and Llanerfyl in Powys.

This SEI is provided to present the findings of additional survey, assessment and design work that has been undertaken since August 2013, together with other information that has been prepared in relation to access for the Llanbrynmair Wind Farm. This SEI comprises further and revised information which is subject to the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (as amended).

The SEI is contained within two separate volumes:

**Volume I** Non-Technical Summary

**Volume II** Main Document, Supporting Appendices and Supporting Figures

The SEI has been prepared by RES in collaboration with the following specialist consultants:

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Copies of the full SEI will be available at the following locations:

<b>Powys County Council</b> Severn Road Welshpool Powys SY21 7AS	<b>Powys County Council</b> The Gwalia Llandrindod Wells Powys LD1 5LG
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Electronic copies of the SEI are available on CD-ROM for £5.

Hard copies of Volume I and II are available from RES at a charge of £150 per combined copy. Copies of the non-technical summary are available free of charge.

The SEI can also be viewed on the RES web page: [www.llanbrynmairwindfarm.co.uk](http://www.llanbrynmairwindfarm.co.uk)

Requests for documents should be made in writing, including payment if purchase of the full SEI is required. RES has an environmental management system which actively encourages the reduction of paper consumption and recycling where possible.

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## 1. INTRODUCTION

### 1.1 About the Development

- 1.1.1 In March 2009, an application for Section 36 consent under the Electricity Act 1989 was submitted by RES UK & Ireland Ltd ('RES') to the Department of Energy and Climate Change (DECC) for a wind energy development of up to forty-three (43) turbines on land between the villages of Llanbrynmair and Llanerfyl in Powys. The Section 36 application is currently under consideration and is being appraised at the Mid-Wales (Powys) Conjoined Wind Farms Public Inquiry. An Environmental Statement (ES) accompanied the Section 36 consent application.
- 1.1.2 The Proposal has undergone considerable changes since the original submission in 2009. Of particular note, the number of turbines has been reduced from forty three (43) to thirty (30). In order to update and consolidate these changes within the ES, eight rounds of Supplementary Environmental Information (SEI) have been submitted between 2010 and 2013. For clarity, the SEI submitted in August 2013 superseded the original Environmental Statement and subsequent SEI packages submitted as supporting information between 2010 and 2012.

### 1.2 The Application

- 1.2.1 The application includes the erection of 30 three-bladed, horizontal axis wind turbines (each up to 126.5m maximum height to tip) and associated infrastructure including; on-site tracks, underground cabling, crane hardstandings, a communications mast (25m high), a permanent (80m high) free standing lattice wind monitoring mast, borrow pits, water crossings, electrical transformers, electrical connection works, a substation, and control building. The wind farm would be operational for a period of 25 years.
- 1.2.2 Each wind turbine would have a capacity of between 2MW and 3MW, providing an installed capacity of 60MW to 90MW. This would be sufficient to power more than 37,000 homes, or nearly two-thirds of the houses in Powys.
- 1.2.3 Consultation has been ongoing with consultees since 2005. Such discussions have offered instrumental advice and input into the detailed site design and mitigation options. This has helped to develop a wind farm design with minimal effects on the environment.

### 1.3 Purpose of this SEI

- 1.3.1 This SEI is provided to present the findings of additional survey, assessment and design work that have been undertaken since August 2013. This SEI is presented in two parts; part one provides additional information and further clarification on the impact of the proposed local highway works between Llanerfyl and Talerddig, and the second part providing additional survey and assessment information on a set of access tracks linking the proposed Llanbrynmair Wind Farm and the adjacent proposed Carnedd Wen Wind Farm.
- 1.3.2 As part of the proposed Llanbrynmair Wind Farm, Abnormal Indivisible Loads (AILs) would use the Llanerfyl to Talerddig minor road in order to access the site, as detailed in the August 2013 SEI. Powys County Council (PCC) has requested that RES consider an alternative shared access arrangement with the adjacent Carnedd Wen scheme.
- 1.3.3 PCC developed an outline alternative access proposal connecting the two sites and presented indicative information during Session 2 of the Mid Wales (Powys) Conjoined Public Inquiry. This consisted of two relatively short sections of access track to allow for the movement of Abnormal Indivisible Loads (AILs) and construction traffic inter-connection between the two schemes.
- 1.3.4 In the event that the proposed access for AILs using the Llanerfyl to Talerddig minor road is considered unacceptable by the Secretary of State, environmental information has been prepared as part of this SEI for the alternative AIL access route.

- 1.3.5 This SEI comprises further and revised information which is subject to the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (as amended).
- 1.3.6 The SEI is contained within two separate volumes:
- Volume I: Non-Technical Summary; and
  - Volume II: Main Text, Supporting Figures and Supporting Appendices.



**PART 1 - ADDITIONAL INFORMATION ON THE LLANERFYL TO TALERDDIG ACCESS ROUTE**

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## 2. ACCESS ROUTE ECOLOGICAL SURVEYS

### 2.1 Introduction

- 2.1.1 This section assesses the potential ecological impact of proposed works along the county road from Llanerfyl to Talerddig. The assessment provides baseline information, identifies potential impacts of the proposal on the ecology of the area, assesses the significance of those impacts, describes mitigation measures to avoid, reduce, remedy or compensate for those impacts, and assesses the significance of the residual effects based on the magnitude of the impact and the sensitivity of the receptor.
- 2.1.2 Surveys were carried out to assess the habitats, to look for the presence of protected species (including badger, otter and dormouse), and to determine where peat is present. Sections of the access route referred to are shown in the figures in Llanbrynmair SEI August 2013, Volume II - C, Transport appendices and figures.
- 2.1.3 The reader should note that the results set out in this chapter from survey work completed before August 2013 were omitted from the August 2013 SEI in error. Its inclusion in this SEI is intended to be viewed in conjunction with Chapter 5 of the August 2013 SEI.

### 2.2 Habitat Surveys

- 2.2.1 Surveys of verges, hedges, trees, rivers and riverbanks, and adjacent fields and other habitats, along the proposed access route for the Proposed Development were undertaken for all areas where works are proposed.
- 2.2.2 Habitat surveys were carried out in August 2010 and repeated in April 2013, with further visits in May 2013 following minor changes to the physical works proposed. In addition further visits have been made through October and November 2013 to further clarify and confirm assessments.
- 2.2.3 All sections where works are proposed were visited by an experienced surveyor and the habitats were classified using the categories described in the Phase 1 Handbook and any areas of particular interest were noted. This is a standard habitat classification. An area of peat habitat on the proposed Neinthirion bypass was classified further using National Vegetation Classification (NVC). A peat survey was undertaken across this section. All other areas of proposed widening were also checked for presence of peat. The main lengths of proposed works considered as having potential for peat, based on habitats present, were Sections 2.4 - 2.8. Sections of the access tracks have previously been assessed as part of the whole site peat assessment.
- 2.2.4 The results for the original survey were presented in SEI 2 (2011) and represented in the August 2013 SEI. No significant changes were noted between the surveys in 2011 and 2013, although there are minor differences in the reported results due to changes in the areas and types of work proposed.

#### Results

- 2.2.5 The results for each section are shown in **Appendix 2.1**. The hedges varied from species-rich sections to relatively newly planted hawthorn hedge. Two small areas of hazel coppice are also affected and some scrub and plantation woodland.
- 2.2.6 Verges were mainly semi-improved or improved grassland with a low diversity of species.
- 2.2.7 Only two main areas of verge / open habitat were identified as being of conservation interest. The first is a section of the proposed Neinthirion bypass that crosses an area of peat. This was classified in NVC terms as U6 derived from M17 mire, M17, M25 and M6. The area has been much modified by drainage and grazing. A full description is given in **Appendix 2.2**. The second is an area of unimproved grassland within a longer section of improved and semi-improved verge at Section 2.17.

- 2.2.8 No peat was found following probing of areas of proposed works between Sections 2.4 and 2.8. Probes across the route of the Neinthirion bypass found depths of between 30 and 50 cm. Full results are given in **Appendix 2.2**.
- 2.2.9 The hedges and verges are considered typical of roadside habitats found across Montgomeryshire.

#### Assessment

- 2.2.10 The proposed works include the removal of a total of 1532 metres of hedgerows of varying quality, and whilst hedgerows such as those found along the route are a common habitat in this area, this is still considered a significant impact.
- 2.2.11 Hedgerows are listed as a priority habitat under Section 42 of the NERC Act 2006. They are also included within the linear habitats plan under the Powys Biodiversity Action Plan. This states (Target 2): *“Ensure that there is no net loss [Powys BAP italics] of species-rich hedgerows and verges in Powys. Encourage replacement of hedgerows lost through development or agricultural activity.”*
- 2.2.12 The proposal to plant 2373 metres of hedge, of a mixture of native woody species, ensures there is no net loss. It is acknowledged that new hedges will not replace lost hedges like for like but it is considered that, using techniques to provide immediate connectivity and with careful management, the new hedgerows will be functioning as hedgerow habitat within 5 years of planting and will continue to improve with continuing management. As many of the new hedges will be separated from the road by a wider verge than at present they will not need to be flailed back each year and can be managed to retain fruiting branches which will enhance their value for wildlife. Where hedges are to be relocated by pushing back existing hedges and banks, the sections will be carefully monitored and any sections where hedges do not regrow will be planted up with appropriate species of local provenance, thus ensuring no loss of hedge in these sections.
- 2.2.13 The proposal also involves the felling of 52 individual trees of varying age and size. These are to be replaced by planting 143 trees. Whilst it is acknowledged that mature trees cannot be immediately replaced by new planting it is considered that the additional new planting will over time compensate for the trees lost. The trees to be lost are spread out along the route and there is no major felling at any one point. Thus it is considered that, within the entirety of the route and within the overall landscape, this is not a significant loss. In addition to the individual trees assessed above, small areas of woodland and hazel coppice will also be lost. At Section 1.14 10 coppiced hazel and 5 Wych elms will be lost. There is 0.3 ha of coppice habitat here, of which 45 square metres or 1.5% will be lost. At Section 1.15 20 hazel coppice stools will be lost and 8 coppice stools are on the edge of the proposed works. There may be some minor impact on these 8 stools but they will not need to be removed. In total 40% of hazel coppice will be lost on this section, although there is a further 1.21 ha of hazel coppice adjacent that will be unaffected. Therefore it is a small proportion of the coppice habitat at these sites that will be affected and the hazel will be replanted at the back of each section and managed appropriately, thus there will be no overall loss of habitat. At Gosen bridge (Sections 1.20 and 1.21) as well as individual trees (included in the above total) an area of woodland, comprising immature ash, birch and hazel will be felled. Following construction this woodland will be replanted. At Dolwen Isaf a small conifer plantation will be replaced by new planting of native species, including oak with a hazel understorey. This is considered to be a net ecological gain. Also at Dolwen Isaf, an area on the northern side of the road will be lost. This comprises a small copse of grey willow which grades into an area of young trees and scrub, mainly birch and alder. The earthworks will be replanted a mix of native trees post-construction, leaving a small net loss.

- 2.2.14 A total of 21676 sq m of highway widening will be required. Of this, 90.1%, or 19711 sq m is 'soft' widening. Where the ground is firm enough Geogrid will be pushed into the existing soil. This will retain existing vegetation to an extent although it is acknowledged that there will be some compaction of the soil from vehicle passes. Where the ground is softer it will be excavated, a stone base added, and the original topsoil used to infill the Geogrid. This will have more impact with greater disturbance and change in the drainage of the sections but vegetation will re-establish. Many of the overrun sections will establish wider verges than at present, separated from the agricultural fields, with potential for future sympathetic management.
- 2.2.15 Verges are recognised as having value as refuges for wildlife and can support remnants of higher quality vegetation compared with the adjacent often agriculturally improved fields. PCC operates a roadside verge nature reserve scheme. None of the verges along the access route have been designated in this scheme. Lowland dry acid grassland is included within Section 42 of the NERC Act 2006 and within the Powys BAP, although definition of this habitat is problematic (JNCC UK BAP Priority Habitat descriptions 2008). Acid grassland is widespread in Montgomeryshire and across Wales, with unimproved dry acid grassland being the most extensive semi-natural grassland in Montgomeryshire (Powys BAP and Trueman et al 1995). The areas of primary conservation concern for lowland dry acid grassland in Powys are those at lower altitudes, away from the upland fringes, where the species-rich examples often occur (Powys BAP). The small areas on the verges affected along the access route are on the upland fringes, are not species-rich, and are of low conservation concern.
- 2.2.16 The verge at Section 2.17 was classified as semi-improved grassland overall. Towards the centre of this section a short stretch of verge is reasonably diverse, damp unimproved neutral grassland, with Devil's-bit Scabious and Meadowsweet. This stretch is considered to be of conservation interest, but is only a small proportion (approximately a tenth) of the 400m section. There will be some impact on this stretch, although the method of strengthening the verges with Geogrid, as described above, will mean that much of the vegetation is likely to remain.
- 2.2.17 Another way of expressing the conservation interest of the verges is to use a list of axiophytes or 'worthy plants' for the county (Botanical Society of the British Isles (a) [BSBI] 2013). Although we did not use this technique, we have consulted the list of axiophytes for Montgomeryshire. None of the scarcer axiophytes mentioned in the developing rare plant register for Montgomeryshire (BSBI (b) 2013) were recorded and less than 20 of the 360 axiophytes for Montgomeryshire were incidentally noted as present within the verges, and the areas they covered along the access route were scattered and not extensive.
- 2.2.18 The short section of the Neinthirion bypass that crosses 50 metres of peat habitat will have an impact on blanket bog - this is also a Section 42 Habitat and a UK BAP habitat. Although the short section to be impacted is not considered to be in good condition (especially compared with the central unaffected area of this habitat to the south) it is nonetheless a significant impact. However, this should be seen in the context of the entire site and the proposals for a peat management plan during construction to mitigate impacts, and also a major Habitat Management Plan (HMP). The HMP includes the restoration of 347 ha of blanket bog and mire (including the addition of HMA 3 into the peat restoration programme, as requested by NRW) and the removal of 149 ha of conifer plantation from former peat habitats, along with the restoration of additional habitats of conservation importance. This plan has been agreed with NRW.
- 2.2.19 Overall, it is considered that, following replanting of hedges and trees, and with management of hedges and verges, there will be no long-term significant adverse impact on the conservation interest of the area.

## 2.3 Otter Surveys

- 2.3.1 Otter surveys were carried out following the methods outlined in *The new rivers and wildlife handbook* (RSPB, NRA & RSNL 1994). The riverbanks and any notable features were searched, mainly by walking the bank. Some wading was necessary to check all areas such as within the Gosen gorge.
- 2.3.2 Presence of otters along the river was assumed in the rivers. This assumption was based on survey results from the wind farm site where spraints were found near Cannon Farm and experience of otters in Montgomeryshire where they are known to be present on most rivers. The purpose of the further surveys was not, therefore, to confirm the presence or absence of otters from the rivers but rather to assess the potential impact of the proposed works on otters. It was for this reason that an area of 100m either side of the proposed works was assessed for evidence of holts, lying up areas and other signs of otter.
- 2.3.3 The area surveyed is therefore considered to be appropriate in order to assess the impact on otters of the proposed works to the county road.
- 2.3.4 Otter surveys were undertaken in 2010 and 2013. In 2010, the surveys were undertaken in August over a number of days. In 2013, the otter surveys were undertaken on 10th and 11th May 2013. On both surveys the river was in a state of low flow and most banks and areas beneath bridges accessible.
- 2.3.5 In 2010, otter surveys were undertaken at the following locations:
- Glen Menial Bridge (chainage 460-590);
  - Diosg Bridge (chainage 875-950);
  - Gosen Bridge (chainage 4335 - 4600) (there was limited access to the gorge on this occasion, so the area was surveyed from the bridge with binoculars);
  - Dolwen Isaf and Dolwen Uchaf Bridges (chainage 7400 - 7670);
  - The river banks at chainage 10410 to 10550;
  - The bridge at chainage 12450.
- 2.3.6 In 2013, the otter surveys were undertaken at the following locations:
- Glen Menial Bridge (chainage 460-590);
  - Diosg Bridge (chainage 875-950);
  - Gosen Bridge (chainage 4335 - 4600);
  - Dolwen Isaf bridge (chainage 7400 - 7550);
  - Dolwen Uchaf Bridge (chainage 7500 - 7670);
  - Culverts at Site Access 1 (chainage 8250 and 8330);
  - Proposed water crossing at the start of Neinthirion bypass;
  - Proposed water course crossings on the bypass section (chainage 280 and 650);
  - The river banks at chainage 10410 to 10550;
  - The culvert at chainage 10752;
  - The culvert at chainage 11658;
  - The culvert at chainage 12059;
  - The bridge at chainage 12450.



- 2.3.7 At Gosen bridge, the survey covered the area from the minor road bridge to the confluence on both sides of the river, and upstream to 100 m above the bridge. The site was accessed from the minor road bridge and the road immediately south of Gosen Bridge for the main Afon Gam and through the woodland area below the bridge and from the fields 100m above the bridge along the Afon Cledan. A short section (approximately 20m) immediately upstream of the bridge was not accessible due to a fallen tree and river bed conditions (where the rocky bed was too smooth to walk on safely) , but was surveyed from below within the stream and from above (from the bridge) with binoculars. The use of the binoculars gave clear vision and so the lack of direct access was not an issue.
- 2.3.8 At Dolwen Isaf crossing, surveys were undertaken from SH979074 upstream to SH976072 along the Afon Gam, and from confluence to SH975074 upstream along Nant Ffriddycastell towards Dolwen farm including minor watercourse and drainage channel. This includes the bridge at Dolwen Uchaf.
- 2.3.9 At Neinthirion the area of the proposed water crossing and a stretch 100 metres up and down stream were surveyed.
- 2.3.10 No signs of otter were found during either of the surveys (in 2010 and 2013). Since the original survey spraints have been found on a rocky ledge under Dolwen Isaf Bridge.
- 2.3.11 There is potential for holts and lying up areas in the areas where physical works are proposed. These include the areas of tree roots and fallen trees around Gosen Bridge, and the areas of wooded bank immediately up and down stream of Dolwen Isaf Bridge. Such areas have been specifically surveyed. There was however no evidence of otters.
- 2.3.12 Otter are protected from deliberate killing and disturbance under the Habitats and Species Regulations 2010. They are also listed under Section 42 of the NERC Act 2006 as a species of principle importance for conservation.
- 2.3.13 The works proposed at the Dolwen Isaf Bridge involve very little, if any, in-channel work, therefore it is concluded that there is no possibility of a negative impact on otters. The river will not be blocked and no riverbank will be cleared. The sprainting point on the rocky ledge will be unaffected and Otters will continue to be able to use the river as a transitory habitat without any material adverse impact.
- 2.3.14 The works proposed at Gosen, involving the bank works on the southern bank of the Afon Gam; do have potential to disturb otter if they are using this section of bank at the time of proposed works. There is no evidence of holts, or lie up areas (or any other evidence of otters) on the basis of the surveys. The crash deck will be raised above the river with minimum footings onto the river bed, thus causing minimum impact to the river bed. In addition at the northern bank the crash deck will be raised above the bank to allow passage of otter beneath it along the existing river bank. Otter will continue to be able to pass along the rivers. Due to the potential for otter, a preconstruction survey will be required prior to any works commencing to ensure that otters are not using this section of bank at the time of the proposed works. In this way, there will be no material adverse impact on otters at Gosen Bridge.
- 2.3.15 The proposed crossing for the Neinthirion bypass includes some habitat that is a possible lie up area for otters. This will, therefore, be re-surveyed prior to any works. The minor river and culvert crossings are not considered to have any potential to impact on otters.
- 2.3.16 If an active otter holt or lying up area is found during the pre-construction surveys then a mitigation plan will be put into place and if necessary a licence application will be made to NRW. Works that can be expected to cause disturbance to otters or may damage or destroy their places of shelter, would only proceed after the appropriate licence has been issued by NRW. Possible mitigation would include clearly marking an area of at least 30m (SNH, 2013) around any active holt and ensuring that it is out of bounds at all times. If a holt needs to be destroyed this could only be done after appropriate discussions with, and licence from, NRW. Pre-construction an artificial replacement holt could be provided and would be provided post-construction in any event.

2.3.17 Further mitigation is proposed within the wind farm HMP with streamside planting and installation of artificial otter holts. For a significant effect on the local distribution or abundance of a species to occur (and therefore an offence to be committed), disturbance would need to produce more than a transient effect (NE/CCW, 2007). It is not considered that the proposed works could have anything more than a transient effect. It is not considered, therefore, that there will be any material adverse impact on otters as a result of the proposed access route works and, on the basis of the current survey evidence a licence is not deemed necessary.

## 2.4 Badger Surveys

2.4.1 All areas where works are proposed were surveyed for badger and surveys were carried out following the methods outlined in Best Practice Guidance - Badger surveys (SNH, 2006). This guidance confirms that the dates for the survey in 2013 were appropriate. The optimum time for badger surveys is February to April. Surveys included a 30 metre buffer, this being the distance recommended for separation of works by heavy machinery in CCW's guidance (Badgers - guidelines for developers - 2011).

2.4.2 All areas to be impacted were searched for signs of badger including:

- Faeces (latrine sites).
- Setts, comprising either single isolated holes or a series of holes.
- Paths between setts or leading to feeding areas.
- Scratching posts at the base of tree trunks.
- Snuffle holes (small scrapes where badgers have searched for insects, earthworms and plant tubers).
- Day nests (bundles of grass and other vegetation where badgers may sleep above ground).
- Hair traces.
- Footprints.

2.4.3 Surveys for signs of badger were undertaken in August 2010 as part of the habitat assessment. All areas then proposed to have works were checked. Signs of badger were found at Section 1.14 (chainage 2970 - 3050 - unoccupied holes); Section 1.15 (chainage 3340 - 3450 - unoccupied hole and fresh latrine); and Dolwen Isaf (chainage 7300 - latrines).

2.4.4 Surveys of known sites from the previous surveys were carried out during site visits in March 2013. All areas where works are proposed were visited during the habitat survey in April 2013, with additional visits in May 2013 following minor changes to the proposed works.

2.4.5 No signs of badgers were found in the March, April and May 2013 surveys. The holes found in 2010 found at Section 1.14 (chainage 2970 - 3050) and Section 1.15 (chainage 3340 - 3450) were still present but appeared unused and no latrines were located.

2.4.6 Badgers are protected under the Protection of Badgers Act 1992. As no active badger setts were found no disturbance can take place and no mitigation is required. However, as stated in the SNH guidance, badger populations are dynamic: sett status, sett distribution, badger numbers and social group composition can change over time therefore new surveys will be undertaken immediately prior to any works starting.

2.4.7 It is not considered, therefore, that there will be any material adverse impact on badgers as a result of the proposed access route works.

## 2.5 Dormouse Surveys

- 2.5.1 During the 2010 survey, sections were identified that were considered suitable for dormouse. These were areas of hazel coppice. Best practice methods from the Dormouse Conservation Handbook were followed. A desk study was undertaken, and then a search for gnawed nuts was undertaken at each site. As there was not sufficient habitat available to survey replicate 10 x 10 metre plots the alternative method of collecting at least 100 nuts was employed. These were then examined using a hand lens to ascertain which species had opened the nut.
- 2.5.2 The Handbook explains that the *“best way to establish dormouse presence at a site is to look for gnawed hazel nuts...Although this is obviously impractical where hazel is absent, it is worth searching any adjacent areas with hazel to see if dormice are nearby and thus likely to be present on the site under investigation”*.
- 2.5.3 Section 3.3 of the Handbook addresses “Dormouse surveys - good practice recommendations”. It states *“if the presence of dormouse is possible, carry out a survey using a recommended method”*. It can be noted that this guidance refers to Table 6, In Table 6 searching for gnawed hazel nuts is identified as the first survey method and that it is “the most efficient” method.
- 2.5.4 A desk study was undertaken in 2010. No Dormouse records were found from Cwm Eira at all. The only record within the two 10 km squares that cover the area was as a record from 1988 in Coed Cwm Byr (SH917023) of hazel nuts with signs of dormouse.
- 2.5.5 At Section 1.17, following further investigation in December 2010, very little suitable habitat was found after close inspection, and no hazel nuts found. At Section 1.14 a total of 148 gnawed nuts were collected. The species responsible were identified as follows:
- Bank vole - 11
  - Wood mouse - 5
  - Squirrel - 103
  - Bird - 28
  - Unknown - 1
- 2.5.6 Therefore there were no signs of dormouse on the sections of potentially suitable habitat that may be impacted. No further Sections of high potential dormouse habitat were identified in surveys following changes to designs in spring 2013. The habitat was considered to be of low quality as the areas of coppice are rather dark and damp with little ground flora and no evidence of dormouse was found. Hedges were heavily flailed and contained little potential food. Within the valley there are areas of woodland that are considered far more suitable for dormouse should they be present in the area. On the basis of this combined evidence the assessment was made that dormice are unlikely to be present and therefore there is no need to undertake a further detailed survey. The results of these were submitted to CCW within SEI 2 in 2011. No concerns about the level of survey or survey method were raised by CCW at that time.
- 2.5.7 However, the Handbook also makes it clear that it is virtually impossible to prove that dormice are absent. Therefore a precautionary approach to the proposed works has been taken. The hedgerow works are proposed to be undertaken as follows:
- 2.5.8 A re-survey will be undertaken in the year prior to any works commencing. Where possible hedgerows will be translocated. Where hedgerow removal and replacement is required existing hedgerows will be cut down to approximately 30-50cm above ground level during November to the end of February. Clearance of the stumps can then be undertaken from mid to late May.
- 2.5.9 Hedgerow vegetation will be removed using hand tools/hand-held machinery. Cut vegetation will be moved away from the hedge and left overnight and some of the brash will be retained on site to be used as dead hedging.

- 2.5.10 Once the work is done, any gaps in the translocated hedgerow or the new hedge line will be planted with local provenance native hedge plants to include a range of species to reflect the removed hedge but also where possible to include hazel and species that can provide food quickly. A hazel may take 5 years or more before fruiting, so species such as bramble, honeysuckle, dog rose, hawthorn, which can grow quickly and provide early-season food for all wildlife, and a range of species for later in the year including blackthorn, elder and crab apple will be included in the species mix. Dead-hedge material will be included amongst the new whips to help provide quick and continuous cover so that there is a corridor connecting the hedge sections. This dead material can be any branches which have been cut recently from nearby, and placed horizontally along the hedge line, woven around interspersed 1m-long 'pegs' of branches to keep this material upright.
- 2.5.11 Where possible hedgerow management will be undertaken under a long term management agreement to maintain hedge structure and limiting flailing to ensure maximum food availability for wildlife.
- 2.5.12 Dormice are protected from deliberate killing and disturbance under the Habitats and Species Regulations 2012. They are also listed under Section 42 of the NERC Act 2006 as a species of principle importance for conservation.
- 2.5.13 Notwithstanding the fact that surveys using recommended methods have shown the absence of dormouse, it is considered that, by employing the methods given above, there is no possibility of deliberately killing or disturbing dormouse even if they were to be present. The methods for removing and relocating hedges mean that the potential for impact on any potential animal's ability to breed, hibernate or migrate has been minimised as far as is practically possible. There is a great deal of similar habitat available in the area and only a very small proportion will be impacted. Even during the period that works are being undertaken it is considered unlikely that there could be a significant adverse impact on any populations of any species overall. Following hedge restoration there will be more hedgerows present, with greater connectivity to other habitat features and therefore there is no mechanism to affect the local distribution or abundance of any species. For a significant effect on the local distribution or abundance of a species to occur (and therefore an offence to be committed), disturbance would need to produce more than a transient effect (NE/CCW, 2007). It is not considered that the proposed works, with the proposed mitigation, could have anything more than a transient effect.
- 2.5.14 As with other protected species, further survey will be carried out prior to development to ensure no change in the distribution of dormouse has occurred. It is concluded that, despite surveys showing no signs of dormouse, the proposed works will not have any effect on the favourable conservation status of dormouse if they were present in this area.
- 2.5.15 On the basis of this evidence, it is not considered likely that a survey will be required.

## 2.6 Conclusions

- 2.6.1 Extensive surveys have been undertaken over a number of years to assess the potential impact of works proposed along the access route. Potential impacts on areas of hedges and peat habitats are considered significant, but following mitigation and enhancement proposals are assessed as having no long-term adverse impact. The impacts on verges are not considered significant.

## 2.7 References

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### 3. BATS

#### 3.1 Introduction

3.1.1 This section has been prepared in response to queries raised by Powys County Council (PCC) and Natural Resources for Wales (NRW) in relation to the October 2013 Bat SEI. Without prejudice to the contention that the October 2013 Bat SEI was adequate, this SEI contains further information concerning potential effects of the proposed access route between Llanerfyl and Talerddig on bats and in relation to the following:

- Bridges and Culverts;
- Additional trees and woodland;
- Roost information within the Carnedd Wen ES; and
- Clarification and corrections to information provided as part of the October 2013 Bat SEI.

3.1.2 For the purposes of this SEI the term ‘significant roost’ refers to those places used by bats for breeding (i.e. maternity roosts used to raise young) and hibernation sites that provide suitable roosting conditions in the winter months for prolonged periods during cold weather. These roosting locations are considered to be of particular significance as they provide the particular conditions necessary to successfully raise young or to survive the winter period. As such they are vital to the survival of the local bat population and they are often used regularly from one year to the next, for sustained periods of time during the relevant season and often by groups of bats.

#### 3.2 Bridges and Culverts

3.2.1 In the original Bat SEI two bridges, Gosen Bridge and Diosig Bridge were subject to detailed visual inspection in accordance with best practice<sup>1</sup>, and where accessible, an endoscope survey of cracks and crevices. They were also subject to emergence and re-entry roost surveys. Bridges and culverts that were not identified as being directly affected were scoped out of the assessment. Since the original bat survey work was undertaken in April-August 2013 additional works to Dolwen Isaf and Glen Menial bridges have been identified by RES as a result of on-going discussions with PCC and as such these have been subject to further detailed visual inspection, including survey with an endoscope in accordance with best practice. The methods and results of these surveys are presented below. In addition NRW, requested information on all bridges and culverts along the route. An inspection of these structures on the 18th November 2013 has been made and the results are detailed in Table 3.1.

3.2.2 Glen Menial Bridge and Dolwen Isaf Bridge were surveyed on the 13th and 18th of November. Both bridges are low and all parts of each bridge were accessible enabling close visual inspection of any cracks or crevices using an endoscope. The results of the surveys and an assessment of whether the structures are likely to be used by roosting bats are presented below. The ability to inspect all features of the bridges that have roosting potential (with an endoscope) means that the survey work was reliable and comprehensive (no roosting features have not been inspected) and that the information is sufficient for an assessment of likely effects to be made.

##### Glen Menial Bridge

3.2.3 This is a small bridge constructed from stone with a stone parapet wall on either side of the bridge with the road surface joining the base of each parapet wall (Photograph 1). The arch of the bridge is low being approximately 1.25 to 1.5 metres above the water surface at its highest point. On the southern side of the bridge is a wooden pedestrian bridge with wooden hand rails on either side (Photograph 1 - Appendix 3.1).

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<sup>1</sup> BCT Bat Survey Guidelines (2012)



- 3.2.4 There are no cracks on the underside of the bridge which appears to have been re-pointed relatively recently and as such no roosting opportunities for bats (**Photograph 2 - Appendix 3.1**). On the northern side of the bridge there are limited cracks in the facing stone on the bridge arch and parapet wall (**Photograph 3 - Appendix 3.1**). In general, the cracks are shallow and very narrow with no bat roosting potential. One crack, however, is larger and extends through the northern parapet wall opening onto the road side at road level. Whilst this is a crevice of a size suitable for use by bats it is open to water seepage off the road and accessible to predators and as such I consider that it is unlikely to be used as a roost. An old ivy stem is visible within the crevice and no evidence of use by bats (scratches at entrances, characteristic staining or smooth stone surfaces indicating movement in and out by bats and no droppings inside the crack were visible) was recorded from the endoscope survey undertaken.
- 3.2.5 On the southern side of the bridge there are a number of deeper horizontal (**Photograph 4 - Appendix 3.1**) and vertical cracks between the stone work on the bridge arch. The parapet wall however, is in good condition with no roosting potential for bats. The cracks on the southern side of the bridge are mainly beneath the level of the wooden pedestrian bridge. They extend into the bridge arch and have potential to be used for roosting. The endoscope survey did not record any evidence of use by bats (droppings, scratch marks or smooth stone surfaces).
- 3.2.6 Based on the detailed visual and endoscope survey that accessed all parts of the bridge no evidence of use by bats was recorded. The bridge however, does have potential to be used owing to the presence of deep and substantial cracks on the southern arch. The underside of the bridge has no roosting potential as there are no cracks available for roosting. The northern arch and parapet wall has low potential (due to the condition of the one suitable crack) and the southern arch has good roosting potential. The lack of evidence of use by bats suggests that, if being used by bats, these cracks and crevices do not support significant roosts and are most likely to be transitory roosts being used by one or two bats. Such roosts are often one of a number of similar locations within the foraging area used by a bat with each roost often being used for short periods of time during the active (spring to autumn) season.
- 3.2.7 The proposed works to this bridge will include the removal of the wooden hand rail from the pedestrian footbridge on the southern side of the road bridge which will not have any impact on roosting opportunities on the south facing arch of the bridge. The works to the north facing arch and parapet wall will result in the removal of the parapet wall and the slight widening of the bridge and re-construction of the parapet wall. This will result in the loss of the crack through the parapet wall. No evidence of use by bats has been recorded from this crack and it is assessed as having low roosting potential and unlikely to be used by bats.
- 3.2.8 It is considered likely that if planning consent were to be granted that works on the access route would not commence for a number of years. If there is a delay in the start of works to this bridge of more than two years it is recommended that the survey of the bridge is repeated to provide an updated understanding of the use of the bridge, which will inform how the works should be undertaken. This is a standard best practice recommendation<sup>2</sup> aimed at ensuring that up to date information is used to inform how works should best proceed and does not indicate that the current information on which the assessment of likely impacts is based is inadequate.
- 3.2.9 If bats, or evidence of bats being present, are found during the update surveys then the status of the (now confirmed) bat roost would need to be assessed and NRW should be contacted prior to this work taking place to discuss the requirement or otherwise to carry out any mitigation measures under a European Protected Species Licence.

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<sup>2</sup> This guidance is provided by NRW in the FAQs document found on the NRW website <http://naturalresourceswales.gov.uk/apply-buy-report/apply-buy-grid/protected-species-licensing/european-protected-species-licensing/bats/?lang=en#.UrfoQPRdWSq>

- 3.2.10 A licence would only be required if it was determined that there would be the loss of, or damage to, a place of rest or breeding or disturbance such that it would impair the ability of the species to survive, breed, reproduce or rear or nurture their young, hibernate, migrate or affect significantly the abundance or local distribution to which the species belongs.
- 3.2.11 It is considered that it is too early to confidently state whether a licence will be required especially if the potential offence was one of disturbance, not destruction/loss of a roost, as seems likely in this situation. Much would depend on the use of the bridge at the time of the works, the timing of the work and the methods by which the works are implemented. However, it is not possible to state categorically that a licence would not be required. The need for a licence would be determined in discussion with NRW closer to the time of the implementation of works, informed by updated survey information and a finalised method of working (including timing of the works).
- 3.2.12 Given the results of the survey work carried out in 2013, it is unlikely that a significant roost would be found following updated surveys. If bats are found to be roosting in cracks on the southern side of the bridges then the principal potential impact would be disturbance. In this circumstance mitigation options may involve timing of works so that they occur when bats are not present, or for works to be undertaken in such a manner that disturbance is unlikely to occur. Alternatively bats could be temporarily prevented from accessing roosting sites whilst works are undertaken with roosts being reopened once work has been completed. These approaches would have very limited impacts on transitory roosts and would not result in an adverse impact on the favourable conservation status of local bat populations.
- 3.2.13 If despite its low quality as a potential roost site, bats are found to be using the crack in the northern parapet wall then the works would result in the loss of the roost. Works would have to be timed so as to occur when bats are not present and as proposed above a replacement roosting feature would need to be built into the new bridge arch and parapet wall. With the replacement roost there would be no net loss of roosts for bats and no adverse impact on the favourable conservation status of local bat populations.
- 3.2.14 If no roosts or evidence of roosts are found following update surveys then the proposed installation of a purpose built roost in the new arch and parapet wall on the northern side of the bridge would result in an improvement of roosting opportunities for bats.

#### **Dolwen Isaf Bridge**

- 3.2.15 This is a bridge of modern construction of concrete spans sitting upon a central abutment and two riverside abutments. The span of the bridge is approximately 17 metres long and 6 metres wide.
- 3.2.16 The facing stone on the retaining walls, abutment walls and central pillar support are in good condition and do not have cracks that could be used by bats. The concrete span is comprised of a number of units abutting each other with a broad V shaped notch between each unit on the underside of the bridge. The notches are open and shallow and backed by an artificial membrane preventing access into any deeper spaces there might be between the span units. Many are also covered in cobwebs indicating no recent use by bats. The notches between the concrete units are not considered suitable for roosting being very shallow and open.



- 3.2.17 There are horizontal crevices between the underside of the bridge span and the abutment walls. These were inspected with an endoscope. A number were filled with cobwebs and other material indicating no use by bats and the gaps above the northern abutment wall are very wet with water seepage making them unsuitable as roost sites. The crevices are about 20 mm wide and between 50 and 100 mm deep. No deep cracks or crevices were present. No bats or signs of bat use (droppings, scratch marks or smooth stone surfaces) were found. The size and nature of the horizontal gap between the underside of the bridge and the abutment walls provides limited roosting potential and as such it is considered unlikely that the bridge is used by a significant roost due to the relatively shallow and open nature of the crevices. However they could be used by small numbers of bats as transitory. Such roosts are often one of a number of similar locations within the foraging area used by a bat with each roost often being used for short periods of time during the active (spring to autumn) season.
- 3.2.18 The works to this bridge are likely to be limited to the replacement of the existing metal barrier on the eastern side of the bridge with a demountable barrier to allow the passing of the AILs. These works would have no impact on roosting potential of the bridge and are very unlikely to affect roosting bats if present. There remains a possibility that the bridge may need to be widened by up to 1 metre. If this is necessary then the existing abutments on the eastern side of the bridge would be extended and a new bridge deck added to the existing deck. The works would have the potential to disturb bats if they were using the bridge at the time of the works, but would not result in the loss or damage of potential roosting locations. If an extension of the bridge is required it is recommended that additional roosting features are designed into the new bridge section which would increase its potential to be used as a bat roost.
- 3.2.19 If there is a delay in the start of works to this bridge of more than two seasons it is recommended that the survey of the bridge is repeated to provide an updated understanding of the use of the bridge, which will inform how the works should be undertaken. This is a standard best practice recommendation aimed at ensuring up to date information is used to inform how works should proceed, given the mobile and often temporary nature of bat roosts. It does not indicate that the current information on which the assessment of likely impacts is based is inadequate.
- 3.2.20 The proposed works including the option to widen the bridge deck will not result in the loss of any potential roosting feature and as such the only potential impact on roosts is disturbance whilst the works take place. In this circumstance mitigation options may involve timing of works so that they occur when bats are not present, or for works to be undertaken in such a manner that disturbance is unlikely to occur. Alternatively bats could be temporarily prevented from accessing roosting sites close to the southern side of the bridge whilst works are undertaken with roosts being reopened once work has been completed. These approaches would have very limited impacts on transitory roosts and would not result in an adverse impact on the favourable conservation status of local bat populations.
- 3.2.21 It is considered that it is too early to confidently state whether a licence will be required especially as the potential offence is one of disturbance, not destruction/loss of a roost. Much would depend on the use of the bridge at the time of the works, the timing of the work and the methods by which the works are implemented. However, it is not possible to state categorically that a licence would not be required. The need for a licence would be determined in discussion with NRW closer to the time of the implementation of works, informed by updated survey information and a finalised method of working (including timing of the works).

Table 3.1: Bridges and Culverts along the access route

Structure	Nature of impact	Chainage	Plan No.*	Roosting Potential	Notes
Pipe culvert	Structural strength TBC.	6950-7000	603832 48-D-011	No	Single 900mm diameter pipe. The pipe was not damaged or displaced with no potential roosting features (PRF). Partially buried and filled with running water.
Dolwen Uchaf bridge	None	7500-7550	603824 8-D-012	No	Similar structure to the Dolwen Isaf bridge with no suitable roosting habitat on the underside of the bridge span, the retaining walls or the abutment walls. The horizontal gap between the underside of the bridge span and the top of the abutment wall is approximately 20 mm wide and between 50 and 100 mm deep. On both sides this gap was very wet and water seepage runs were evident reducing the potential for this gap to be used for roosting.
Pipe culvert	Minimal earthworks.	7950-8000	603832 48-D-013	No	Single 900mm diameter pipe. The pipe was not damaged or displaced with no PRF.
Pipe culvert	Structural strength TBC.	8250-8300	603832 48-D-015	No	Double pipes of 900mm diameter. The pipe was not damaged or displaced with no PRF.
Pipe culvert	Structural strength TBC.	8300-8350	603832 48-D-015	No	Double pipes of 900mm diameter. The pipe was not damaged or displaced with no PRF.
Box culvert	Culvert to be extended to the north and tied into new land drain.	10600-10650	603832 48-D-019	No	Dimensions, 300mmx1m. Structure is smooth with no PRF.
Bridge and pipe culvert	To be widened and lengthened on north side.	10750-10800	603832 48-D-019	No	Triple 900mm pipes not damaged or displaced with no PRF. Abutting walls no PRF.
Pipe culvert	Extended and strength checked post-planning.	11900-11950	603832 48-D-021	No	Single 300mm diameter pipe. Was blocked with north end submerged.

Structure	Nature of impact	Chainage	Plan No.*	Roosting Potential	Notes
Pipe culvert	Extended and strength checked post-planning.	11950-12000	603832 48-D-021	No	Double 300mm diameter pipes, not damaged or displaced with no PRF.
Pipe culvert	Extended and strength checked post-planning.	12050-13000	603832 48-D-021	No	Double 900mm diameter pipes, not damaged or displaced with no PRF.
Bridge	None	12400-12450	603832 48-D-022	Low	Low potential roosting opportunities at junction between side wall of bridge and underside of span bridge span (as Dolwen Isaf Bridge). Bridge not affected by works
Pipe culvert	None	12750-12800	603832 48-D-022	No	Single 900mm diameter pipe. The pipe was not damaged or displaced with no PRF.
Pipe culvert	Extended to suit	13100-13150	603832 48-D-024	No	Single 300mm diameter pipe. The pipe was not damaged or displaced with no PRF.
Pipe culvert	Extending under grass reinforcement area	15780	603832 48-D-027	No	Single 900mm diameter pipe. The pipe was not damaged or displaced with no PRF.
Talerddig junction Bridge	None	17450	602832 48-D-030	No	It is of metal construct with support beams sitting on abutments. The retaining walls and abutments provide no roosting opportunities and the underside of the bridge span and the space above the abutment walls are lined with corrugated metal that is tight fitting.

*\*Plans provided in August 2013 SEI*

### 3.3 Trees

- 3.3.1 For the Bat SEI trees were selected for assessment from drawings provided by RES that identified trees/woodland that would be affected by works along the access route. Those not affected by the proposed works as shown on the access road drawings were scoped out. This is considered a proportionate and reasonable approach to determining the scope of the baseline survey as it is based upon the occurrence or not of likely significant effects (i.e. the tree would be lost or require significant tree surgery). Trees that would be affected by the scheme were further assessed for their potential to support roosting bats with reference to the BCT Bat survey Guidelines (2012). Full details on trees that would be affected, and that had some potential to support roosting bats (for which further survey would then be recommended) were collected. For the other trees that were assessed, photographs were taken and notes made to confirm species and that they did not support features that could be used by roosting bats and result in trees being placed in Category 1 or 1\* as set out by the BCT Survey Guidelines (2012). As a result of this preliminary assessment process full survey details were only collected for one tree, a single mature ash at Chainage 3950 (60283248-D-007). This was the only tree that was proposed to be removed that was assessed as having good potential to support roosting bats (Category 1\*).
- 3.3.2 Since the survey work for the Bat SEI was completed, additional land at Gosen bridge has been assessed in terms of the bat roosting potential of additional trees (to those assessed in the Bat SEI). This information is presented below. In addition the assessment of the roosting potential of a Rowan *Sorbus aucuparia* tree at Chainage 9680-9840 has been re-checked in response to a query from PCC.
- 3.3.3 Trees have been assessed using the categorisation proposed in Table 8.4 of the BCT Bat Survey Guidelines (2012). In summary:
- Category 3 trees have no roosting potential;
  - Category 2 trees have no obvious potential to support bats but are of a size and age that closer inspection may reveal hidden cracks and crevices, or are trees with some features but with limited roosting potential;
  - Category 1 trees have clear roosting potential but fewer opportunities than Category 1\* trees or potential for use by single bats;
  - Category 1\* trees have multiple suitable features capable of supporting larger roosts; and
  - Confirmed tree roosts - where bats or signs of bats have been found and current or past use is confirmed.
- 3.3.4 For Category 2 and 3 trees no further survey is required, whilst for Category 1 and 1\* trees some form of additional survey is required. No specific mitigation measures are proposed for Category 3 trees. Reasonable avoidance measures are proposed for Category 2 trees and for work to stop if bats are found during tree works or felling.

#### Trees at Gosen Bridge

- 3.3.5 Trees will be removed on the northern side of the side to east (**Photograph 5 and 6 - Appendix 3.1**) and west (**Photograph 9 - Appendix 3.1**) of the Cledan river that flows beneath Gosen Bridge (see drawing 60283248-D-008-001).

- 3.3.6 On the eastern side of the river bank trees will be removed to the north of the existing road from the southern edge of the block of woodland that runs along the eastern bank of the Cledan river and the southern bank of the Afon Gam. This will include even-aged semi-mature oaks *Quercus robur*, an immature birch *Betula pendula* and one young crab apple *Malus* sp. tree. Also present are a few shrubs of hazel *Corylus avellana*. One of the oak trees opposite the end of the proposed haul route access track has a tension split in one small side branch (**Photograph 7 - Appendix 3.1**), which is very open and provides limited roosting potential. An oak by the bridge has a light cover of small ivy *Hedera helix* stems, which may provide some limited roosting cover for bats. All of these trees have been assessed and considered to be Category 3 or 2 trees as defined by Table 8.4 of the BCT Bat survey Guidelines (2012). Given this categorisation of the trees to be affected no further survey work is required or proposed as the trees have very low likelihood of supporting bat roosts. There is also an oak tree to the south east of the proposed haul route access track, where it comes through the wood, which supports a tension split in a large upper branch. The main tension split is wide and open, but there is also a vertical split on the underside of the branch that is sheltered from above and has higher potential to be used by roosting bats. This tree is assessed as being a Category 1 tree as it has a split with apparent potential for roosting bats, but no other obvious roosting features. This tree is outside the working area and located up slope of the proposed road widening. It will not be directly affected and was scoped out of any further survey work. Given the distance from the proposed haul route and its location up-hill from the route it is also highly unlikely to be affected by root damage.
- 3.3.7 To the west of the Cledan river and along the southern bank of Afon Gam is woodland on a steep embankment. There has been a landslip in this location and parts of the woodland are dominated by hazel scrub. Trees that form an upper canopy above shrub height include young to semi-mature trees including ash *Fraxinus excelsior*, oak and alder *Betula pendula*. All except one tree are in good condition with little ivy covering and are assessed as belonging to Category 3 with no obvious roosting potential. As such no further survey of these trees is required or proposed. One tree at the western end of the woodland is an immature ash with a thin covering of ivy. This tree has a broken side-branch that has bent towards the ground creating a small tension split. The split is shallow, filled by wood splinters and is exposed to rain and wind. As such it is considered to have limited roosting potential. The tree is assessed as being a Category 2 tree because of the nature of the split and the lack of obvious roosting potential elsewhere on the tree. Given this categorisation no further survey work is required or proposed as the tree has a very low likelihood of supporting roosting bats.

#### Rowan tree at Chainage 9680-9840

- 3.3.8 This is an isolated mature rowan tree in an open landscape where there are no connecting features such as hedgerows. This tree was assessed for bat roosting potential as part of the assessment of trees for further survey along the access route as it is to be removed. Following this assessment of roosting potential it was scoped out of the need for further survey as the tree was assessed as having very limited roosting potential based on the features of the tree. This tree was re-inspected in response to concerns raised by Powys County Council. The tree has a couple of rotten upper branches that are upward facing and exposed to the rain. The tree was surveyed further with an endoscope and assessed as having very limited roosting potential. As such the tree is assessed as a Category 2 tree. This confirms the original assessment and the decision to scope the tree out of any further survey. Further survey is not recommended in Table 8.4 of the BCT Bat Survey Guidelines 2012 for Category 2 trees.

### Roost information within the Carnedd Wen ES

- 3.3.9 The information on bats collected from field surveys presented in the Carnedd Wen ES was reviewed as stated in Section 6.1.5 of the Bat SEI. These data and that from the updated desk study carried out in 2013 were considered in terms of cumulative impacts of the proposed wind farm in Section 8.10 of the Bat SEI. Records of potential roosts presented in the Carnedd Wen ES were not used to inform the cumulative assessment as an updated desk study of bat roosts over a much wider area than that used in the Carnedd Wen ES was undertaken.
- 3.3.10 Four records of bat roosts associated with the access route were identified in the Carnedd Wen ES in a table titled 'Bat Roosts Identified in 2006'. These are presented in Table 3.2 below with comments on each location and the data provided: No statutory protected nature conservation sites designated wholly or partly for their bat interest are located within 10km of the site.

**Table 3.2: Bat Roosts reported in the Carnedd Wen ES**

Location and date	Roost and survey details	Comments
SH007 085, 3 <sup>rd</sup> July 2006	10 Myotis bats. Surveyed remotely due to restricted access	If the grid reference is accurate this roost is located adjacent to woodland some 180 to 200 metres from the Afon Gam to which the site is well connected by mature hedgerows. It is some 350 to 400 metres from the access route at Chainage 3950 at its nearest point. This is the location where emergence surveys of a category 1* ash tree were undertaken.
SH090 073 Sytchyn farm, 29 <sup>th</sup> August, 2006	1 common pipistrelle bat seen entering a farm building, precise access point not identified	This is an unreliable record that does not confirm roosting. The activity recorded could very well be a bat entering a farm building to hunt for insects.
SH959073, Cannon Farm, 6 <sup>th</sup> September, 2006	7 common pipistrelle bats seen to enter the eaves of the stone cottage opposite the farmhouse.	This roost was known about when the survey work for the wind farm was being planned. It is adjacent to the Afon Cannon within a sheltered valley with mature trees and scrub habitat and blocks of coniferous forestry.
SH 947 039, Ffrid Fawr, 7 <sup>th</sup> October, 2006	3 common pipistrelle seen flying around farm buildings at dawn during a raptor survey. Access point not confirmed	This site is adjacent to the Afon Gam which provides the main flight paths and foraging habitats in this exposed area.

- 3.3.11 The unnamed roost of Myotis bats at SH007 085 is located some distance from the access route and in proximity to high quality foraging habitat in the form of the wooded riverside of the Afon Gam, mature hedgerows and deciduous woodland. To the north east is a complex of further deciduous woodland, and a pattern of mature hedgerows and small fields providing excellent foraging habitat for bats. To the south west towards the access road there is less suitable habitat. In addition the extent of habitat to be lost temporarily along the road is minor compared to that available in the local area and as such there is no need for an emergence roost survey at this (unknown) roost location in order for an assessment of the likely impacts of the proposed access road at this location to be made.



- 3.3.12 The farm at Sychtyn is located on the top of the hill and is surrounded by large open improved pasture farmland. None of the farm buildings will be affected by the access route. In addition, the road between the farm and Gosen Bridge is lined on the western side by a closely trimmed hedge and on the eastern side by a fence. The proposed works will not affect the trees or hedges to the north of the farm. The western hedge along the road will be retained and a new hedgerow will be planted to the east, improving habitat and flight features within the immediate landscape of the farm. To the south of the farm sections of hedgerow will be lost and this is where an automated detector was placed to determine use of this possible flight route. Considering the scale of impacts arising close to the farm there is no need for an emergence roost survey at the farm complex in order for an assessment of the likely impacts of the proposed access road at this location to be made.
- 3.3.13 The presence of a common pipistrelle roost at Cannon Farm was known when the survey work for the wind farm and access route were being devised. Given the distance (850 to 900 metres) from the proposed by-pass at Neintherion and the complex of foraging and commuting habitat available in the surrounding landscape to bats roosting at Cannon Farm, there is no need for an emergence roost survey at the farm complex in order for an assessment of the likely impacts of the proposed access road at this location to be made.
- 3.3.14 Ffridd Fawr is located between the road route and the Afon Gam. The landscape here is open with no hedges or fences along the road. The key landscape feature and likely flight route that would be used by bats is the Afon Gam river corridor. There will be no loss of potential foraging or roosting habitat at this location and thus no impact on bats. As such there is no need to survey the farm for roosting bats in order to assess the likely impacts of the proposed access route at this location.
- 3.3.15 None of the information about roosts along the access route from the Carnedd Wen ES changes the approach taken to survey of the access route nor does it affect the assessment of likely impacts of the access route.

### 3.4 Clarifications and Corrections

#### Desk study date and extent

- 3.4.1 The desk study was undertaken following the approach proposed by the BCT Guidance 2012 (Hundt, 2012). It was undertaken in May 2013 and is described in the Bat SEI at 5.7.6-7. The results of the desk study are described in 6.1 and include a summary of the bat records returned from within 10km (for high-risk species) and 5km for all other bat species. The 10km (also for statutory sites) and 5km buffers were applied to both the development boundary of the Wind Farm Proposal (WFP) and the access route. Although there was no requirement for such a large search area for the access route it was decided that the additional background provided by an extended search area may be useful. As such the desk study at the time it was undertaken was the most up to date set of desk study information for bats and the most extensive undertaken for the proposed wind farm at Llanbrynmair.

#### Dates of Driven Transects

- 3.4.2 As set out in the Bat SEI, section 5.8.3, the driven transects were undertaken in May, July and August 2013. The results of the driven transects are presented graphically in Figures 12, 13 and 14 and Table 2.6 of Appendix 2 to the Bat SEI. The dates on the figures are the correct dates when the surveys were undertaken namely 22<sup>nd</sup> May, 10<sup>th</sup> July and 6<sup>th</sup> of August 2013.

### Dates of roost surveys

- 3.4.3 Roost emergence and re-entry surveys were undertaken in mid-June and mid-July 2013. Table 2.6 in the Appendices to the Bat SEI is not correct. The dates of 12, 13 and 14<sup>th</sup> of June and 16<sup>th</sup>/17<sup>th</sup> of July 2013 as is accurately shown in Table 6.6 of the Bat SEI are the correct survey dates.

### 3.5 Conclusions

- 3.5.1 The original Bat SEI presents a series of conclusions in relation to likely impacts on bats arising from the construction of the proposed access route. It identified potential impacts arising from loss of hedgerows and trees and works to bridges on foraging habitat and flight paths and loss or disturbance to roosts. It concluded that taking account of mitigation measures impacts would not be significant.
- 3.5.2 The information contained in this second Bat SEI includes further information on potential roosting opportunities in bridges and culverts and trees and provides corrections and clarifications in relation to the first Bat SEI. No additional roosts have been identified, but limited potential for insignificant roosts (transitory) associated with bridges has been identified and the potential for adverse impacts to arise has been considered.
- 3.5.3 Where potential impacts have been identified suitable mitigation measures have been considered in the event that bats are found from future update surveys and the overall impact on bats assessed. In summary, whilst there are potentially additional roosting opportunities, potential impacts are considered to be low and readily addressed through various mitigation options. These approaches would have very limited impacts on transitory roosts and would not result in an adverse impact on the favourable conservation status of local bat populations. As such it is considered that the additional information presented in this second Bat SEI does not change the assessment of impacts presented in the original Bat SEI.
- 3.5.4 The information presented in this second Bat SEI in relation to potential impacts on bat roosts does not change the situation in relation to whether there is likely to be a need for a European Protected Species licence to enable the access route works to be implemented lawfully. It is considered that it is too early to confidently state whether a licence will be required especially if the potential offence was one of disturbance, not destruction/loss of a roost, as seems likely based on the information presented in this and the original Bat SEI. Much will depend on the use of potential roosting features at the time of the works, the timing of the work and the methods by which the works are implemented. However, it is not possible to state categorically that a licence would not be required. The need for a licence would be determined in discussion with NRW closer to the time of the implementation of works, informed by updated survey information and a finalised method of working (including timing of the works).





**PART 2 - ADDITIONAL INFORMATION FOR POTENTIAL ALTERNATIVE ACCESS  
ACROSS ADJACENT WIND FARM**

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## 4. PROJECT DESCRIPTION

### 4.1 Introduction

- 4.1.1 As part of the proposed Llanbrynmair Wind Farm, Abnormal Indivisible Loads (AILs) would use the Llanerfyl to Talerddig minor road in order to access the site, as detailed in the August 2013 SEI.
- 4.1.2 Powys County Council (PCC) has requested that RES consider an alternative shared access arrangement with the adjacent Carnedd Wen scheme. PCC presented the concept of the shared access arrangement during Session 2 of the Mid Wales (Powys) Conjoined Public Inquiry.
- 4.1.3 This chapter provides a description of the alternative access arrangement as proposed by PCC and any changes to the existing infrastructure layout as presented in the August 2013 SEI.

### 4.2 Alternative Access Description

- 4.2.1 PCC have developed an outline alternative access proposal connecting the proposed Llanbrynmair Wind Farm and proposed Carnedd Wen Wind Farm. The shared access consists of two relatively short sections of access track to allow for the movement of Abnormal Indivisible Loads (AILs) and construction traffic between the two sites. An overview of the alternative access arrangement is provided in **Figure 4.2**.
- 4.2.2 The alternative access proposal would involve AILs gaining access to the Llanbrynmair Wind Farm through the proposed Carnedd Wen Wind Farm. All AILs would access using the Carnedd Wen A458 site entrance and main spine road, the only additions being the two linking tracks assessed as part of this supplementary environmental information.

### 4.3 Alternative Infrastructure Design

- 4.3.1 An alternative infrastructure design has been developed in conjunction with the alternative access arrangements, please refer to **Figure 4.1**. This section outlines the main differences to the current infrastructure layout as presented in the August 2013 SEI.
- 4.3.2 As a result of the alternative access arrangements, fully loaded AILs will approach parts of the Llanbrynmair site from the opposite direction. This would result in a change to the vehicle swept path necessitating a change to some junction orientation and radii as well as the orientation of some crane pads.
- 4.3.3 The main changes to the infrastructure layout as a result of the alternative access arrangements are as follows:
- The removal of site entrances 1 and 2 and approximately 4km of associated access tracks;
  - The relocation of two temporary construction compounds (SC5 & SC3). These have been relocated within the northern and middle turbine areas;
  - The addition of 0.48km of track connecting the Llanbrynmair site between turbines R26 & R27 with the Carnedd Wen infrastructure around turbine T21;
  - The addition of 0.84km of track between turbines R8 & R12, of which 0.48km is upgraded existing track; and
  - The movement of the northern welfare building within the northern site area.

#### Differences with off-site access arrangements

- 4.3.4 The currently proposed works to the Llanbrynmair local road (sections 1 and 2) as detailed in the August 2013 SEI would not be constructed.

- 4.3.5 Site entrance 4 would be retained and used for all HGV construction traffic. All construction traffic would access the site from Talerddig as currently proposed.

#### Changes Required to the Wind Farm Southern Area

- 4.3.6 The southern area of the proposed Llanbrynmair Wind Farm includes: Turbines R4, R5, R6, R7, R8, R9, R18, R31, R32, R39, and R41.
- 4.3.7 The current access arrangements allow for both AILs and construction traffic to access this area of the scheme through Site Entrance 4.
- 4.3.8 The alternative access arrangement would mean AILs are delivered to the turbines within the southern section from the proposed Carnedd Wen access track network via a new section of track east of Turbine R8. Construction traffic would continue to access the southern area from site entrance 4.

#### Changes Required to the Wind Farm Middle Area

- 4.3.9 The middle section of the proposed Llanbrynmair Wind Farm includes: Turbines R12, R13, R14, R15, R16, R17, R19, R23, R24, R25, and R42 as well as the substation.
- 4.3.10 The current access arrangements allow for both AILs and construction traffic to access this area of the scheme from Site Entrance 2.
- 4.3.11 The alternative access arrangement would mean AILs are delivered to the turbines within the middle section from the proposed Carnedd Wen access track network via an upgraded existing track to the west of R12. Construction traffic would access the middle section from Site Entrance 4 but would also pass through the proposed Carnedd Wen development, crossing a short section of track and cable infrastructure for the adjacent site.

#### Changes Required to the Wind Farm Northern Area

- 4.3.12 The northern section of the proposed Llanbrynmair Wind Farm includes: Turbines R26, R27, R35, R36, R37, R38, R40, and R43.
- 4.3.13 The current access arrangements allow for both AILs and construction traffic to access this area of the scheme from Site Entrance 1.
- 4.3.14 The alternative access arrangement would mean AILs are delivered to the turbines within the northern section from the proposed Carnedd Wen access track network via a new track to the north of R27. This new track would connect to the Carnedd Wen site infrastructure at Carnedd Wen Turbine 21. Construction traffic would access the northern section from Site Entrance 4 but would pass through the Carnedd Wen development, utilising approximately 11km of site track within the Carnedd Wen development before connecting close to R27.

## 5. LANDSCAPE AND VISUAL EFFECTS

### 5.1 Introduction

#### *Background*

- 5.1.1 This section of the SEI provides a brief appraisal of the potential landscape and visual effects associated with two potential connections, which would provide an alternative link to the adjacent proposed wind farm development of Carnedd Wen. The two alternative access track sections are shown on Figure 4.1 - Alternative Infrastructure Layout.
- 5.1.2 These potential connections would present an alternative solution for the access of Abnormal Indivisible Loads (AILs) to the Llanbrynmair Wind Farm site, with AILs accessing the site from the A458 and through the proposed network of access tracks within the Carnedd Wen Wind Farm site. The use of this alternative access route for AILs would mean that the minor public road through the Nant yr Eira valley to the east of the site, from which three connections to the site are proposed, would no longer be required for AIL access.

#### Northern Potential Connection Track

- 5.1.3 The northern connection track is approximately 480m in length and connects the existing access track between the proposed Llanbrynmair turbines of R26 and R27, with the existing forestry track used by Carnedd Wen to the north. The track would require one minor watercourse crossing. The forestry in this area is proposed to be felled, and remain felled as part of the Carnedd Wen development.

#### Southern Potential Connection Track

- 5.1.4 The southern connection track is approximately 840m in length, and runs between turbines R8 and R12. This potential connection track would require the upgrading of an existing forestry track. Forestry to the north of the link track is proposed to be removed as part of the Carnedd Wen development, however coniferous forestry to the south is proposed to be retained.

#### *Previous Assessment*

#### Carnedd Wen Wind Farm

- 5.1.5 Chapter 6 of the Carnedd Wen September 2011 SEI (RWE, 2011) describes the potential landscape and visual effects associated with the Carnedd Wen Wind Farm. The 50 proposed turbines would be linked by approximately 16.6km of new access tracks branching out from the existing upgraded forest roads (approximately 28km) which would serve the site from the A458, as shown on Figure 1.1. Access tracks and typical cross sections are shown in Figures 4.7 and 4.8 (a, b and c) of the original ES.
- 5.1.6 Forestry felling and retention is shown on the Summary Habitat Management Plan (Figure 1.2 of the 2011 SEI) and outlined in more detail in Appendix 2.2: Forestry Felling Plan of the September 2011 SEI (RWE, 2011).

#### Llanbrynmair Wind Farm

- 5.1.7 Section 4 of the Llanbrynmair August 2013 SEI describes the potential landscape and visual effects associated with the proposed Llanbrynmair Wind Farm. The 30 wind turbines would be connected by approximately 25.3km of access tracks, joining the public highway at three points, as shown in Figure 3.6 of the SEI. Typical access track designs are described in Section 3.4 of the SEI and shown in Figure 3.9, and a typical watercourse crossing is shown in Figure 3.10.

## 5.2 Potential Effects

5.2.1 The sources of potential effects on the landscape and visual resource are:

- the felling of forestry within the Carnedd Wen Wind Farm site, for both the northern and southern connection tracks, over and above that assessed in the Llanbrynmair Wind Farm ES;
- the introduction of new access tracks and a water crossing for the northern connection track, between turbines R26 and R27, and the Carnedd Wen track to create the northern connection track; and
- the introduction of a new access track and the upgrading of an existing access track to create the southern connection track, between turbines R8 and R12.

5.2.2 The direct and indirect effects are predicted to be small in scale, in the context of the overall proposed development therefore only the landscape elements which have the potential to be directly affected are discussed. Similarly only visual receptors in close proximity to the potential connection tracks are discussed.

## 5.3 Link Track Assessment

### *Effects on Landscape Character and LANDMAP Aspect Areas*

5.3.1 The additional link tracks have the potential to directly affect Landscape Character Area (LCA) 5 - Dyfnant Forest/Llanbrynmair Moors (Powys Landscape Character Study 2008) which the site is located within. No additional effects are anticipated on the Dyfnant Forest/Llanbrynmair Moors LCA, over and above those already assessed in the LVIA of the August 2013 SEI (Volume I - Main Document, Chapter 4, Table 4.10).

5.3.2 The potential connection tracks would also have direct effects on the LANDMAP Aspect Areas (Geological Landscape, Landscape Habitats, Visual and Sensory, Cultural Landscape, Historic Landscape) within which they are located. The additional effects are not predicted to be greater than those identified in the LVIA of the August 2013 SEI (Volume II A - Supporting Appendices, Appendix 4.2: LANDMAP Baseline and Assessment, Tables 6 to 10).

### *Effects on Designated Landscapes*

5.3.3 The link tracks are not located within any nationally or locally designated landscapes and no indirect effects are anticipated, over and above those assessed in the Llanbrynmair August 2013 SEI.

### *Effects on Visual Amenity*

#### *Viewpoints*

5.3.4 The proposed connection tracks are not likely to be perceptible from the viewpoints used within the LVIA to assess the visual effects of Llanbrynmair Wind Farm. Any visibility of the construction and operation of the proposed alternative connection tracks would be in the context of the other components of the Llanbrynmair and Carnedd Wen Wind Farms and would form a minor additional feature where visible.

5.3.5 From the Nant yr Eira Valley, the presence of coniferous forestry located to the south of the southern connection track, and to be retained throughout the operational period of the proposed Carnedd Wen Wind Farm, would screen any visibility of the proposed southern connection track.

### Residential Properties

- 5.3.6 Visual effects on views from residential properties were assessed in the August 2013 SEI (Volume II A - Supporting Appendices, Appendix 4.1: Residential Visual Amenity Assessment).
- 5.3.7 The proposed connection tracks are not located in close proximity to any settlements or residential properties. The closest properties to the northern connection track are approximately 2km to the south (P8 - Cannon and P9 - Ysgubor Cannon) and 2.5km to the south-east (P10 - Dolwen Uchaf and P11 - Dolwen Isaf). No visibility of the northern connection track is predicted from these residential properties.
- 5.3.8 The closest property to the southern connection track is approximately 1.5km to the north (P21 - Ffriddfawr) and has theoretical visibility of turbines of the development and the access track leading from site entrance 4. No visibility of the southern connection track is predicted from this residential property.
- 5.3.9 Due to the distance between the relatively small scale and visually contained connection tracks and the closest properties, no effects are anticipated, over and above those assessed in the Residential Amenity Assessment for these properties.

### Glyndŵr's Way

- 5.3.10 Glyndŵr's Way National Trail passes through the site, from south west to north east. The closest views from the National Trail are represented by Viewpoint 1 (Figure 4.13 in the August 2013 SEI). It is judged that there will be no additional visual effects on views from this National Trail.

## 5.4 Summary and Conclusions

- 5.4.1 Landscape effects will extend to the physical footprint of the proposed connection tracks and the areas disturbed during construction of the wind farm. These landscape effects would be relatively small scale when considered in the context of the whole wind farm development.
- 5.4.2 Visual effects associated with the two proposed connection tracks would always be in the context of the other proposed Llanbrynmair wind turbines, access tracks and ancillary infrastructure which will form the key feature(s) in these views.
- 5.4.3 Due to the small scale and visually contained nature of the proposed alternative connection tracks and their location within the interior of the wider Llanbrynmair Wind Farm development, it is judged that the landscape and visual effects resulting from these components would not be greater than those identified within the LVIA within the August 2013 SEI.

## 6. ECOLOGICAL ASSESSMENT

### 6.1 Introduction

- 6.1.1 This section assesses the potential ecological impact of the alternative proposal to provide link tracks to allow joint access between Llanbrynmair and Carnedd Wen proposed wind farms.
- 6.1.2 The assessment provides baseline information, identifies potential impacts of the proposal on the ecology of the area, assesses the significance of those impacts, describes mitigation measures to avoid, reduce, remedy or compensate for those impacts, and assesses the significance of the residual effects based on the magnitude of the impact and the sensitivity of the receptor. The proposal also involves minor changes to the existing proposed infrastructure involving the slight re-alignment of some tracks, the moving of some crane pad locations and re-location of site compounds. These have also been assessed.
- 6.1.3 Surveys were carried out to assess the habitats, for presence of protected species (especially badger, otter and water vole) and for peat where present. These surveys were identified as appropriate following a meeting with NRW and PCC in January 2014. It was considered that the proposed link tracks will have no impact on bats and therefore no assessment for bats is required.

### 6.2 Surveys

- 6.2.1 Surveys of the proposed route, comprising a southern link track between Llanbrynmair turbines R8 and R12 and a northern link between Llanbrynmair turbine R27 and Carnedd Wen turbine T21 have been carried out. Surveys were carried out in January 2014.
- 6.2.2 For habitats, both proposed sections were visited by an experienced surveyor and the habitats were classified using National Vegetation Classification.
- 6.2.3 For protected species, surveys for water vole and otter were carried out at Nant Ffriddycastell where there is a proposed water crossing on the northern link. No prospective habitat for these species is present at the southern link. Signs of badger were looked for at both sections.

### 6.3 Results

#### Habitats

- 6.3.1 Full results for each section are shown in **Appendix 6.1**.
- 6.3.2 The main area where the track is proposed going east from turbine R8 is a mosaic of U5 *Nardus stricta-Galium saxatile* grassland and U6 *Juncus squarrosus-Festuca ovina* grassland. Mat-grass *Nardus stricta* is abundant here, and this shares dominance with heath rush *Juncus squarrosus*. There is an area of M18 blanket bog to the north of the proposed route, and a small area of M17 bog to the south. The route then follows an existing forestry track through the plantation, with wide verges of very modified vegetation that has been recently flailed. The proposed route to link to turbine R12 crosses an area of M6 / M23 grassland.
- 6.3.3 For the northern link, where the new track leaves the current proposed route the main vegetation is M25 *Molinia caerulea - Potentilla erecta* mire '*Eriophorum vaginatum* variant'. The vegetation here is a species-poor community. It is relatively dry (certainly based on the species present), and comprises dominant purple moor-grass, occasional mat-grass, occasional *Pleurozium schreberi*, occasional *Polytrichum commune* and occasional *Polytrichum strictum*. Hare's-tail cottongrass is at a relatively low frequency here. Small areas of soft rush are also present. The route then goes down hill through forestry with no ground flora. Where the proposed track crosses the small watercourse, to the south side of stream the vegetation resembles M17a, with frequent cranberry, frequent cross-leaved heath, frequent to abundant *Spahgnum palustre* and frequent *Spahgnum capillifolium*. This area is only small in extent and to the immediate west (between the forestry and the south



side of the watercourse) becomes species-poor M6d *Carex echinata* - *Sphagnum fallax/denticulatum* mire, *Juncus acutiflorus* sub-community. Here, *Sphagnum palustre* is occasional (abundant towards the forestry edge), sharp-flowered rush is frequent to abundant and purple moor-grass is abundant to dominant. On the north side of the stream here, the vegetation is similar, though more closely resembles M23a *Juncus effusus/acutiflorus* - *Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community. The route up slope to turbine T21 again goes through forestry with no ground flora.

### Protected Species

- 6.3.4 No signs of either otter or water vole were found at the proposed water crossing at Nant Ffriddycastell or 50 metres up or down stream. The stream at the crossing point is not considered particularly suitable for water vole as it is deeply incised with no direct access from the water course to the vegetated bank. Below the crossing the water course becomes more rocky and fast flowing and again is not particularly suitable for voles. This stream was previously surveyed for otter as part of the original site assessment and no signs of otter or water vole were found then.
- 6.3.5 No signs of badger were found at either section.

### 6.4 Mitigation

- 6.4.1 The proposals for the short link tracks should be seen in the context of the larger scheme proposals. All mitigation measures, such as no clearance of vegetation during the bird breeding season, the requirements of the peat management programme and the restoration and enhancement programme proposed within the Habitat Management Plan, would equally apply to any work on the proposed link tracks. No separate mitigation measures have been identified for the short link tracks and none are thought necessary.

### 6.5 Assessment

- 6.5.1 The southern route would involve approximately 320 metres of track to be constructed across U5 / U6 grassland. This is a common habitat in upland Wales, and the presence of heath rush indicates previous heavy grazing of this site. The areas of M18 and M17 blanket bog do have conservation value but will be avoided by the proposed route. The loss of grassland habitat also needs to be seen in the context of the proposed Habitat Management Plan (HMP) for the whole site that will see the active management of large areas of peatland habitat.
- 6.5.2 The section of the southern route that passes through the forestry is on existing track. The proposals may involve some widening of this track, but this will be within the existing shoulders of the track that are already much modified and are regularly flailed.
- 6.5.3 The section of proposed track of about 130 metres to R12 crosses species poor M6 and M23, with rushes and some pockets with *Sphagnum*. This is not considered to have a high conservation value, and as above will benefit from the HMP.
- 6.5.4 Overall it is considered that the proposed southern access link would not have a significant impact on the conservation interest of the site.
- 6.5.5 The northern route comprises of approximately 40 metres of track crossing species poor M25. After a section through forestry with no ground vegetation there is a section of approximately 60 metres including a water crossing. This involves a small section of M17a, which has conservation interest, along with an area of species poor M6d which has less interest. The route then returns into conifer plantation with no ground flora.
- 6.5.6 Although the section at the water crossing is of interest, the loss of vegetation here, in the overall context of the proposed windfarm and the HMP, is not considered significant.
- 6.5.7 A desk assessment of the proposed minor changes to the currently proposed layout for the Llanbrynmair site was undertaken. This involves minor changes to the existing proposed



infrastructure involving the slight re-alignment of some tracks, the moving of some crane pad locations and re-location of site compounds. The changes were assessed against the existing survey information for the site. In all cases the changes were found to be within the vegetation blocks and none of the changes involved the movement of infrastructure onto sensitive habitats, deeper peat habitats or habitat previously identified as having high conservation value. Thus it is concluded that the minor changes are not significant in terms of their impact, or in terms of the original conclusion of the previous environmental statement.

## **6.6 Conclusion**

- 6.6.1 The proposed link tracks are small sections when viewed within the context of the two proposed windfarms, and must be seen in the context of the two proposed HMPs. Little vegetation of conservation interest would be lost, especially on the southern link. That lost on the northern link is a very small area. No protected species would be affected. Therefore it is concluded that the link tracks would have no additional significant impact.

## 7. CULTURAL HERITAGE

### 7.1 Introduction

- 7.1.1 This section provides an assessment of the predicted effects of changes to the infrastructure layout on the cultural heritage resource of this area resulting from creating access to Llanbrynmair from the Carnedd Wen Wind Farm. The two access points from Carnedd Wen via additional sections of track would replace the proposed Llanbrynmair Site Entrances 1 and 2 along with their associated access tracks. There would also be minor changes to the infrastructure layout elsewhere to accommodate the movement of vehicles in the opposite direction to that originally envisaged.
- 7.1.2 Construction of the proposed linking tracks and other changes to the wind farm infrastructure has the potential to damage or destroy historic assets. The effects may be direct, for instance where an asset is disturbed during ground-breaking works, or indirect, perhaps when changes in hydrology may lead to waterlogged archaeological deposits becoming desiccated and degraded. It may be noted that the net effect of the proposed changes will be less ground disturbance as the length of additional tracks is less than those that could be removed from the proposals.
- 7.1.3 During its operational phase, the proposed development may affect the significance of historic assets through visual change in their setting. The degree of visual change caused by the two new proposed sections of track and changes to the site layout is extremely limited and its potential to affect the setting of historic assets does not merit further consideration.
- 7.1.4 Assessment of effects has therefore been restricted to the potential for damage during construction works.

### 7.2 Methods

- 7.2.1 The methods adopted for this assessment follow those set out in Section 7.4 of the August 2013 SEI for Llanbrynmair Wind Farm.
- 7.2.2 Baseline information has been taken from heritage information already collated for the Llanbrynmair application (see Section 7.5 of the August 2013 SEI) without the need for additional site survey work. Land affected by the proposed links within the Llanbrynmair application area is covered by this baseline, including both collations of existing records and site survey work in 2006. Those sections of the proposed links within the Carnedd Wen application area contain no existing records for historic assets. Site survey work is not justified for these sections as the proposed links either run along existing modern tracks or run through areas of dense conifer plantation where effective survey is impossible.

### 7.3 Baseline Conditions

- 7.3.1 The northern link runs for 480m between Carnedd Wen T21 and between Llanbrynmair R26 & R27. There are no recorded historic assets in this area. The section of track within the Carnedd Wen application area runs almost entirely through dense conifer plantation. The section of track within the Llanbrynmair application area is in an area of unimproved moorland; no historic assets were identified in this area during previous site surveys.
- 7.3.2 The southern link runs for 840m between Llanbrynmair T8 & T12. There are no recorded historic assets in this area. The section of track within the Carnedd Wen application area would follow an existing forestry track through dense conifer plantation. The section of track within the Llanbrynmair application area is in an area of unimproved moorland; no historic assets were identified in this area during previous site surveys.
- 7.3.3 The absence of historic assets visible on the ground surface does not rule out the possibility that sub-surface archaeological features exist in these two areas or that upstanding features survive within areas of dense plantation.

- 7.3.4 The proposed northern link would replace access via Site Entrance 1 to the northern end of Llanbrynmair Wind Farm. The access track from Site Entrance 1 would have run immediately adjacent to a possible ring cairn (Site N26). There would be minor adjustments to the position of tracks and hardstandings in the vicinity of turbines in this area. No historic assets were identified in areas affected by these works during previous site surveys.
- 7.3.5 The proposed southern link would replace access via Site Entrance 2 to the central part of Llanbrynmair Wind Farm. No historic assets were identified in this area during previous site surveys. There would be minor adjustments to the position of tracks and hardstandings in the vicinity of turbines in this area. No historic assets were identified in areas affected by these works during previous site surveys.

#### 7.4 Potential effects and mitigation

- 7.4.1 No recorded historic assets would be affected, directly or indirectly, by the proposed changes to the access and infrastructure layout. Indeed, the removal of a proposed access track from Site Entrance 1 would remove the potential for accidental damage to one historic asset (possible ring cairn N26).
- 7.4.2 Potential effects are limited to damage to currently unrecorded historic assets within the construction footprint of the proposed works where they do not follow existing tracks. Inevitably, the nature and importance of any such assets is not known; however it is considered unlikely that any would be of greater than Low Importance. There would be potential for effects of High Magnitude, if an asset experienced complete or substantial damage. There is therefore potential for adverse effects of up to Moderate Significance. It should be noted that the net effect of the proposed changes is to reduce the overall construction footprint of the wind farm. As a result, the potential for damage to currently unrecorded historic assets is also slightly reduced.
- 7.4.3 Mitigation of adverse effects on currently unrecorded archaeological features (if any exist) would be achieved through an appropriate programme of archaeological works which would fully offset the adverse effect. This would form part of the wider specification for a programme of archaeological works required for the development as a whole. This would be prepared and submitted to Clwyd Powys Archaeological Trust (as archaeological advisors to Powys County Council) for approval prior to the commencement of construction works.

## 8. GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

### 8.1 Introduction

- 8.1.1 This section has been undertaken by Fluid Environmental Consulting Ltd (Fluidec) and provides additional detail to compliment Chapter 8 of the Supplemental Environmental Information (SEI) submitted in August 2013 which assessed the potential geological, hydrogeological and hydrological effects of the proposed wind farm development at Llanbrynmair, north of Llanbrynmair Village, Powys, Wales.
- 8.1.2 The potential alternative access through the proposed Carnedd Wen Wind Farm would require a number of modifications to the site layout. This has resulted in the removal of site access 1 and 2 and associated sections (4,050m) of track, the addition of approximately 1,320m of new track to link the proposed track layout to the proposed Carnedd Wen Wind Farm, relocation of construction compounds 3 and 5 and some minor realignment of tracks and crane pads.
- 8.1.3 These changes have slightly altered the potential geological, hydrogeological and hydrological effects of the proposed wind farm. This additional assessment therefore considers these minor alterations based on the alternative infrastructure layout provided in Figure 4.1. The assessment uses the methodology presented in Section 8.2 of the SEI (August 2013).

### 8.2 Site Visits and Field work

- 8.2.1 An inspection of the site was undertaken by Mick Green of Ecology Matters in January 2014 to obtain peat depth information through probing along the proposed new sections of track that will link the Proposed Development with the proposed Carnedd Wen Wind Farm and to collect data and photographic record of the additional watercourse crossing required.

### 8.3 Existing Environment

- 8.3.1 The southern access route would link the proposed turbine locations R8 and R12 to the Carnedd Wen Wind Farm infrastructure. The route is fairly flat, running very slightly up gradient along the ridgeline from turbine R8 to the crest within the forested area at about 420mAOD and then slightly down gradient to turbine R12 at 400mAOD.
- 8.3.2 The northern access route would link the track to the south of proposed turbine location R26 to the proposed Carnedd Wen infrastructure at turbine T21. The route starts at 360mAOD at the exiting track and then runs down gradient to cross the Nant Ffriddycastell watercourse at 350mAOD and then rises to about 370mAOD to join with the Carnedd Wen infrastructure.
- 8.3.3 Both of these sections of track are within the surface water catchments of the proposed windfarm infrastructure.

#### Peat

- 8.3.4 Peat probing was undertaken along the two new access routes as presented in Figure 8.2a, Figure 8.2b, and Figure 8.2c. The probing identified peat depth of between 0 and 1.2m.
- 8.3.5 Peat probing has previously been completed in the new locations for construction compound 3 (average depth 0.14m), construction compound 5 (average depth 0.05m) and the new welfare building (north) (average depth 0.65m).
- 8.3.6 The updated peat depths (based almost entirely on probe penetration depth) across the area of infrastructure ranges from a complete absence, where topsoil over mineral soil is present, to over 3 metres. Based on an assumption that a probe penetration depth of 0.1m signifies no peat then 241,235m<sup>2</sup> of the infrastructure is on peat compared to the 2013 layout where 244,150 m<sup>2</sup> of the infrastructure (65%) is on peat. The total area of the infrastructure footprint is now 315,022 m<sup>2</sup>, compared to the 377,850 m<sup>2</sup> for the 2013 layout.

- 8.3.7 Across the majority of the area of infrastructure, 95%, the peat depth is less than one metre (this includes the 35% that is not located on peat), with areas of deeper peat (>1.5m) being found in small pockets rather than large areas of blanket bog.

**Table 8.1 - Maximum Potential Peat Depth across the Site**

Depth range (m)	Peat depth distribution (m <sup>2</sup> )	Peat depth distribution (%)
0 - 0.1 (no peat)	77,390	24
0.1 - 0.5	156,900	49
>0.5 - 1	63,070	20
>1 - 1.5	12,800	4
>1.5 - 2	4,440	1.4
>2	425	0.1
<b>Total</b>	<b>315,025</b>	

#### Peat Excavation Volumes

- 8.3.8 The total calculated excavation volumes of peat are based on almost 5,000 locations where a probe has been used to ascertain the depth of penetration to 0.1m accuracy. The probe depth is generally an overestimation of actual peat depth due to the presence of clay of similar penetration resistance across almost the whole of the site and therefore the volumes calculated are conservative. The excavated volumes have been recalculated based on the adjustments and additions to the previous layout (**Appendix 8.1**). This has resulted in an overall reduction in the volume of peat to be excavated of approximately 12,000m<sup>3</sup>.
- 8.3.9 The total volumes of peat that will be excavated are:
- Total volume of peat which will be excavated = 109,300m<sup>3</sup>
  - Total volume of acrotelm which will be excavated = 38,000 m<sup>3</sup>
  - Total volume of catotelm which will be excavated = 71,400 m<sup>3</sup>
- 8.3.10 These values are estimates based on the available data and a number of assumptions regarding peat distribution.

#### Watercourse Crossings

- 8.3.11 Three of the previous 22 proposed watercourse crossings would no longer be required. These are crossing numbers 1, 2 and 4 (Table 8.9 of the SEI 2013). An additional crossing would however be required at the northern section of the site numbered crossing 23. A total of 20 watercourse crossings would therefore be required.

**Table 8.2: Watercourse crossings eliminated**

No.	Watercourse	Location	Grid Ref (SH)	Type of Crossing	Description	Photograph (Appendix VII SEI 2013)
1	Drain	East access track	97030 07130	Existing	Culverted drainage channel. Narrow, incised channel, eroded to base. Currently partly collapsed and in need of replacement.	Photos 12 and 13
2	Nant Craigyfrân tributary	Access track up to R35	96580 08070	New	Approx 2m wide incised channel, eroded to a gravel, cobble and clay base. Moderate gradient with steep sided banks in places. Less than 50m upgradient of woodland.	Photos 14 and 15
4	Nant Craigyfrân tributary	Between R36 - R35	95630 08300	New	Narrow channel <1m width, generally incised to clay base. Shallow gradient with low flow.	Photo 18

**Table 8.3: Additional Watercourse Crossings**

No.	Watercourse	Location	Grid Ref (SH)	Type of Crossing	Description	Photograph (Appendix 8.2)
23	Nant Ffriddycastell	Northern access linking Llanbrynmair to Carnedd Wen	96360 09200	New	Approx 1 to 1.2m wide shallow channel of approx 0.5m depth. Moderate gradient with steep sided banks.	Photos 1 to 5

## 8.4 Assessment of Potential Effects

8.4.1 The following tables describe the elements of the proposal that would change from the SEI 2013 if the alternative access was adopted and a magnitude of potential effect has been assigned to these based on their location and activity. This magnitude of potential effect takes into account the best practise and standard mitigation methods described in Section 8.5 of the 2013 SEI.

### Access and Site Tracks

8.4.2 The relevant elements are:

- An additional 1,324 m of site tracks, resulting in 9,930 m<sup>2</sup> of land take.



**Table 8.4: Inventory of track sections and their associated Magnitude of Potential Effect of causing sedimentation, pollution, alteration of natural water flows, excavation of peat and changes to peat hydrology**

Section of track	Description	Magnitude
From track south of turbine R26 northwards to link to Carnedd Wen Wind Farm site	<ul style="list-style-type: none"> <li>• Gradient: On shallow and moderate slopes</li> <li>• Watercourse proximity: Crosses the Nant Ffriddycastell watercourse</li> <li>• Max peat depth: 1.2m</li> <li>• Sensitivities: Upgradient of Dolwen PWS (borehole approx 3km distant) but no likely connection</li> </ul>	Low
New section of track between turbine R8 and R12	<ul style="list-style-type: none"> <li>• Gradient: on ridge with shallow slope</li> <li>• Watercourse proximity: Generally &gt;100m</li> <li>• Max peat depth: 0.7m</li> <li>• Sensitivities: Upgradient of watercourses that are potential spawning grounds for designated species</li> </ul>	Low

### Watercourse Crossings

8.4.3 The relevant elements are:

- 1 new watercourse crossings and removal of the need for 3 proposed watercourse crossings (Table 8.5).

**Table 8.5: Inventory of watercourse crossings**

No.	Watercourse	Description	Magnitude
23	Nant Ffriddycastell	<ul style="list-style-type: none"> <li>• New structure required over less than 2m wide channel.</li> <li>• Small catchment area &lt;1km<sup>2</sup>.</li> <li>• Upgradient of Dolwen PWS (borehole approx 3km distant) but no likely connection.</li> </ul>	Low

### Other infrastructure

8.4.4 The relevant elements are:

- Relocation of 2 temporary construction compounds (No. 3 and 5);
- Relocation of 1 welfare building (north) (Table 8.6).

**Table 8.6: Inventory of other infrastructure locations and their associated magnitude of potential effect of causing sedimentation, pollution, alteration of natural water flows, excavation of peat and changes to peat hydrology**

Infrastructure	Location	Comments	Magnitude
Construction Compound 3	SH 94560 05380	<ul style="list-style-type: none"> <li>• Gradient: On moderate slopes</li> <li>• Watercourse proximity: &gt;100m of a Nant y Graig Lwyd tributary</li> <li>• Maximum peat depth: 0.14m</li> <li>• Other sensitivities: Upgradient of Cwnderwen PWS but no likely connection. Watercourses in catchment are potential spawning grounds for designated species.</li> </ul>	Low
Construction Compound 5	SH 96630 08830	<ul style="list-style-type: none"> <li>• Gradient: Shallow slopes</li> <li>• Watercourse proximity: &gt;200m to the Nant Ffriddycastell.</li> <li>• Average peat depth: 0.22m</li> <li>• Sensitivities: Upgradient of Dolwen PWS but no likely connection.</li> </ul>	Low
Welfare Building (North)	SH 95830 08670	<ul style="list-style-type: none"> <li>• Gradient: On shallow slopes</li> <li>• Watercourse proximity: &gt;100m from the Nant Craigyfrân.</li> <li>• Average peat depth: 0.65m</li> <li>• Sensitivities: Upgradient of Dolwen PWS but no likely connection.</li> </ul>	Low

## 8.5 Assessment of Significance of Effect

### Project Assumptions

- 8.5.1 The assessment of effect significance has been undertaken based on the changes to the project description provided in section 4, the assessment of baseline conditions across the site, coordination with the ecological sections in section 5 and the best practice techniques described in Section 8.5 of the SEI 2013.
- 8.5.2 The changes to the layout do not alter any of the previous significance of effect evaluations.

## 8.6 Further Mitigation and Management and Residual Effects

- 8.6.1 From the assessment of potential effects, the minor alterations to the infrastructure layout and the additional small sections of track do not demonstrate a potential effect significance of *Moderate* or higher and therefore no additional mitigation or management is required.

## 9. TRANSPORT

### 9.1 Introduction

- 9.1.1 Powys County Council (PCC) has requested that RES consider an alternative shared access arrangement with the Carnedd Wen site. PCC developed an outline alternative access proposal connecting the two sites and presented indicative information during Session 2 of the Inquiry. This consisted of two relatively short sections of access track to provide inter-connection. These tracks allow for the movement of Abnormal Indivisible Loads (AILs) and construction traffic.
- 9.1.2 The northern track would be approximately 480m long linking Carnedd Wen turbine number 21 with Llanbrynmair turbines number 26/27.
- 9.1.3 The southern track would be approximately 840m long and would connect Llanbrynmair turbine number 8 with Llanbrynmair turbine number 12.
- 9.1.4 There is no likely engineering reason why the northern track and the southern track could not be built. This is stated in the Llanbrynmair Transport Statement of Common Ground for Session 2 (paragraph 46).
- 9.1.5 RES has decided to prepare Supplementary Environmental Information (SEI) for the proposal to ensure that sufficient supporting information is available to the Inspector for him to fully consider the shared access proposal.
- 9.1.6 The routes for the interconnecting tracks have been visually assessed by RES engineering staff.

### 9.2 Access

- 9.2.1 The shared access concept is for AILs to enter the Llanbrynmair site via the proposed Carnedd Wen A458 trunk road access rather than via the the A458 Llanerfyl trunk road junction. All non-AIL construction traffic will enter the site from the A470 Talerddig trunk road junction as currently proposed.
- 9.2.2 The use of the A470 Talerddig trunk road junction for construction traffic and the use of the minor road from the A470 to site access 4 has been agreed by PCC as satisfactory during Session 2 of the Inquiry.
- 9.2.3 The use of the A458 Carnedd Wen trunk road access for access by abnormal loads for both Carnedd Wen and Llanbrynmair has been agreed by Welsh Government Transport. This was indicated within a WG e-mail dated 16 September 2013 to PCC. This was included as Appendix MR01 of PCC transport evidence for Session 2 of the Inquiry.

*“The Welsh Government as highway authority for the trunk road network in Wales has no objection in principle to the use of the proposed new A458 access into Carnedd Wen for abnormal load or construction traffic associated with the Llanbrynmair wind farm....”*
- 9.2.4 Transport evidence provided on behalf of Carnedd Wen during Session 2 of the Inquiry confirmed that the highway authority responsible for the A458 trunk road, Welsh Government (WG) has approved the proposed access arrangements (confirmed in WG’s Statement of Case for Session 2). The details have been the subject of a Stage 1 Road Safety Audit and no significant issues were raised. The roads safety Audit was submitted as Appendix 1 of CW transport evidence for Session 2.
- 9.2.5 There is, therefore, an evidence base that has already been presented which supports the use of the A458 Carnedd Wen access junction for AIL access to Llanbrynmair.
- 9.2.6 AILs associated with Llanbrynmair would subsequently travel a further 12 km along the A458 from Llanerfyl (being the current turn-off point from the A458 trunk road) to the turn off point at the Carnedd Wen access point.

- 9.2.7 This section of the A458 is contained within section 3 of the sTMP which is approved by both WG and PCC. As such, the alternative AIL access route is already an approved route.
- 9.2.8 There are, therefore, no transport-related reasons for AIL deliveries for Llanbrynmair not to access the site via Carnedd Wen and the Carnedd Wen A458 trunk road access.

## 10. CARBON CALCULATOR

### 10.1 Introduction

- 10.1.1 This section has been undertaken by Fluid Environmental Consulting (Fluidec) in order to provide a carbon calculator assessment for the alternative access proposals put forward resulting in infrastructure amendments.
- 10.1.2 The Scottish Government Carbon Assessment Tool (v 2.7.0) for Llanbrynmair Wind Farm has been revised in light of the infrastructure amendments to the site layout, using the information laid out in Tables 1 and 2 of Appendix I of the Hydrology section of the SEI 2014.
- 10.1.3 In total, four sections of the tool have been amended:
1. The peat depth in the borrow-pits has been revised slightly upwards, adding approximately 400 tCO<sub>2</sub>e losses to the soil organic category;
  2. The turbines and hardstanding area have been increased slightly in area but the peat depth estimate has been revised downward. This has reduced the soil organic losses by around 1,100 tCO<sub>2</sub>e;
  3. The access track length has decreased at the same time as the average peat depth has increased. The net effect is to decrease soil organic losses by about 400 tCO<sub>2</sub>e; and
  4. Finally, updated volume and area in the section 'additional peat excavated' which is used to account for other infrastructure such as construction compounds has had the effect of reducing the losses by about 150tCO<sub>2</sub>e.

### 10.2 Results

- 10.2.1 The overall net effect of the changes is to decrease the estimated losses by 1430 tCO<sub>2</sub>e; the majority of which come from a reduction in losses of soil organic matter from excavated peat. However, the impact of these revisions on the overall payback is negligible - the expected payback for the grid-mix of electricity generation remains as 1.1 years. The minimum payback remains the same at -0.1 years but the estimated maximum payback has reduced by 2 months to 3.6 years as better refinements of peat depth upper and lower end estimates have been possible.
- 10.2.2 These results show that Natural Resources Wales can be reassured that the infrastructure changes proposed are unlikely to have a negative effect on the overall site payback and could have a minor positive impact on the soil carbon losses. However, since the amendments proposed are well within the margins of error of the carbon assessment tool, it can only be stated that the infrastructure changes are insignificant with respect to the overall carbon emissions.
- 10.2.3 The revised parameters and results are shown in the table below with explanations for auditing purposes. The carbon assessment tool has also been forwarded for reference and is shown in **Appendix 10.1**.



Table 10.1 Input table for revised parameters to the carbon assessment tool 31/01/14

Data	Expected Value	Minimum Value	Maximum Value	Data Source	Assumption / Comment
<b>Borrow pits</b>					
Number of borrow pits	5	5	5	Key information from RES	
Average length of pits (m)	60	57	63	Dimensions of the borrowpits have been taken from Table 2 Appendix I)	+/-5% range used to estimate likely maximum and minimum sizes
Average width of pits (m)	60	57	63		
Average depth of peat removed from pit (m)	0.24	0.01	0.46	The average peat depth is calculated as the volume of peat divided by the area as presented in Table 2, Appendix I for the five borrow pits. This data is estimated from an average of peat depth probes at the five locations.	The range was calculated as +/- 2 standard errors from the mean (count = 6, Standard deviation = 0.274)
<b>Foundations and hard-standing area associated with each turbine</b>					
Average length of turbine foundations (m)	20	19	21	Dimensions of the turbines have been estimated from the total size of the shape for the turbine including crane pad in GIS (from Table 2 Appendix I)	+/-5% range used to estimate likely maximum and minimum sizes
Average width of turbine foundations(m)	20	19	21		
Average depth of peat removed from turbine foundations(m)	0.45	0.33	0.57	The average peat depth is calculated as the volume of peat divided by the area as presented in Table 2, Appendix I. This data is estimated as an average of peat depth at the 30 turbine locations.	The range was calculated as +/- 2 standard errors from the mean (count = 30, Standard deviation = 0.324)



Average length of hard-standing (m)	66.1	62.8	69.4	Dimensions of the hard-standing have been estimated from the total size of the shape for the turbine including crane pad in GIS (from Table 2 Appendix I)	+/-5% range used to estimate likely maximum and minimum sizes
Average width of hard-standing (m)	66.1	62.8	69.4		
Average depth of peat removed from hard-standing (m)	0.45	0.33	0.57	The average peat depth is calculated as the volume of peat divided by the area as presented in Table 2, Appendix I. This data is estimated as an average of peat depth at the 30 hard-standing locations.	The range was calculated as +/- 2 standard errors from the mean (count = 30, Standard deviation = 0.324)
<b>Access tracks</b>					
Total length of access track (m)	18,123	17,217	19,029	Total length of track on site, excluding areas where the track cross the hard-standing, as calculated by GIS. The track length is from Table 1, Appendix I. This includes new and existing track.	+/-5% range used to estimate likely maximum and minimum sizes
Existing Track Length (m)	2,258	2,145	2,371	Total length of existing track on site. The existing track length is from Table 1, Appendix I. However, since at least some of this track will require upgrading, the total calculated length of access track has been used as the input value below.	+/-5% range used to estimate likely maximum and minimum sizes
Length of access track that is excavated road (m)	18,123	17,217	19,029	Total length of track on site, excluding areas where the track cross the hard-standing as calculated by GIS. The track length is from Table 1, Appendix I. This includes new and existing track.	
Excavated road width (m)	7.5	6.75	8.25	The width of 7.5m which includes 5.5m running width and 1m of drainage on either side of track.	A range of +/- 10% has been used to estimate the minimum and maximum width.





Average Depth of Peat Excavated for Road (m)	0.31	0.28	0.34	The average depth of peat excavated for the track is taken from Table 2, Appendix I.	A range of +/- 10% has been used to estimate the minimum and maximum depth
<b>Additional Peat Excavated (not already accounted for above)</b>					
Volume of Additional Peat Excavated (m <sup>3</sup> )	4,900	4,410	53,90	The total additional volume of peat extracted is taken from Table 2 in Appendix I. This data has been estimated from peat depth probes at each of the locations for: the met mast and crane pad, the substation, two welfare buildings, five construction compounds and a batching plant.	A range of +/- 10% was used to estimate likely maximum and minimum volume
Area of Additional Peat Excavated (m <sup>2</sup> )	25,906	24,611	27,201	The area of additional peat excavated is taken from the total area of the above infrastructure as listed in Table 2, Appendix I.	A range of +/- 5% was used to estimate likely maximum and minimum area

**Table 10.2: Results from the carbon assessment tool**

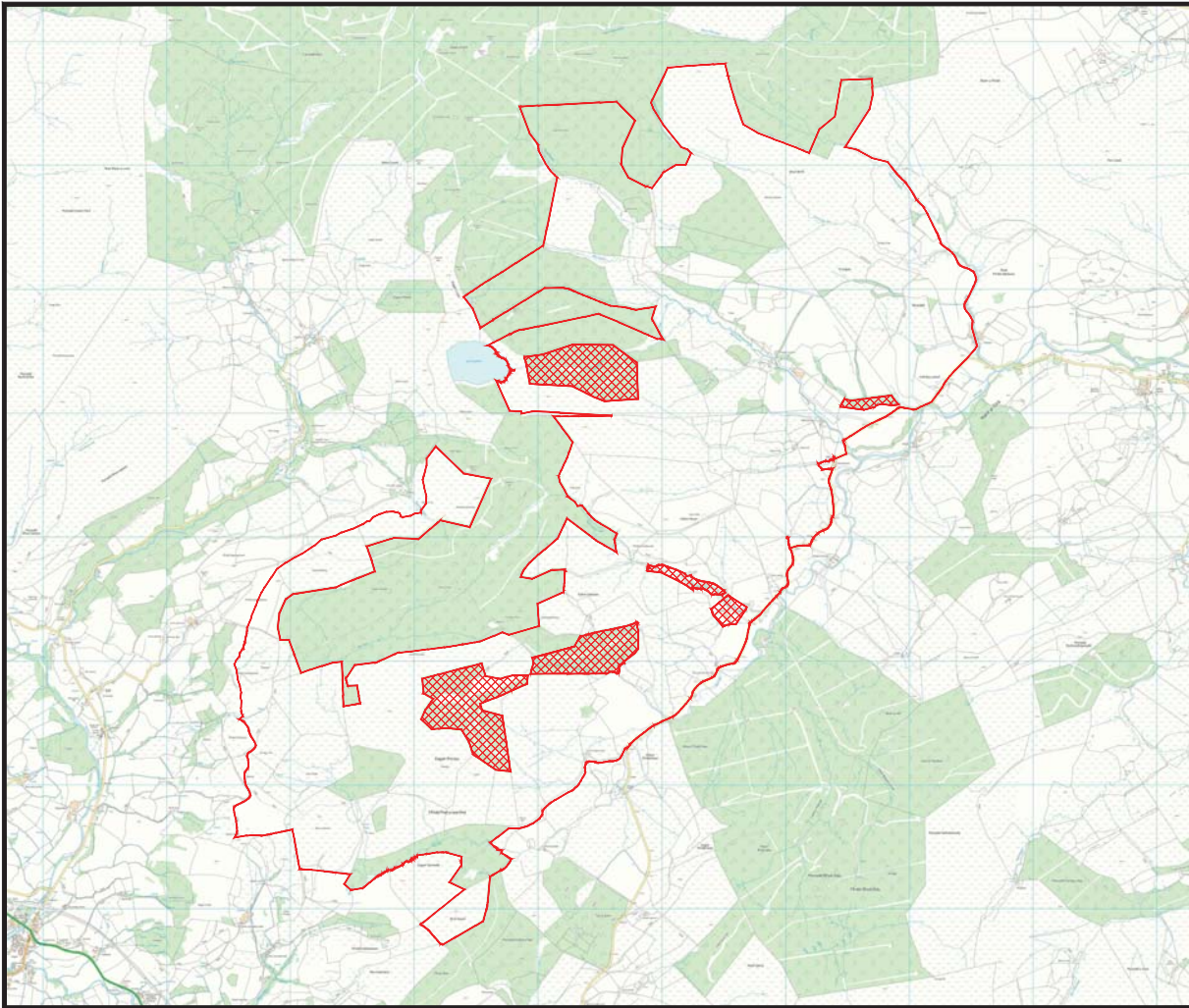
	<i>Exp.</i>	<i>Min.</i>	<i>Max.</i>
<b>1. Windfarm CO<sub>2</sub> emission saving over...</b>			
...coal-fired electricity generation (tCO <sub>2</sub> yr <sup>-1</sup> )	132034	96822	201373
...grid-mix of electricity generation (tCO <sub>2</sub> yr <sup>-1</sup> )	66017	48411	100687
...fossil fuel - mix of electricity generation (tCO <sub>2</sub> yr <sup>-1</sup> )	93191	68338	142132
<b>Total CO<sub>2</sub> losses due to wind farm (t CO<sub>2</sub> eq.)</b>			
2. Losses due to turbine life (eg. manufacture, construction, decommissioning)	50444	42035	70065
3. Losses due to backup	9631	6784	15200
4. Losses due to reduced carbon fixing potential	1687	1231	2186
5. Losses from soil organic matter	22339	9631	38719
6. Losses due to DOC & POC leaching	1443	237	3109
7. Losses due to felling forestry	22538	-3685	54125
Total losses of carbon dioxide	108082	56232	183404
<b>8. Total CO<sub>2</sub> gains due to improvement of site (t CO<sub>2</sub> eq.)</b>			
8a. Gains due to improvement of degraded bogs	-7926	-298	-23915
8b. Gains due to improvement of felled forestry	-30651	-8760	-46218
8c. Gains due to restoration of peat from borrow pits	-11	-9	-73
8d. Gains due to removal of drainage from foundations & hardstanding	-23	-9	-219
Total gains	-38611	-9076	-70425

<b>RESULTS</b>			
	<i>Exp.</i>	<i>Min.</i>	<i>Max.</i>
<b>Net emissions of carbon dioxide (t CO<sub>2</sub> eq.)</b>			
	<b>69471</b>	<b>-14194</b>	<b>174328</b>
<b>Carbon Payback Time</b>			
...coal-fired electricity generation (years)	0.5	-0.1	1.8
...grid-mix of electricity generation (years)	1.1	-0.1	3.6
...fossil fuel - mix of electricity generation (years)	<b>0.7</b>	<b>-0.1</b>	<b>2.6</b>

## FIGURE LIST

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FIGURES 1A TO 1-3E: SITE BOUNDARY



**LLANBRYNMAIR  
WIND FARM**

**DRAWING 1A**

**SITE BOUNDARY**

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**KEY**

- SITE BOUNDARY
- ▣ EXCLUDED FROM WIND POWER PROJECT



**SITE OVERVIEW  
SHEET 1 OF 25**

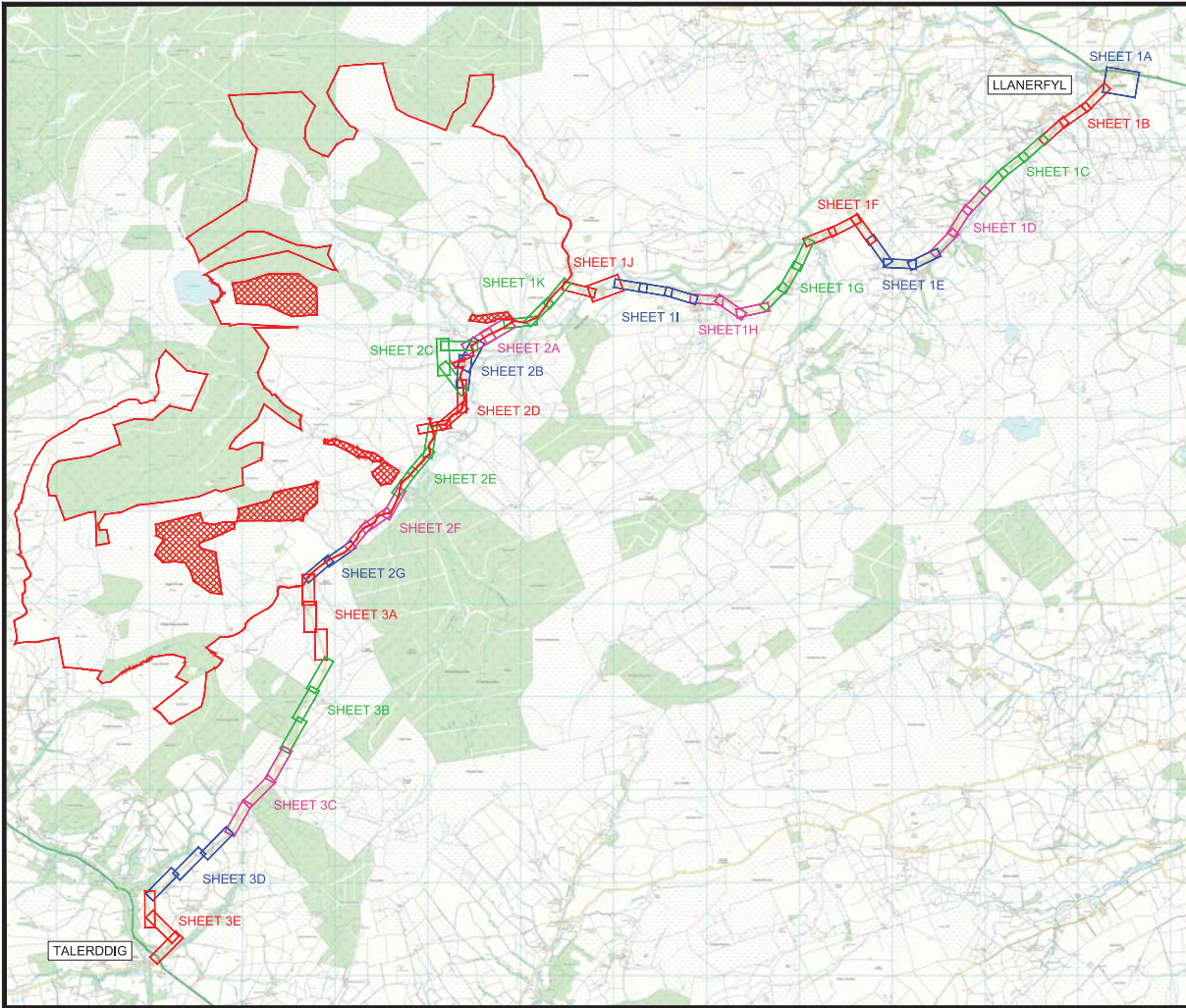
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**LLANBRYNMAIR  
WIND FARM**

**DRAWING 1B**

**SITE BOUNDARY**

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- KEY**
- SITE BOUNDARY
  - EXCLUDED FROM WIND POWER PROJECT



ACCESS ROUTE OVERVIEW  
SHEET 2 OF 25

LAYOUT DATE: N/A PLANNING NO: N/A

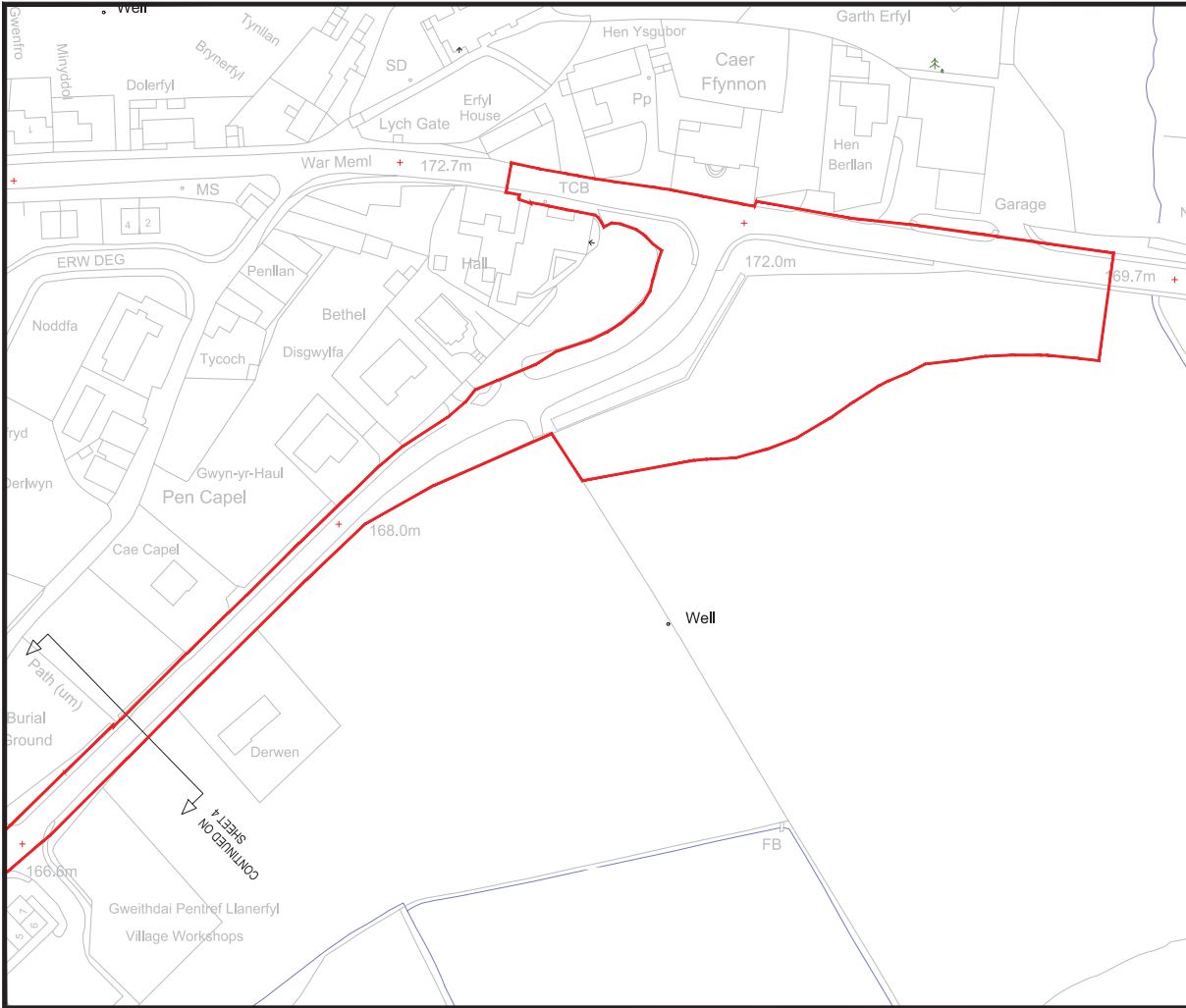
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**LLANBRYNMAIR  
WIND FARM**

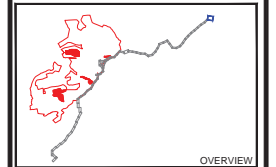
**DRAWING 1-1A**

**SITE BOUNDARY**

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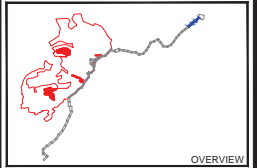
**DRAWING 1-1B**

**SITE BOUNDARY**

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SHEET 4 OF 25

REVISED DATE: N/A      REVISED BY: N/A

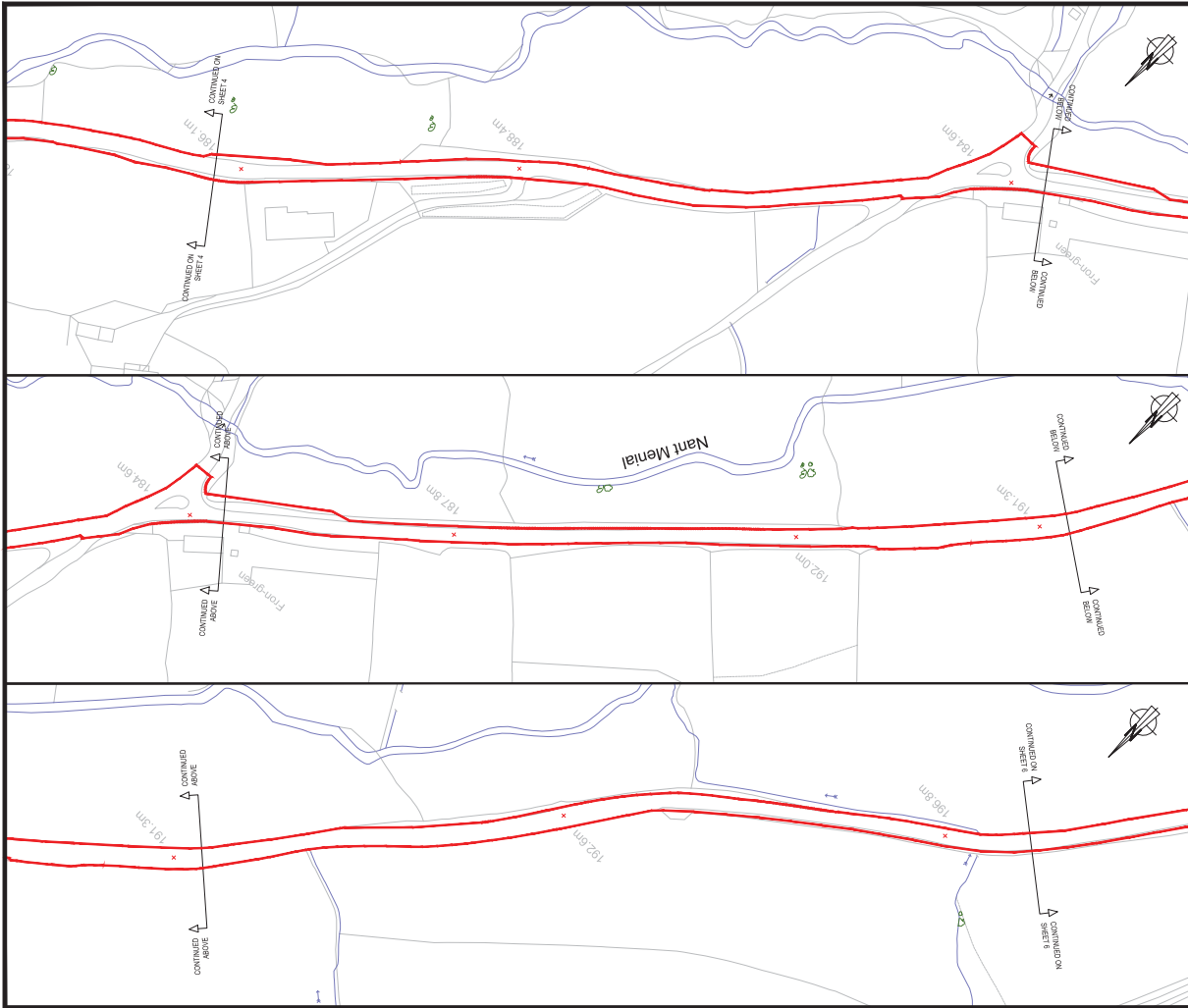
DRAWING NUMBER: **01592D2205-16**

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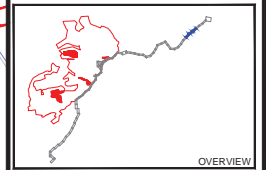
**DRAWING 1-1C**

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SHEET 5 OF 25

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DRAWING NUMBER: **01592D2205-16**

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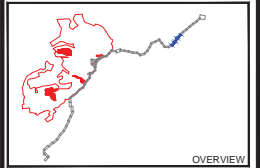
**DRAWING 1-1D**

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**ACCESS DETAILS**  
SHEET 6 OF 25

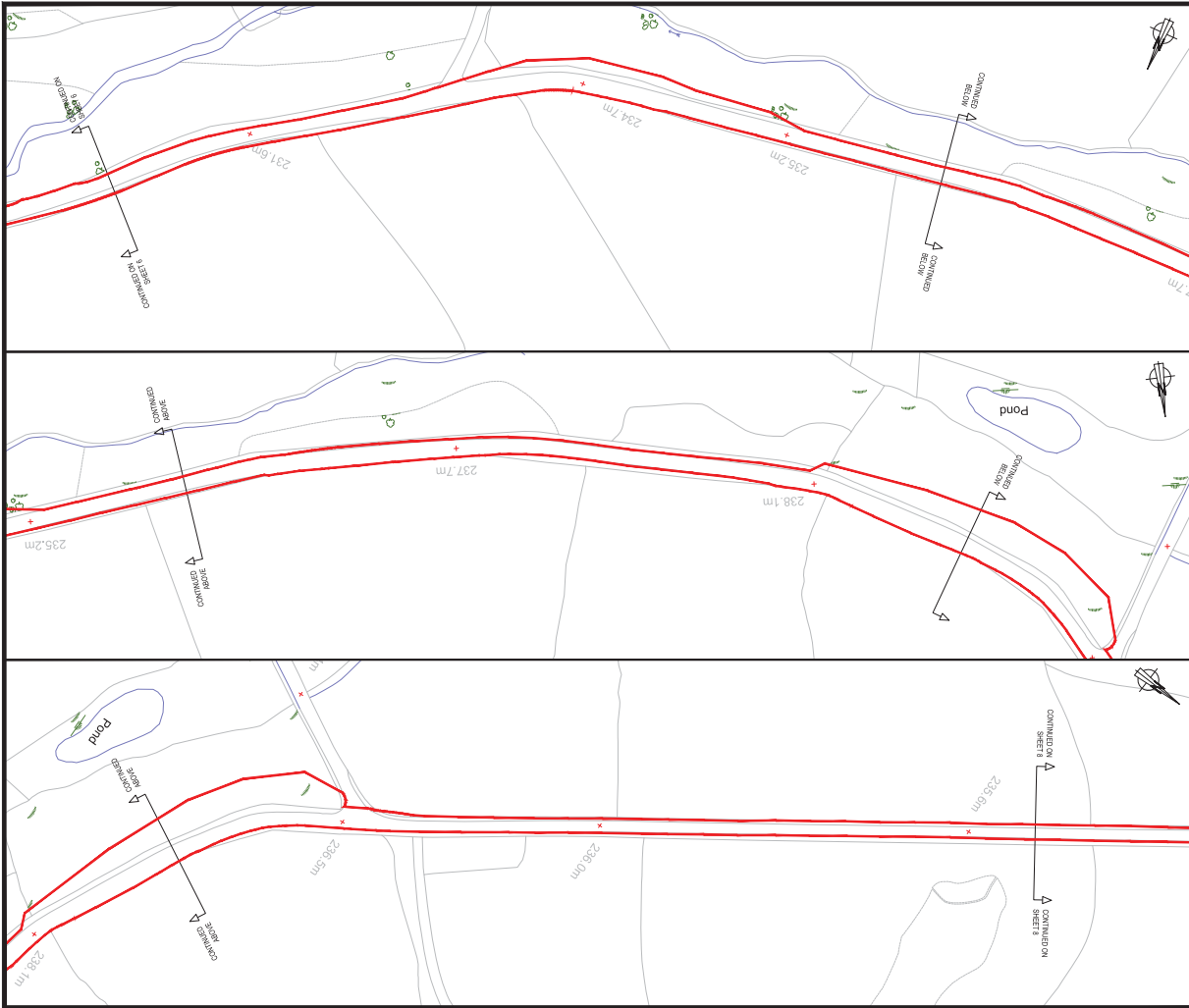
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DRAWING NUMBER: **01592D2205-16**

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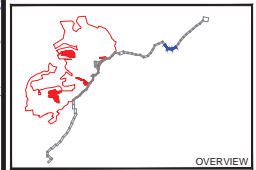
**DRAWING 1-1E**

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SHEET 7 OF 25

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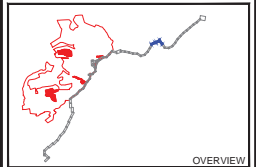
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OVERVIEW

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SHEET 8 OF 25

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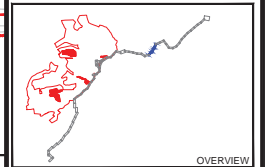
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SHEET 9 OF 25

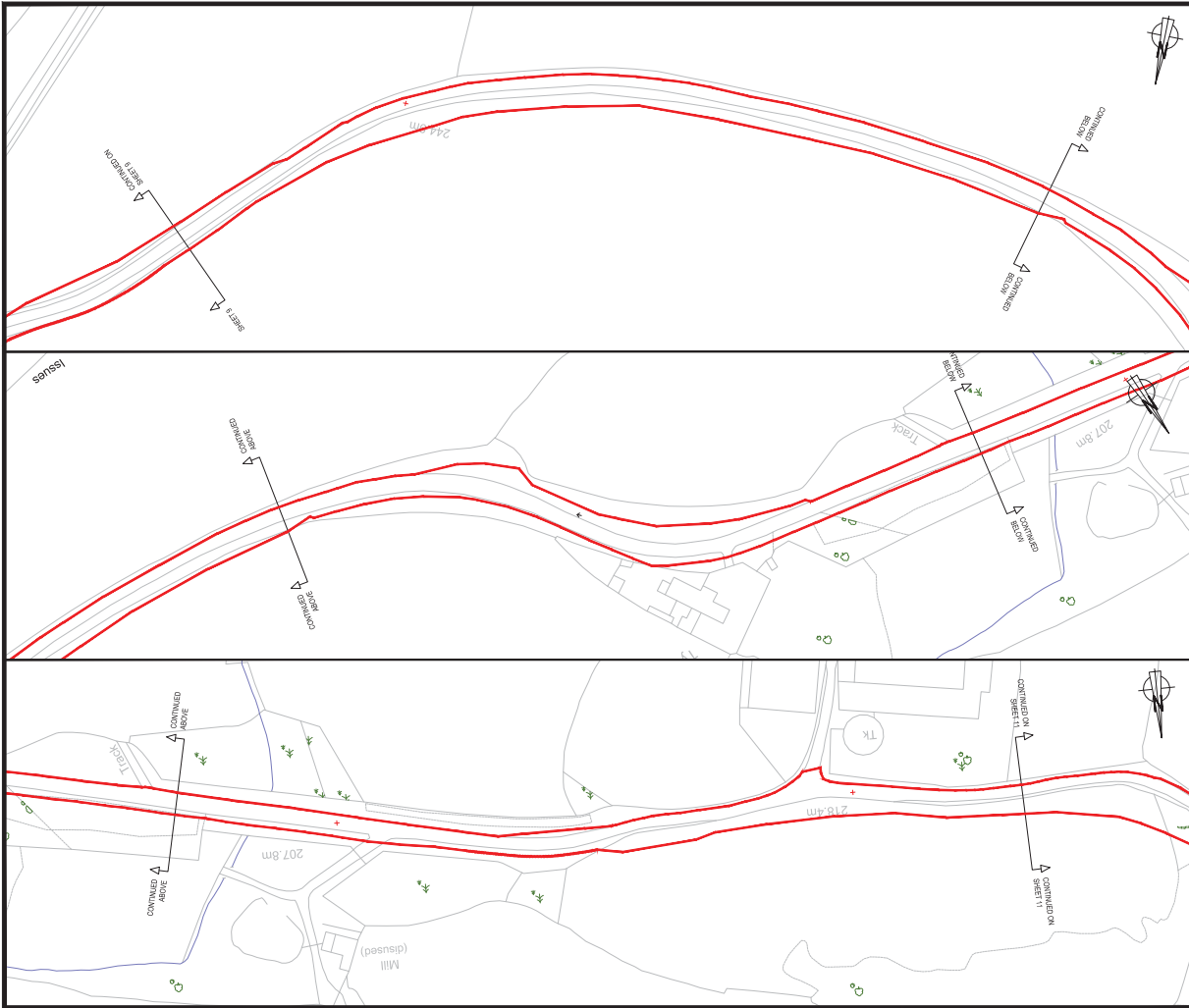
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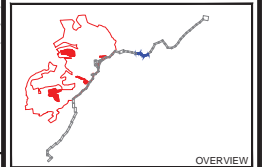
**DRAWING 1-1H**

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SHEET 10 OF 25

LAYOUT DATE: N/A      LAYOUT NO: N/A

DRAWING NUMBER: **01592D2205-16**

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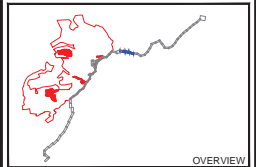
**DRAWING 1-11**

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SHEET 11 OF 25

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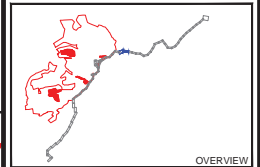
**DRAWING 1-1J**

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ACCESS DETAILS  
SHEET 12 OF 25

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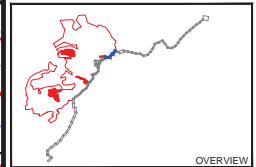
**DRAWING 1-1K**

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SHEET 13 OF 25

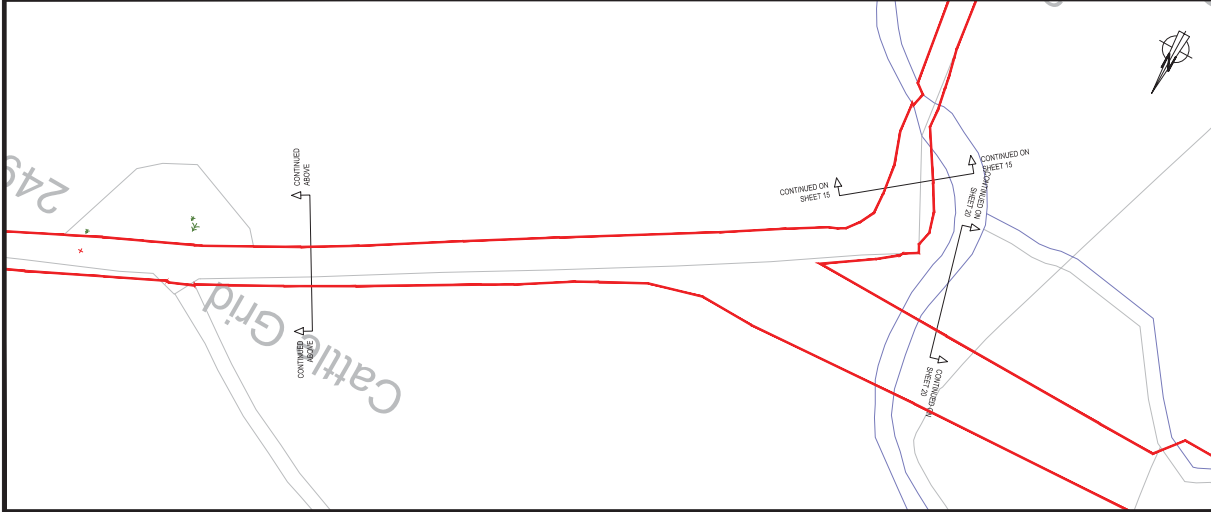
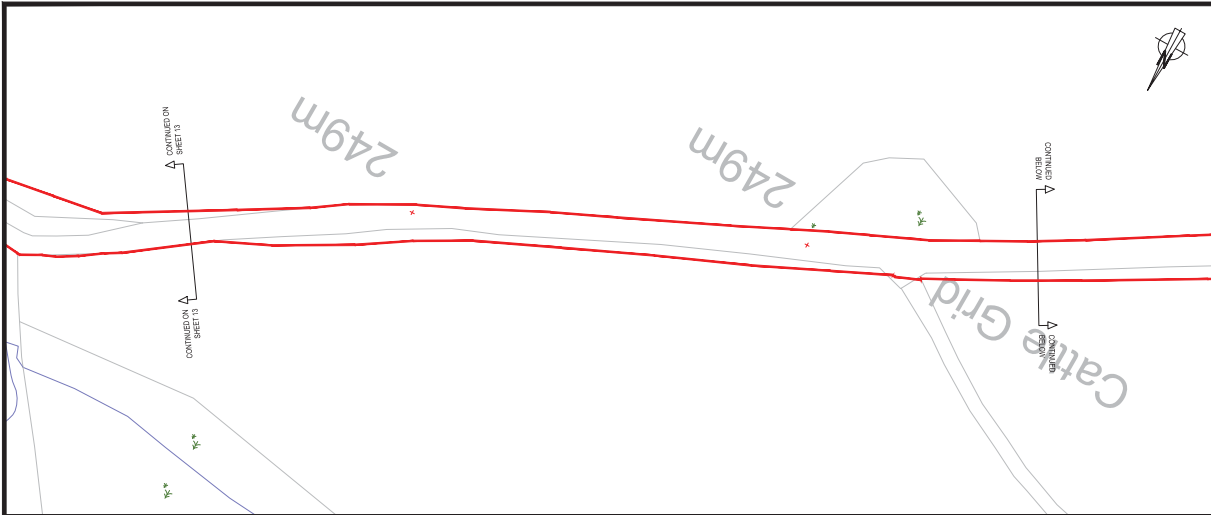
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SCALE - 1:1,250 @ A3

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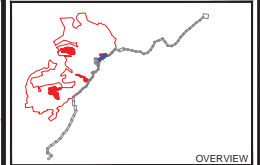
**DRAWING 1-2A**

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SHEET 14 OF 25

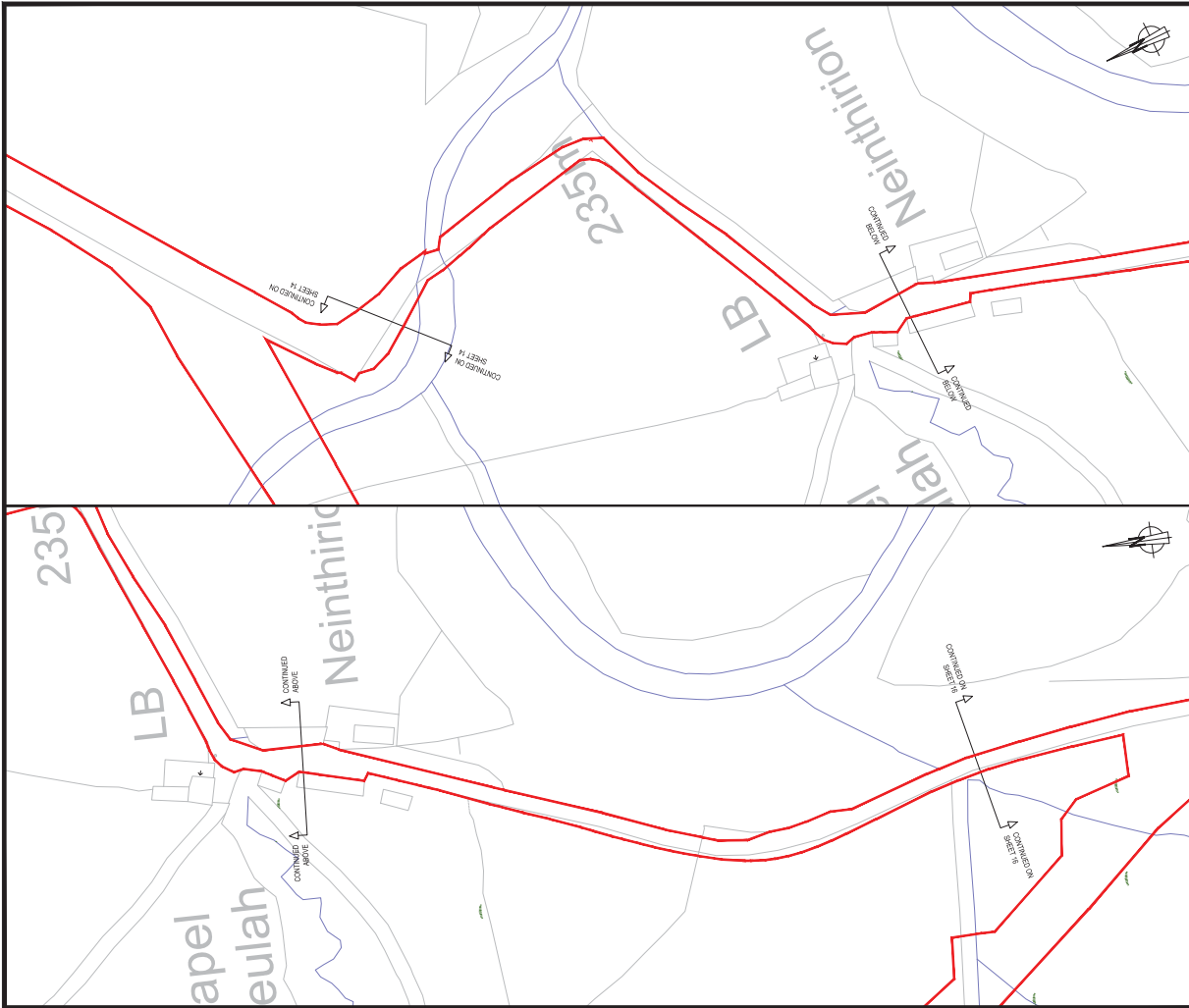
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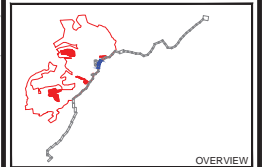
**DRAWING 1-2B**

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SHEET 15 OF 25

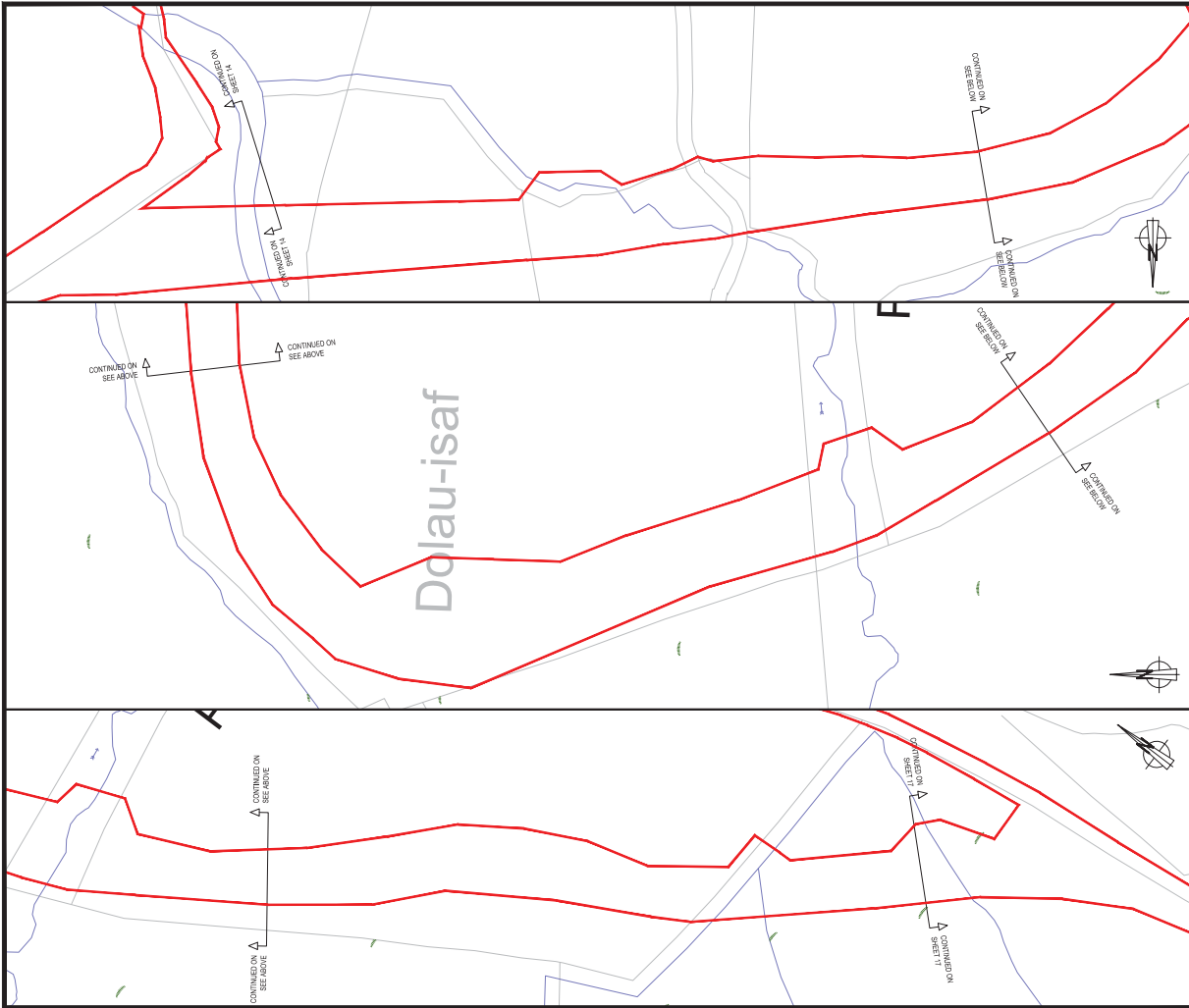
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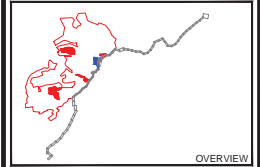
**DRAWING 1-2C**

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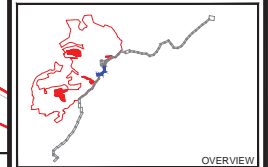
**DRAWING 1-2D**

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OVERVIEW

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DRAWING NUMBER: **01592D2205-16**

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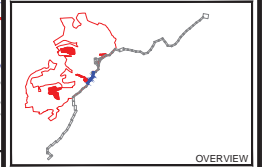
**DRAWING 1-2E**

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SHEET 18 OF 25

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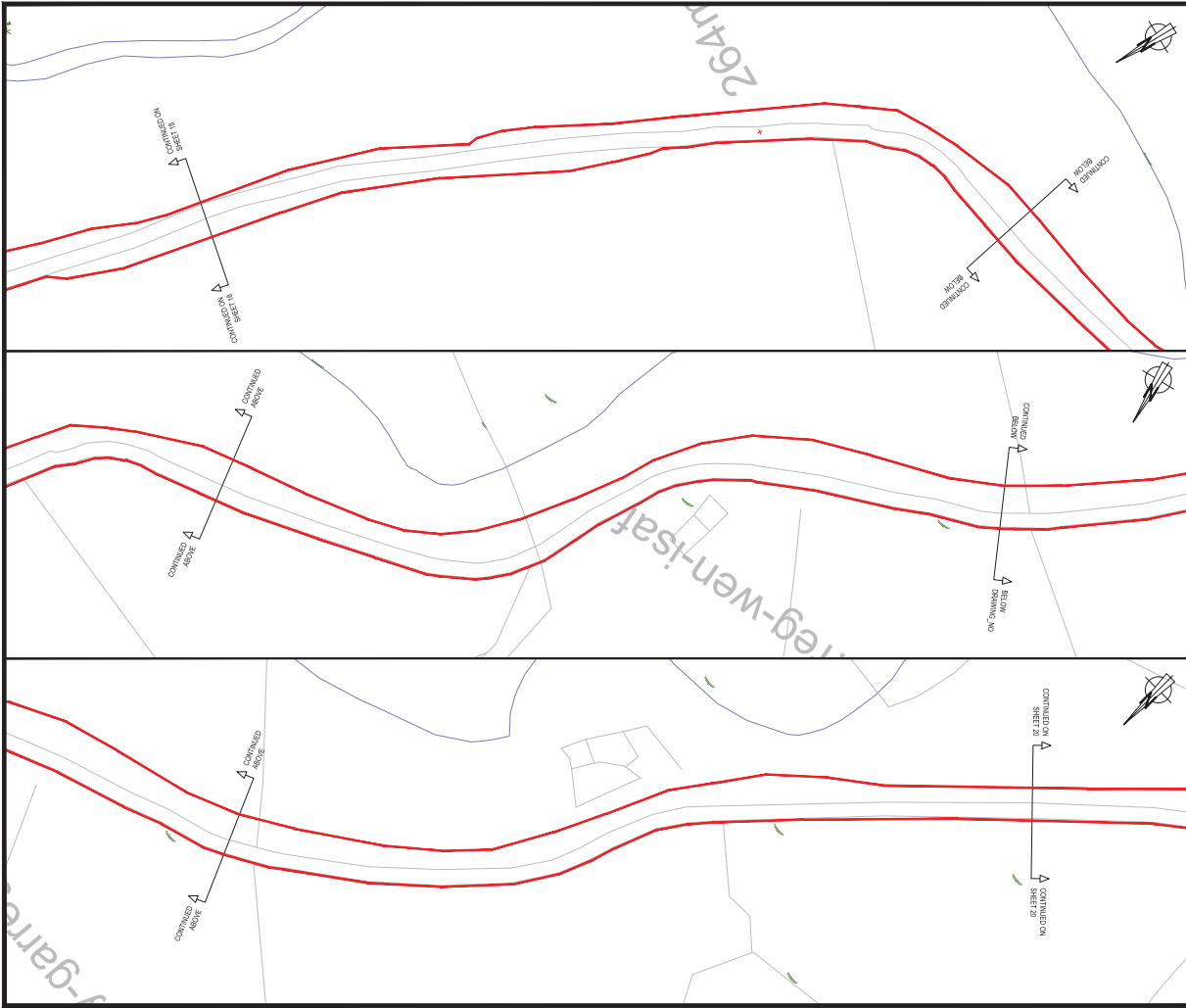
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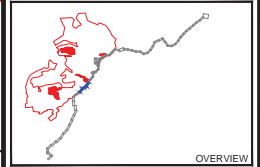
**DRAWING 1-2F**

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SHEET 19 OF 25

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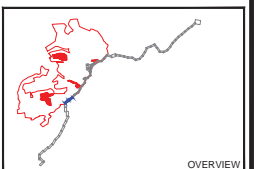
**DRAWING 1-2G**

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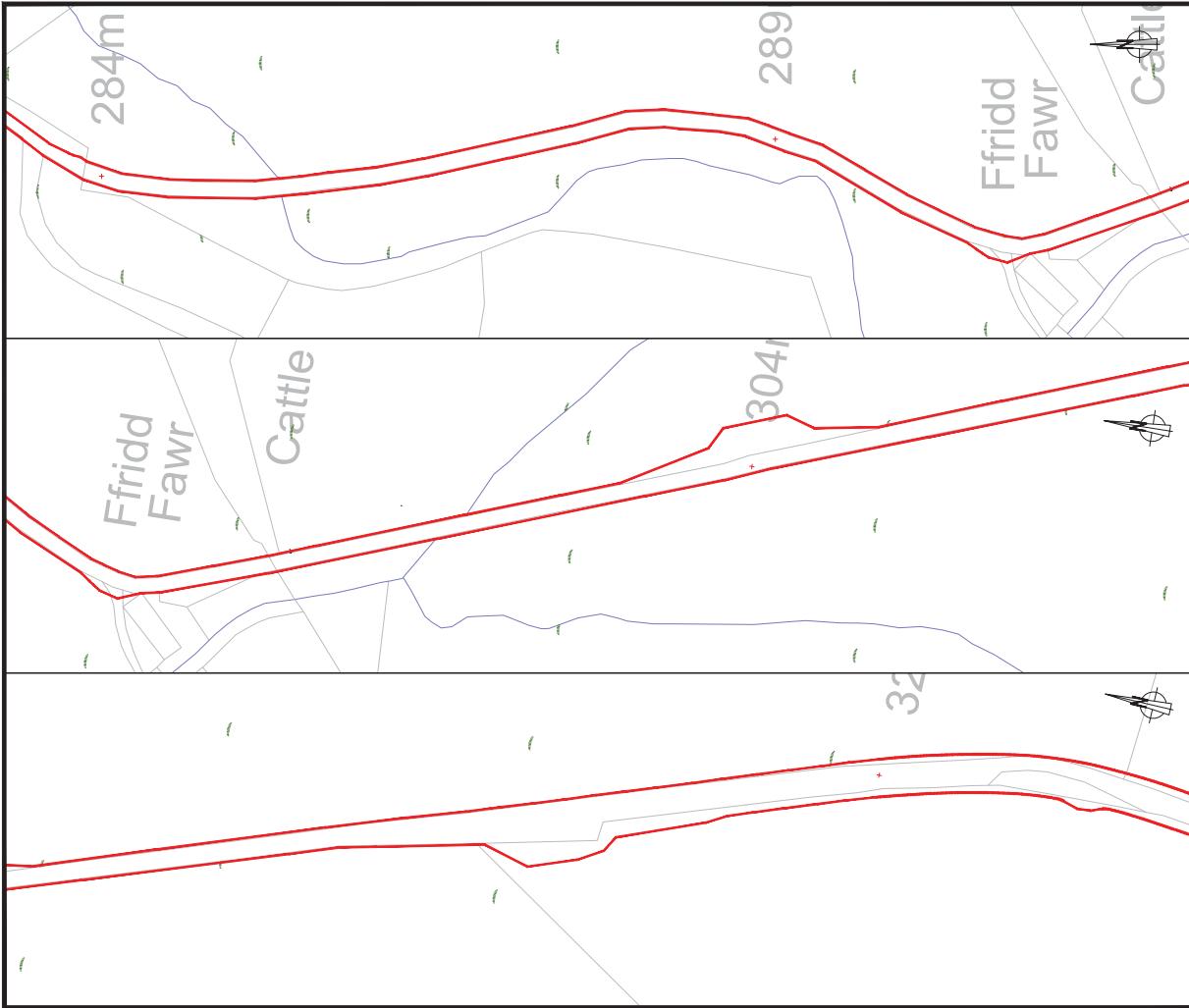
**ACCESS DETAILS**  
SHEET 20 OF 25

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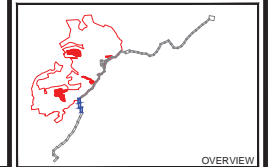
**DRAWING 1-3A**

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ACCESS DETAILS  
SHEET 21 OF 25

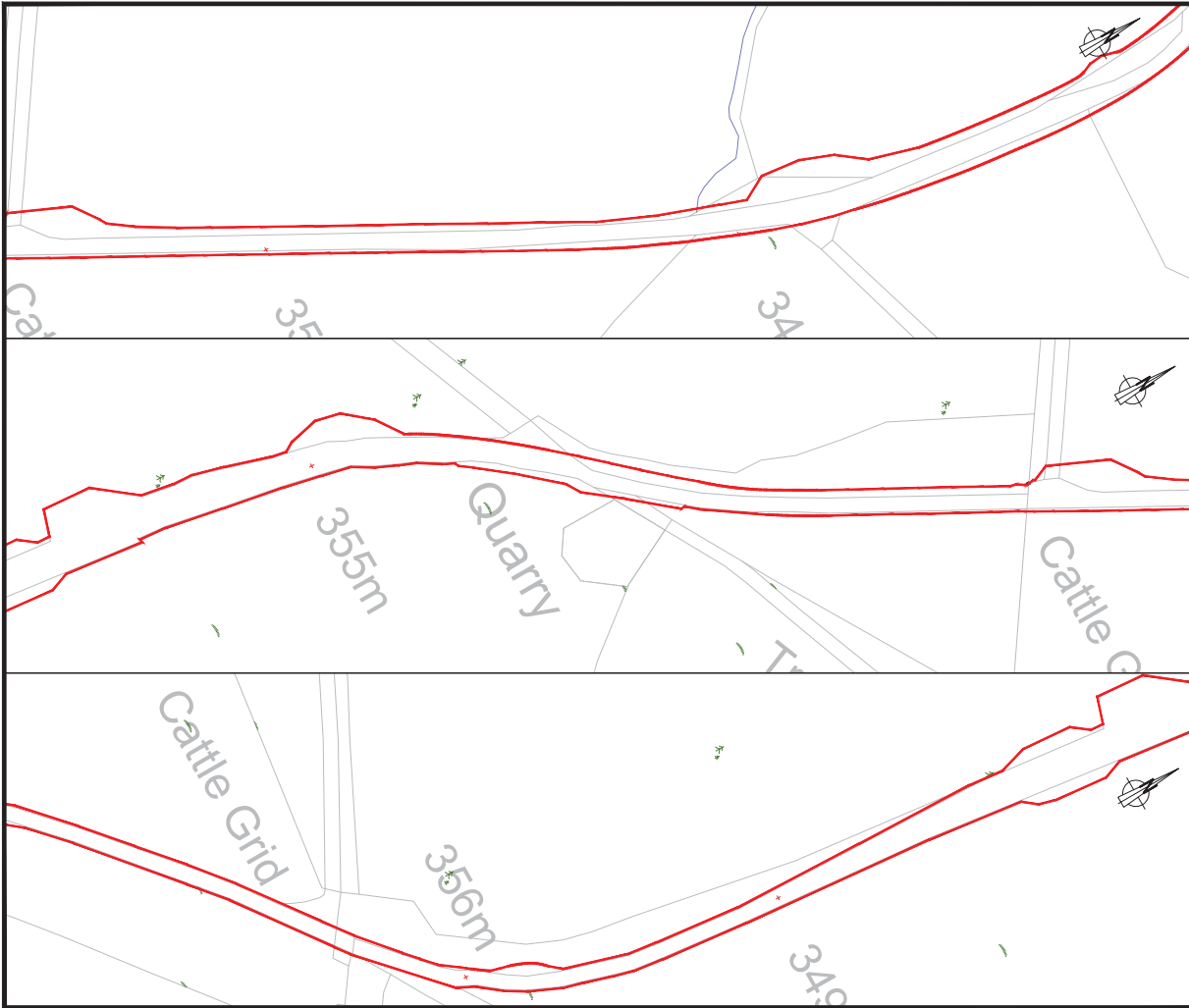
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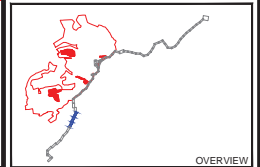
**LLANBRYNMAIR  
WIND FARM**

**DRAWING 1-3B**

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**ACCESS DETAILS**  
SHEET 22 OF 25

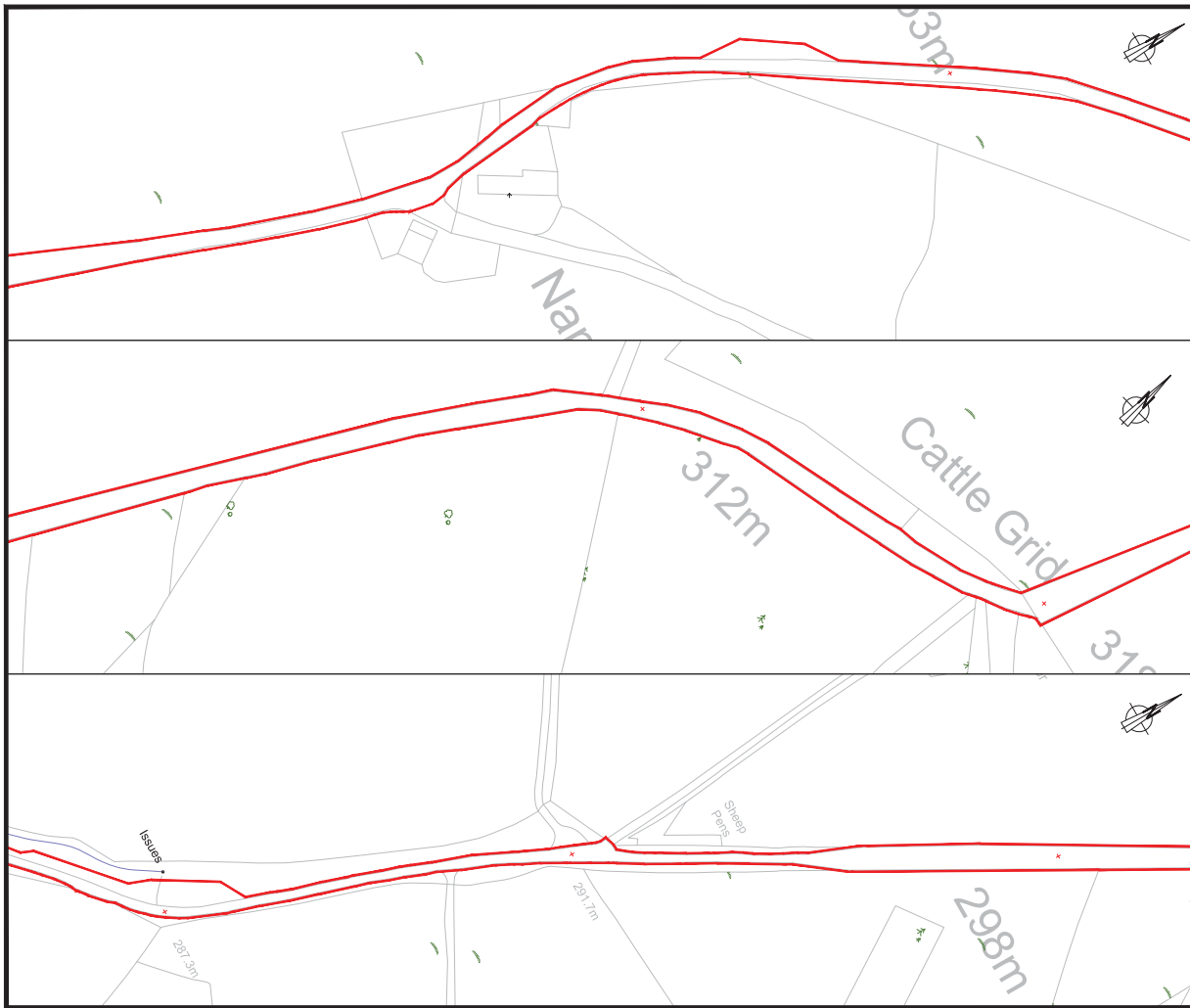

REVISION NO: N/A      DRAWING NO: N/A

DRAWING NUMBER: **01592D2205-16**

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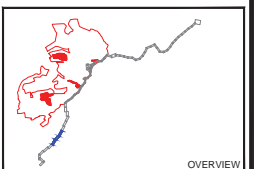
**DRAWING 1-3C**

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SHEET 23 OF 25

LAYOUT DATE	N/A	DRAWING NO.	N/A
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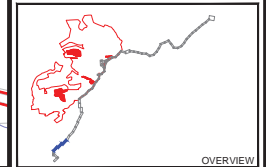
**DRAWING 1-3D**

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OVERVIEW

**ACCESS DETAILS**  
SHEET 24 OF 25

LAYOUT DATE: N/A      LAYOUT NO: N/A

DRAWING NUMBER: **01592D2205-16**

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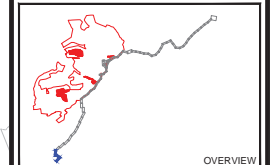
**DRAWING 1-3E**

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**ACCESS DETAILS**  
SHEET 25 OF 25

LAYOUT DATE: N/A      PLANING NO: N/A

DRAWING NUMBER: **01592D2205-16**

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**FIGURE 4.1: ALTERNATIVE INFRASTRUCTURE LAYOUT**



### LLANBRYNMAIR WIND FARM

#### FIGURE 4.1

### ALTERNATIVE INFRASTRUCTURE LAYOUT

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- KEY**
- WIND TURBINE
  - CARNEDD WEN WIND TURBINE (RWE SEI 2013)
  - SITE TRACK
  - HARDSTANDING
  - BORROW PIT (BP#)
  - TEMPORARY SITE COMPOUND (SC#)
  - SUB STATION
  - LOCATIONS OF EXISTING TRACK
  - WATER CROSSING EXISTING
  - WATER CROSSING NEW
  - TEMPORARY TURBINE MAST
  - TEMPORARY CALIBRATION MAST
  - PERMANENT MAST
  - BATCHING PLANT
  - TEMPORARY INFRASTRUCTURE (PASSING BAYS & TURNING HEADS)
  - SITE BOUNDARY (REFER TO DRAWING 01592D2205-16 FOR DETAILS).
  - WELFARE BUILDING
  - PROPOSED CARNEDD WEN WIND FARM INFRASTRUCTURE (RWE SEI 2013)

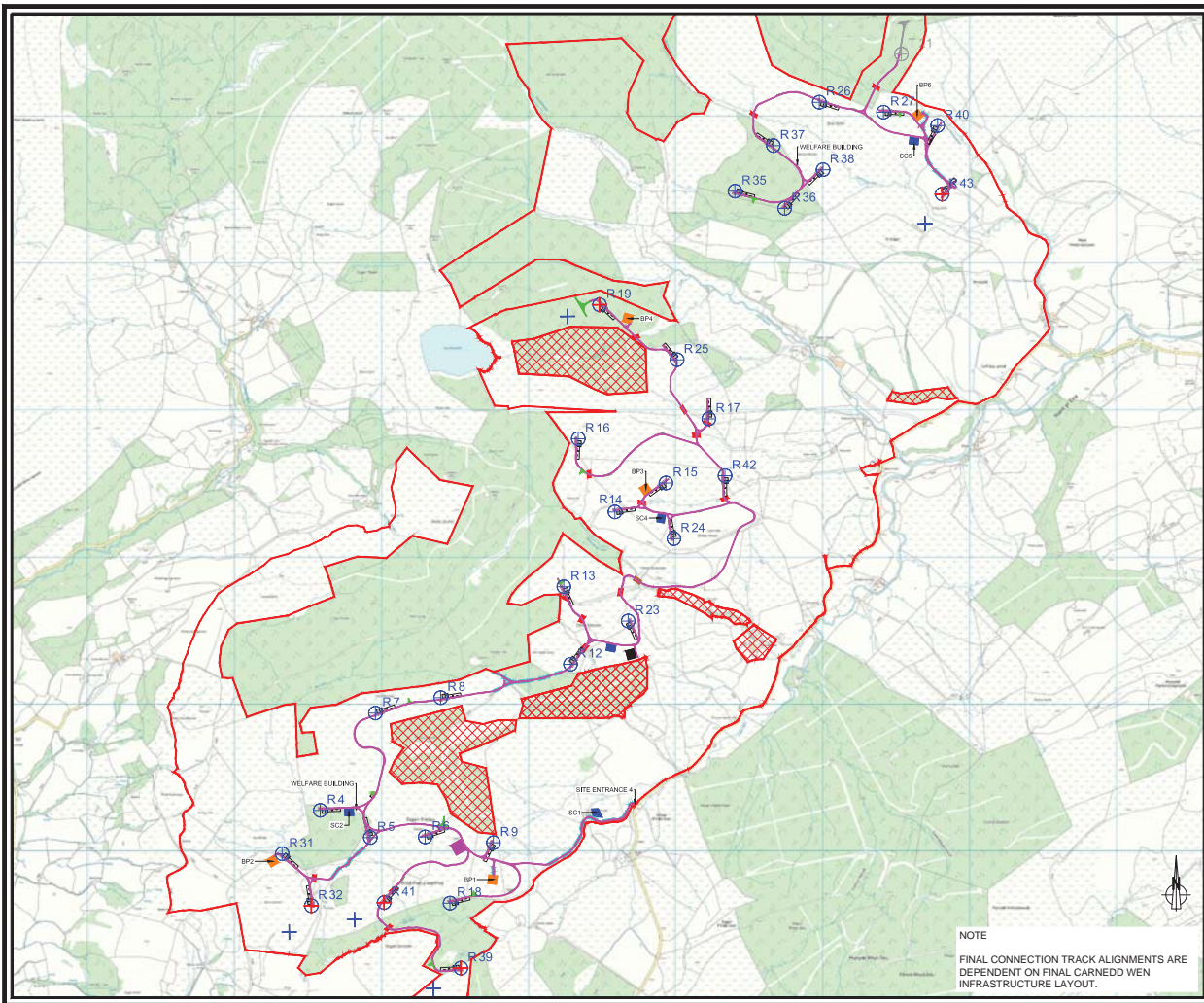
LEAFLET NO: 01592D0004-10      TRACK NO: PWWL14a087

DRAWING NUMBER: **01592D2276-05**

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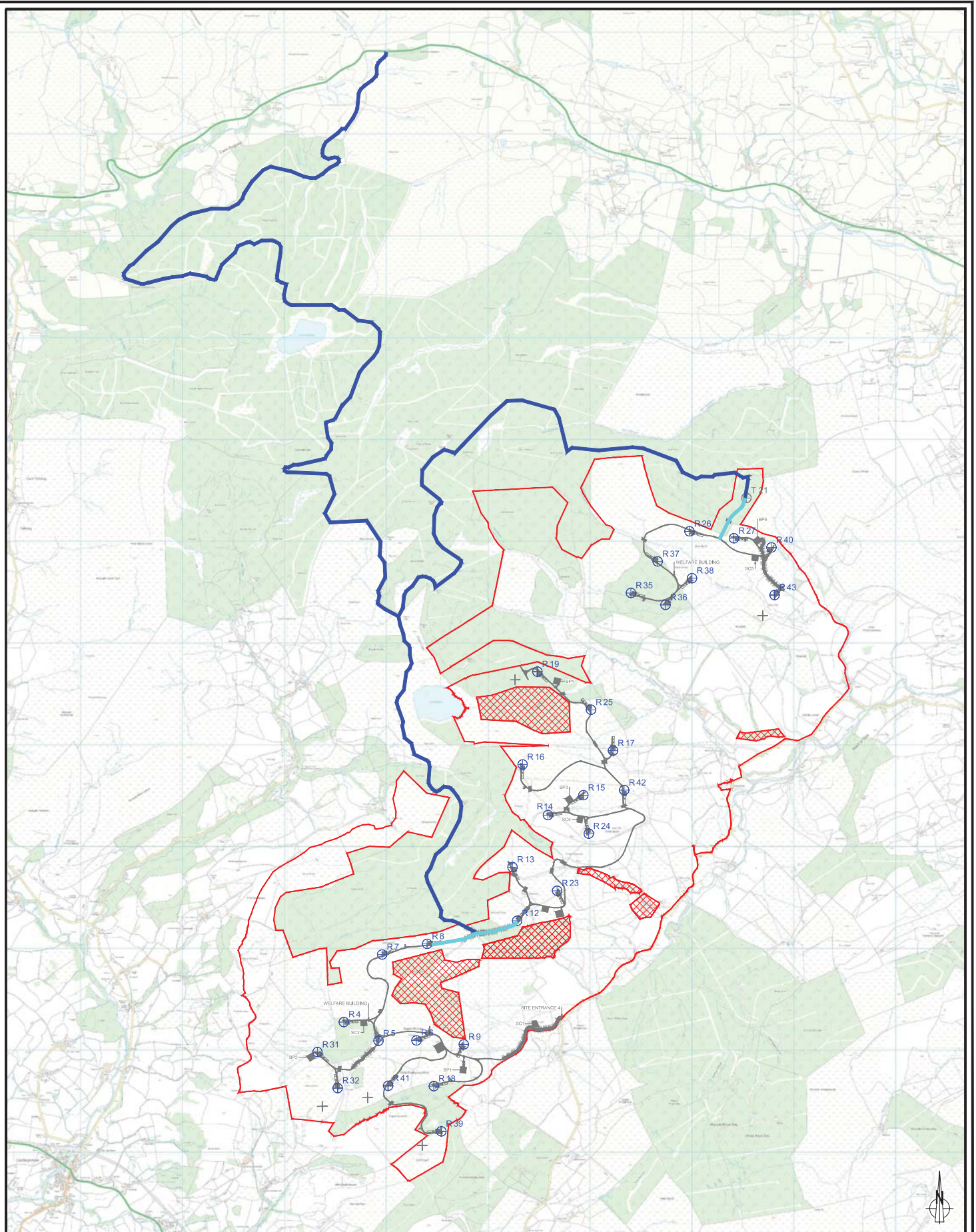
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**FIGURE 4.2: ALTERNATIVE ACCESS OVERVIEW**





**LLANBRYNMAIR  
WIND FARM**

**FIGURE 4.2**

**ALTERNATIVE ACCESS  
OVERVIEW**

01592D2278-01

LAYOUT  
DWG 01592D0004-10

T.LAYOUT  
NO. PWALla087




SCALE 1:35,000 @ A3

SUPPLEMENTARY ENVIRONMENTAL  
INFORMATION 2014

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2014 LICENCE NUMBER 0100031673.

**KEY**

-  CARNEDD WEN TRACK
-  PROPOSED CARNEDD WEN - LLANBRYNMAIR LINKS
-  LLANBRYNMAIR ALTERNATIVE INFRASTRUCTURE (TAKEN FROM RES DRAWING 01592D2276-05)



**FIGURE 6.1: LINK TRACK NVC MAP**





**LLANBRYNMAIR  
WIND FARM**

**FIGURE 6.1**

**LINK TRACK  
NVC AREAS**

Area	NVC
1	M25 (E vag variant)
2	M17a
3	M6c / M17a
4	M6c / U5a
5	M6c / M17a
6	M17a
7	M18a
8	M17a / M18a
9	MG6
10	MG6



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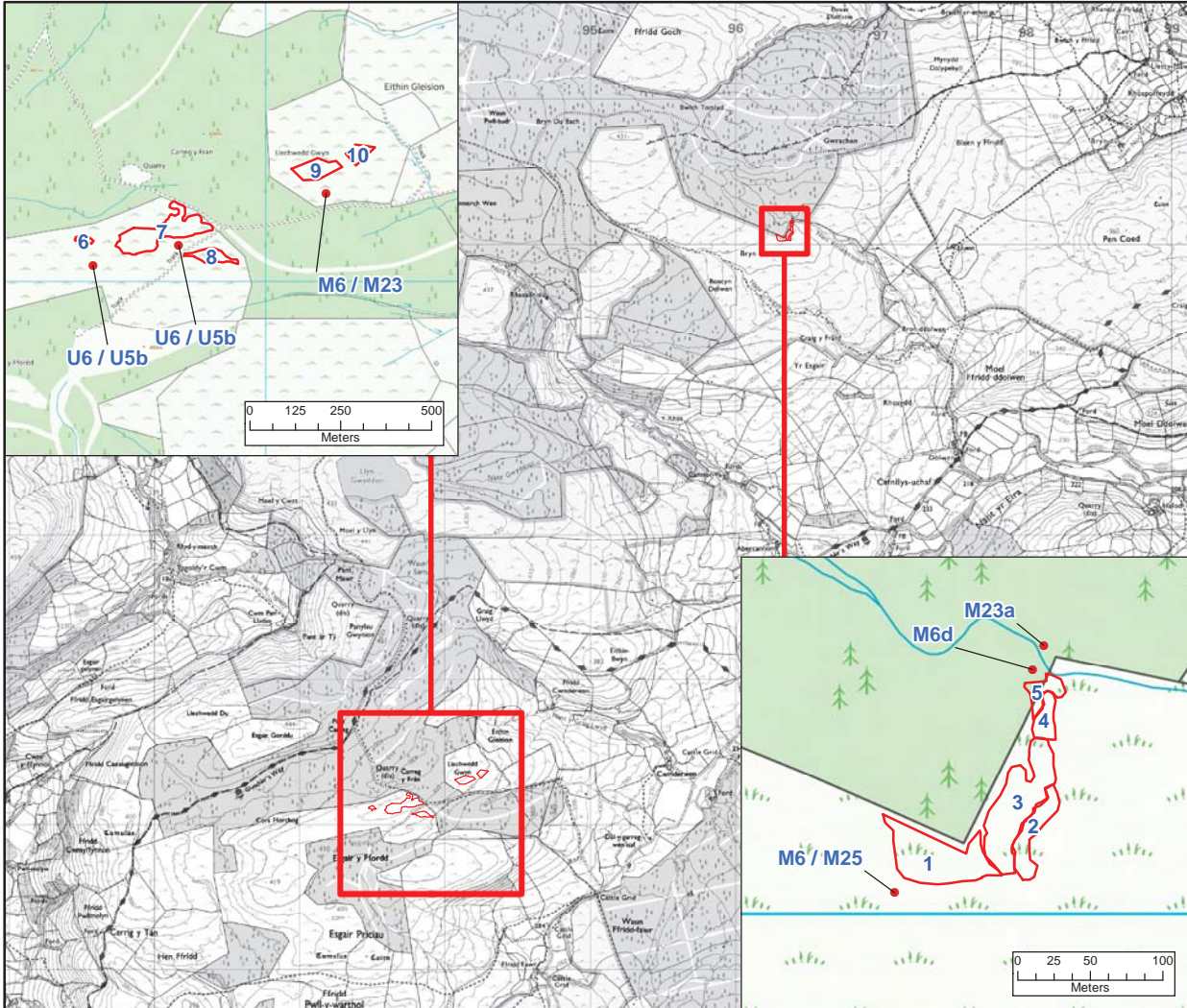
source data: N/A      content: N/A

document number: 01592D6915-01

**SCALE (MAIN VIEW) - 1:25,000**

**SUPPLEMENTARY ENVIRONMENTAL  
INFORMATION 2014**

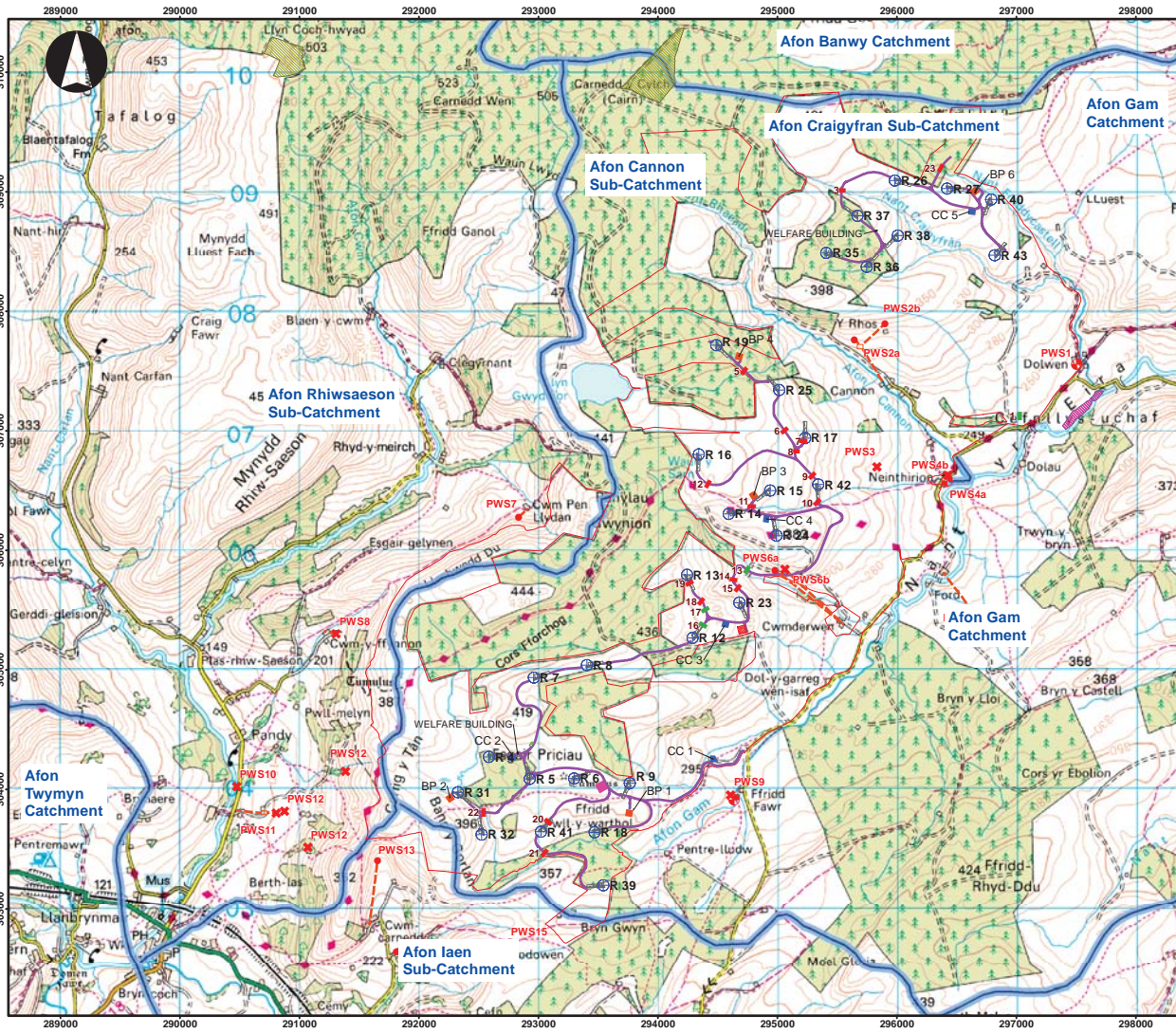
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**FIGURE 8.1: WATER FEATURES MAP**





**LLANBRYNMAIR WINDFARM**

**FIGURE 8.1**

**WATER FEATURES MAP**

REPRODUCED FROM ORDNANCE SURVEY DIGITAL MAP DATA  
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NUMBER 0100031673

**KEY:**

	WIND TURBINE
	HARDSTANDING
	SITE ACCESS TRACK
	EXISTING TRACK
	BORROW PIT
	CONSTRUCTION COMPOUND
	SUBSTATION
	BATCHING PLANT
	WELFARE BUILDING
	PERMANENT MAST
	SITE BOUNDARY
	TRANSPORT ROUTE
	WATER CROSSING EXISTING
	WATER CROSSING NEW
	BOREHOLE PRIVATE WATER SUPPLY
	SPRING PRIVATE WATER SUPPLY
	WELL PRIVATE WATER SUPPLY
	CORSYDD LLANBRYNMAIR
	GWEUNYDD DOLWEN
	SURFACE WATER CATCHMENT BOUNDARY

DATE	N/A	REVISION	N/A
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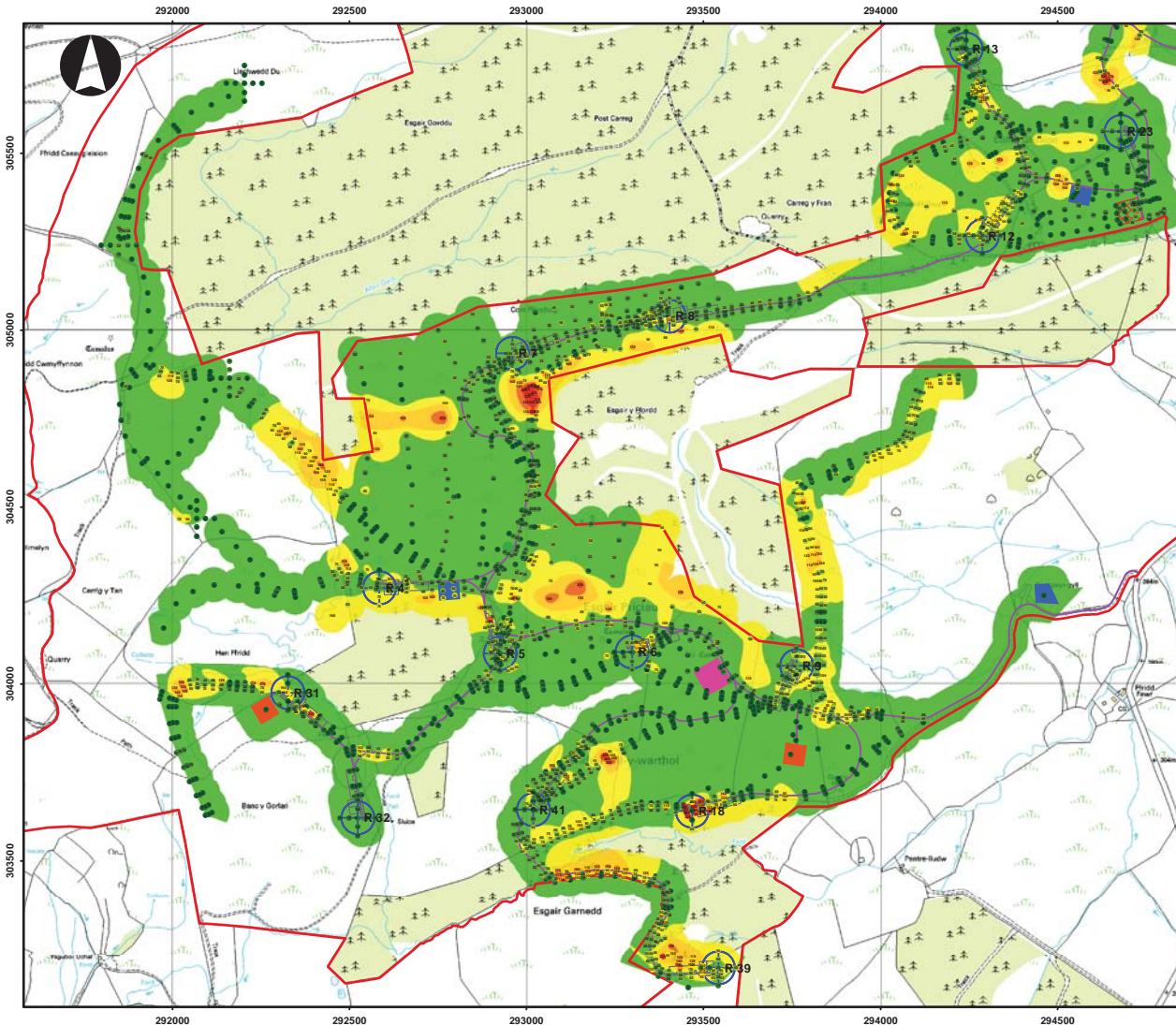
SCALE - 1:30000

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**FIGURE 8.2A: MAXIMUM PEAT DEPTH CONTOUR PLAN**





**LLANBRYNMAIR WINDFARM**

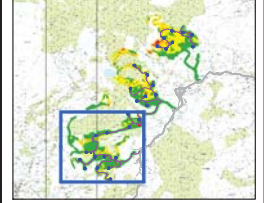
**FIGURE 8.2A  
MAXIMUM PEAT DEPTH  
CONTOUR PLAN**

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NUMBER 0100031673

- KEY:**
- WIND TURBINE
  - HARDSTANDING
  - SITE ACCESS TRACK
  - BORROW PIT
  - CONSTRUCTION COMPOUND
  - WELFARE BUILDING
  - SUBSTATION
  - BATCHING PLANT
  - PERMANENT MAST
  - SITE BOUNDARY

- PEAT DEPTH (METRES)**
- 0 - 50
  - 50 - 100
  - 100 - 150
  - 150 - 200
  - 200+

**NOTE:** DEPTHS PRESENTED ARE PROBE PENETRATION DEPTHS AND THEREFORE ARE MAXIMUM POSSIBLE DEPTHS



LASTED DATE: N/A      CONTACT NO: N/A

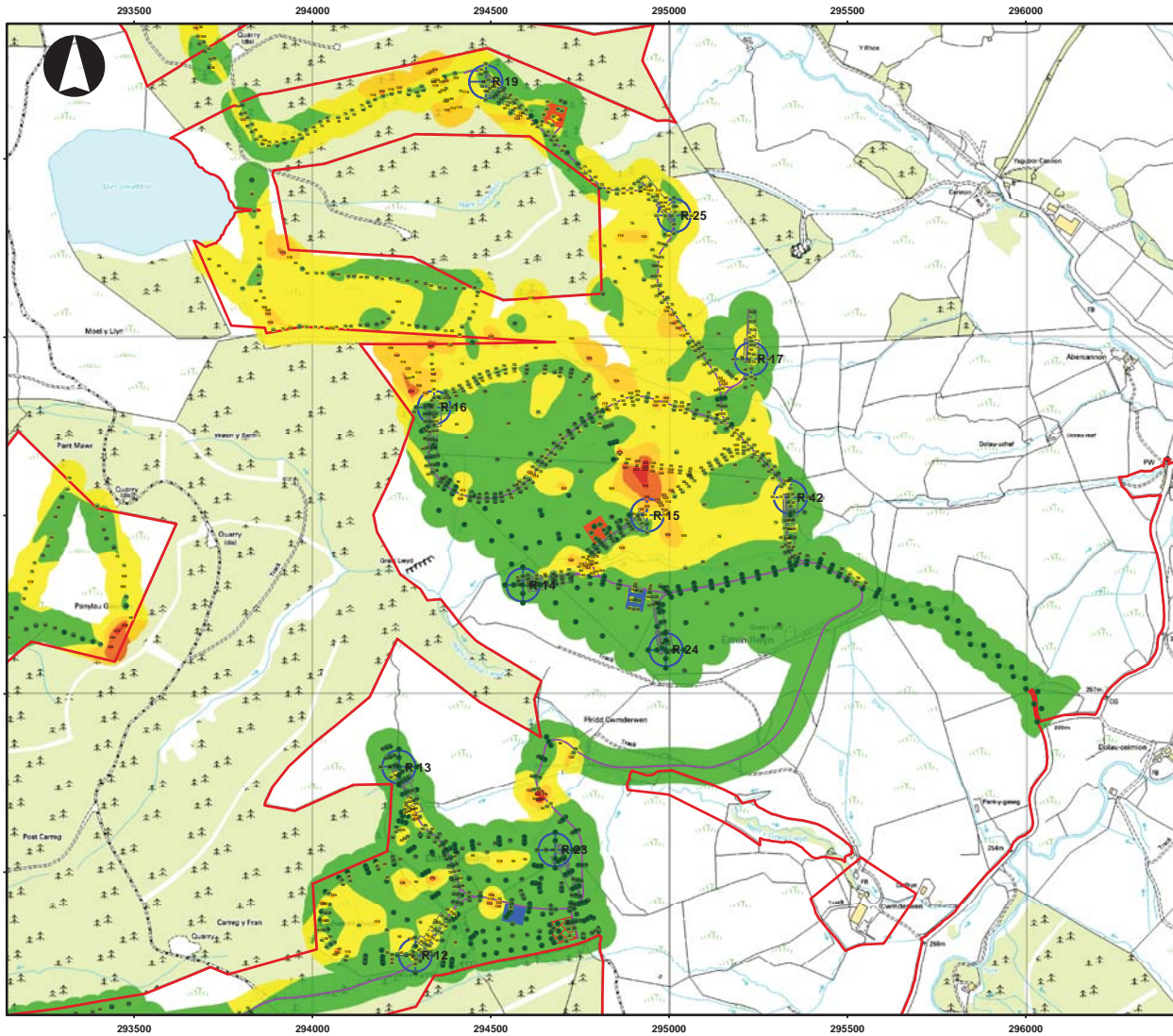
REVISION NUMBER: N/A

**SCALE - 1:10000**

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**FIGURE 8.2B: MAXIMUM PEAT DEPTH CONTOUR PLAN**



**LLANBRYNMAIR  
WINDFARM**

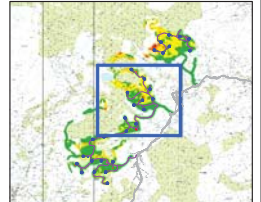
**FIGURE 8.2B  
MAXIMUM PEAT DEPTH  
CONTOUR PLAN**

REPRODUCED FROM ORDNANCE SURVEY DIGITAL MAP DATA  
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NUMBER 0100031673

- KEY:**
- WIND TURBINE
  - HARDSTANDING
  - SITE ACCESS TRACK
  - BORROW PIT
  - CONSTRUCTION COMPOUND
  - WELFARE BUILDING
  - SUBSTATION
  - BATCHING PLANT
  - PERMANENT MAST
  - SITE BOUNDARY

- PEAT DEPTH (METRES)**
- 0 - 50
  - 50 - 100
  - 100 - 150
  - 150 - 200
  - 200+

**NOTE:** DEPTHS PRESENTED ARE PROBE  
PENETRATION DEPTHS AND  
THEREFORE ARE MAXIMUM  
POSSIBLE DEPTHS



DATE: N/A

SCALE: N/A

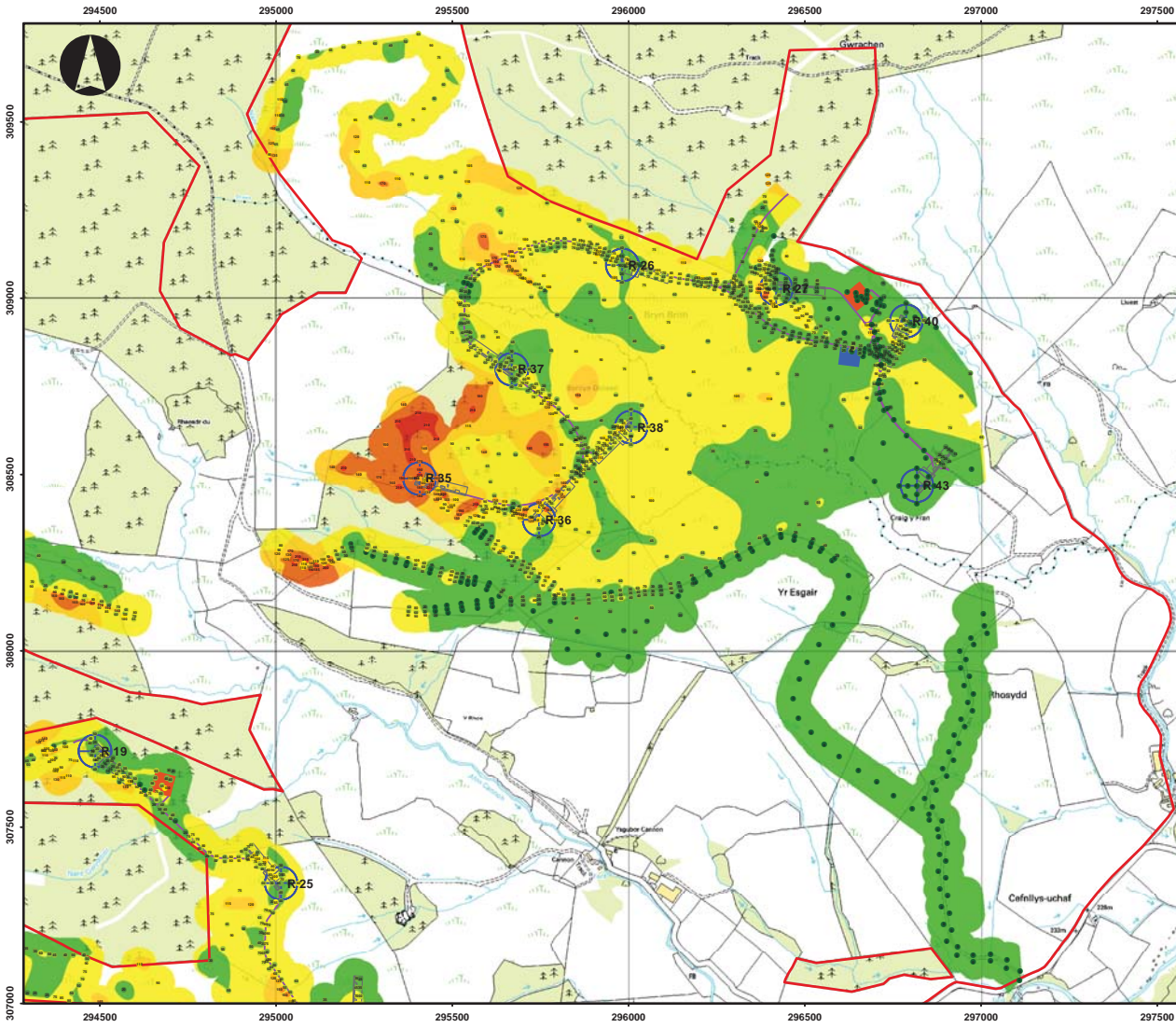
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**FIGURE 8.2C: MAXIMUM PEAT DEPTH CONTOUR PLAN**





**LLANBRYNMAIR  
WINDFARM**

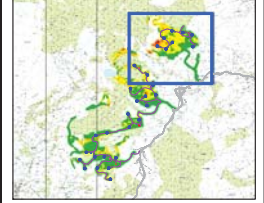
**FIGURE 8.2C  
MAXIMUM PEAT DEPTH  
CONTOUR PLAN**

REPRODUCED FROM ORDNANCE SURVEY DIGITAL MAP DATA  
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NUMBER 0100031673

- KEY:**
- WIND TURBINE
  - HARDSTANDING
  - SITE ACCESS TRACK
  - BORROW PIT
  - CONSTRUCTION COMPOUND
  - WELFARE BUILDING
  - SUBSTATION
  - BATCHING PLANT
  - PERMANENT MAST
  - SITE BOUNDARY

- PEAT DEPTH (METRES)**
- 0 - 50
  - 50 - 100
  - 100 - 150
  - 150 - 200
  - 200+

**NOTE:** DEPTHS PRESENTED ARE PROBE  
PENETRATION DEPTHS AND  
THEREFORE ARE MAXIMUM  
POSSIBLE DEPTHS



LASTED DATE: N/A      CONTACT NO: N/A

REVISION NUMBER: N/A

**SCALE - 1:10000**

**SUPPLEMENTARY ENVIRONMENTAL  
INFORMATION 2014**

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## APPENDICES

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### APPENDIX 2.1: ACCESS ROUTE HABITAT SURVEYS

Sections of the access route referred to are shown in the figures in Llanbrynmair SEI August 2013, Volume II - C, Transport appendices and figures.

The results, for each section of proposed works, are as follows:

#### SECTION 1

##### Llanerfyl Access

The hedge is mainly newly planted Hawthorn. The verge and adjacent field are both improved grassland. The base of the hedge is species-poor, typically with Ivy and Nettle.

##### 1.1 - Over-Run Area and Bridge Parapet Works

CH 460 - 590

The mixed hedge is mainly Hawthorn, Blackthorn and Hazel. The verge and adjacent field are both improved grassland, with frequent Soft Rush in the field. Works proposed are at the edge of a patch of marshy grassland at the eastern end of the field which is dominated by rushes.

##### 1.2 - Over-Run Area

CH 720 - 740

The mixed hedge is mainly Sycamore, Hawthorn, Blackthorn and Hazel. The adjacent field is improved grassland. The verge is poor semi-improved grassland with species including Cock's-foot, Red Campion and Common Sorrel.

##### 1.3 - Over-Run Area

CH 875 - 950

The hedge is mixed with Sycamore, Hawthorn, Blackthorn, Holly, Ash and Hazel which has been heavily flailed. The adjacent field is improved grassland. The verge is poor semi-improved grassland with species including Cock's-foot, Nettle and Male Fern.

##### 1.4 - Over-Run Area

CH 1050 - 1070

The verge is poor semi-improved grassland.

##### 1.5 - Over-Run Area

CH 1045 - 1080

The verge is poor semi-improved grassland with frequent Common Sorrel, Nettle, Male Fern and a little Bramble.

##### 1.6 - Over-Run Area

CH 1130 - 1175

The hedge is mixed, with Hazel, Sycamore and Ash. The Ash tree at chainage 1150 has been felled to a stump. The verge is poor semi-improved grassland with frequent Ivy, Dog's Mercury and Red Campion.

##### 1.7 - Existing Access

CH 1240 - 1250

This section is an existing access with no vegetation.

##### 1.8 - Over-Run Area

CH 1380 - 1450

The small traffic island is improved grassland. The verge is poor semi-improved grassland with abundant Nettle.



1.9 - Over-Run Area

CH 1950 - 2000

The mixed hedge is mainly Hazel and Hawthorn. The ditch is very species-poor, but with a little Brooklime present. The verge is narrow and semi-improved, including a little Meadowsweet.

1.10 - Existing Access

CH 2055 - 2090

This section is an existing access with no vegetation.

1.11 - Existing Access

CH 2300 - 2340

This section is an existing access with no vegetation.

1.12 - Over-Run Area

CH 2400 - 2575

Mainly Hazel coppice with a little Elder and Hawthorn, but little understorey. The verge is poor semi-improved grassland with species including Creeping Buttercup, Nettle and Dog's Mercury.

1.13 - Existing Access

CH 2580 - 2630

This section is an existing access with no vegetation.

1.14 - Over-Run Area

CH 2970 - 3050

The coppice is mainly Hazel, with Sycamore, Blackthorn and a little Bramble. The understorey is sparse but included some Dog's Mercury and Enchanter's-nightshade. The verge is poor semi-improved grassland with some Dog's Mercury, Meadowsweet, Creeping Buttercup and Nettle.

1.15 - Over-Run Area

CH 3340 - 3450

The coppice is mainly Hazel, but also Sycamore, Blackthorn and a little Bramble. The understorey is sparse. The verge is poor semi-improved grassland, but with some Dog's Mercury, Meadowsweet, Creeping Buttercup and Nettle.

1.16 - Existing Access

CH 3870 - 3930

The hedge is mixed but trimmed, with species including Hazel, Hawthorn, Ash, Blackthorn and Sycamore. The verge is poor semi-improved grassland with Creeping Buttercup and Nettle.

1.17 - Over-Run Area

CH 3875 - 4090

The hedge is mixed with species including Hazel, Hawthorn, Ash, Blackthorn and Sycamore. Trimmed. Trees are oak, Ash and Sycamore. The verge is poor semi-improved grassland with Creeping Buttercup and Nettle.

1.18 - Over-Run Area

CH 3950 - 4200

The hedge is mainly Hazel with Hawthorn. The verge is poor semi-improved grassland with a little Meadowsweet. The field at the rear of the hedge is semi-improved with some Bracken and Common Knapweed.

1.19 - Over-Run Area

CH 4235 - 4315

The hedge is mainly Hazel, with Hawthorn and Blackthorn. The verge is poor semi-improved grassland with Hogweed. Field to rear is improved grassland.

1.20 - Over-Run and Passing Place

CH 4335 - 4430

The hedge is mainly Sycamore and Hazel. The verge is poor semi-improved grassland with Nettle, Broad-leaved Dock and Male Fern.

1.21 - Over-Run Area  
CH 4390 - 4450

The mixed hedge is mainly Sycamore, Hawthorn, Blackthorn and Hazel. The verge is narrow and poor semi-improved grassland with frequent Nettle. Field to rear is improved grassland.

1.22 - Gosen Bridge: Road Widening  
CH 4440 - 4540

The wood on the east side of the river has an open, grazed, grassy ground flora and is dominated by even-aged oaks. The construction areas marked are on improved grassland. The young trees to be removed are mainly Hazel, Birch and Ash with a sparse understorey with abundant Ivy. There are several fallen trees that have opened the canopy.

The hedge at the front of the section is mixed, with Blackthorn, Hazel, Ash and Hawthorn. No verge here.

1.23 - Road Widening For Over-Run  
CH 4540 - 4560

The junction here has young, spindly Hazel trees, with mainly Ivy beneath and a five meter section of low wall below, which is to be removed and replaced. The verge here is poor semi-improved grassland.

1.24 - Road Widening For Over-Run  
CH 4550 - 4640

The verge on the east side is mainly species-poor, semi-improved grassland, with much Creeping Buttercup, but also a small patch (a meter or so wide) with Devil's-bit Scabious. The trees here are mainly birch and Prunus sp., and to the rear of the fence is mainly Bracken over poor semi-improved grassland.

Gosen to Sychtyn Off-Road Track  
CH 4620 TO 4970

The proposed new route runs through improved grassland. The verge is poor semi-improved grassland with abundant Creeping Buttercup. The hedge at the entrances to the new route is mixed with mainly Hawthorn, Blackthorn and Hazel.

1.25 - Road Widening  
CH 4970 - 5040

The hedge is mixed, with trimmed Sycamore, Hazel and Blackthorn. The verge is improved grassland.

1.26 - Road Widening  
CH 5050 - 5110

The verge here is improved grassland.

1.27 - Over-Run Area and Wall Removal  
CH 5130 - 5180

There is a small section of wall at the end of a drive, topped by garden species and a grassy flora with a few other species present, including Yorkshire Fog, Common and Sheep's Sorrel. Behind this is Bracken, Sycamore and garden shrubs.

1.28 - Over-Run Area  
CH 5175 - 5315

The hedge is mainly Hazel, with Blackthorn and Hawthorn. The verge is semi-improved grassland with frequent Cock's-foot, Yorkshire Fog, Nettle, Common Sorrel and Cow Parsley, and occasional Common Knapweed and Meadowsweet. The adjacent field is improved grassland.

1.29 - Over-Run Area  
CH 5330 - 5430

The hedge is low (up to a meter high), and formerly laid, of Hazel and Hawthorn, on a bank of poor semi-improved grassland with frequent Creeping Buttercup and Common Sorrel.

1.30 - Over-Run Area and Improved Passing Place  
CH 5430 - 5700

There are a few Hawthorn and gorse bushes in this section. There is a species-poor semi-improved grassland verge with frequent Cock's-foot, Creeping Buttercup, Common Knapweed and occasional Devil's-bit Scabious.

1.31 - Over-Run Area  
CH 5770 - 5880

Grey Willow is dominant in this stretch. The verge is poor semi-improved grassland.

1.32 - Over-Run Area  
CH 6060 - 6115

This is mainly Grey Willow, with some Ash and Hazel. The verge is poor semi-improved grassland.

1.33 - Over-Run Area  
CH 6090 - 6325

The young trees here are Sycamore, Beech and planted non-native species. The verge here is improved grassland. The field beyond the hedge is also improved grassland, which is damper at the southern end. Lower down the field it is more diverse, but the area affected by the proposed works is very species-poor, with abundant Soft Rush and Tufted Hair-grass.

1.34 - Over-Run Area  
CH 6350 - 6480

The hedge is mainly Blackthorn and Hawthorn, becoming a discontinuous line of young trees including Grey Willow. The verge is species-poor semi-improved with some Common Knapweed, and a very small patch of Heather.

1.35 - Over-Run Area  
CH 6560 - 6580

The hedge is mainly Hazel, Blackthorn and Hawthorn, formerly laid, and on a small bank. The verge is semi-improved with abundant Creeping Buttercup, and also Common Knapweed, Ribwort Plantain and Common Sorrel. Immediately to the rear of the hedge the field is improved grassland.

1.36 - Over-Run and Passing Places  
CH 6530 - 6770

The layby vegetation includes young trees of Birch and Hazel, and low hedges mainly of Hazel and Blackthorn. The verge is narrow, poor semi-improved grassland with Meadowsweet. There is a fence between the laybys with abundant Bracken and, rarely, a shrub. The field to the rear is improved grassland.

1.37 - Over-Run Area  
CH 6730 - 6950

The hedge is formerly laid and mainly Hazel up to 1.5 meters high. The verge is species-poor and semi-improved. The field to the rear is improved grassland.

1.38 - Over-Run and Passing Place  
CH 6950 - 7130

South of the culvert is a formerly laid hedge with Hazel, Blackthorn, Hawthorn and abundant Bracken. To the north of the culvert is a fence, with an occasional gorse bush. The culvert is species-poor with a patch of Meadowsweet and a half-meter high willow. The adjacent field is improved grassland. The verge and passing area is semi-improved with much Creeping Buttercup and some Common Knapweed and Meadowsweet.

1.39 - Over-Run Area  
CH 7100 - 7200

The verge is poor semi-improved grassland with abundant Nettle, Creeping Buttercup and some Meadowsweet, with Bracken at the rear.

1.40 - Over-Run Area  
CH 7150 - 7290

The eastern end of this section has a small patch of Grey Willow adjacent to the road. This grades into an area of young trees and scrub, mainly birch, with Alder, Blackthorn and Bramble, scattered down the slope with ruderal species beneath, mainly Rosebay Willowherb.

Dolwen Isaf - Bridge Widening With Over-Run  
CH 7220 - 7530

There is a plantation on the south side of the road approaching the bridge, dominated by Sitka Spruce, with small young trees and shrubs at the front mainly of Grey Willow, Ash, Hazel and Grey Alder. There is little or no ground flora under the spruce. The verge here is mostly fairly species-poor semi-improved grassland, with frequent Meadowsweet and rarely, Angelica. The easternmost ten to fifteen meters is a rather damp bank, at the base of an improved field, so it is less improved and more diverse. The upper half holds abundant Purple Moor-grass with frequent Bracken and Marsh Thistle. Typical species on the lower half include frequent Devil's-bit Scabious, Hard Fern and Betony.

On the north side of the road is a continuation of the young trees and scrub described in the previous section, with a birch tree on the corner. By the river here, where widening works are proposed, is a small alluvial area with semi-improved grassland containing abundant Creeping Buttercup and Nettle, and frequent Opposite-leaved Golden-saxifrage. Adjacent to the current buttress was a small Ash which has recently been cut back as part of highway maintenance. On the small steep opposite bank is species-poor, semi-improved grassland and occasional Bramble, adjacent to a mature Ash tree unaffected by the proposals. Next to the field entrance are young trees of birch, willow and Ash along the field boundary.

The construction areas are on improved grassland and the proposed grass reinforcement crosses improved fields.

The small stretch of hedge on north side of road, between the bridges is mixed, with birch and Hawthorn. The verge is species-poor, semi-improved grassland with species including Creeping Buttercup, Nettle and Meadowsweet. The field to the rear is improved grassland.

1.41 - Over-Run Area  
CH 7500 - 7670

There is a very short stretch of mixed hedge with Hazel and Hawthorn. The verge is poor semi-improved grassland with abundant Nettle and Creeping Thistle.

1.42 - Over-Run Area  
CH 7660 - 7720

The verge is semi-improved and species-poor. The field to the rear is improved grassland.

1.43 - Over-Run Area  
CH 7700 - 7780

There is a short stretch of mixed Hazel and Hawthorn hedge here. The verge is species-poor, semi-improved grassland.

1.44 - Over-Run Area  
CH 7950 - 8040

The verge ranges from improved to poor semi-improved grassland with Nettle and Creeping Thistle locally dominant. The fields here are improved grassland.

1.45 - Over-Run Area  
CH 8150 - 8240

There is a short stretch of young Grey Willow and a Hawthorn in this section. The verge is poor semi-improved grassland overall, but included a small patch of Devil's-bit Scabious, Tormentil and Purple Moor-grass. The field to the rear is improved grassland.

Site Access 1  
CH 8250

The verge is poor semi-improved grassland and the field to rear is improved with frequent Soft Rush. Culvert is very species-poor with some Soft Rush.

## SECTION 2

2.1 - Over-Run Area  
CH 8280 - 8320

The verge is poor semi-improved grassland with Bracken and a gorse bush.

2.2 - Over-Run and Passing Place  
CH 8330 - 8580

The small trees here are Ash, Rowan and Hawthorn. The verge is poor semi-improved grassland overall, but with a little Devil's-bit Scabious, Purple Moor-grass, Soft Rush and Common Knapweed. The field to rear is poor semi-improved grassland with Soft Rush.

2.3a - Over-Run Area  
CH 8500 - 8850

The verge and adjacent field are improved.

2.3b - Neinthirion Bypass Access and Over-Run Area  
CH 8850 - 8950

The verge and field to rear are improved.

Neinthirion Bypass - Drawing 60283248-D-045.  
900m of new road

Where this section leaves the existing carriageway the verge is semi-improved. The banks either side of the river are mainly semi-improved neutral grassland with typical species including Tufted Hair-grass, False Oat-grass, Cock's-foot and Common Sorrel. There are also scattered small young willow and Hawthorn here. There is a small area of species-poor unimproved acid grassland at the steep top of the southern bank. There is no aquatic vegetation within the watercourse at this point.

Beyond this, the route crosses a series of improved fields, passing a group of Sycamore and Aspen. There is then a further series of improved fields. As the route drops down it crosses a stream at chainage 650 where there is a narrow strip of Purple Moor-grass on mineral soil. The next section is over improved grassland and then it crosses a peat section.

The peat section was surveyed separately as part of the peat assessment process. (See Appendix 2.)

The final section of the track where it rejoins the existing road is over improved grassland on initially peaty soil then finally mineral soil.

2.4 - Neinthirion Bypass Egress and Over-Run  
CH 9550 - 9680

The verge here is improved grassland.

2.5 - Over-Run and Passing Place  
CH 9680 - 9840

The verge is partly marshy grassland, dominated by Purple Moor-grass, and partly improved grassland, with a Rowan tree and a little gorse.

2.6 - Over-Run and Passing Place, Adjacent To Cattle Grid  
CH 9770 - 9980

The verge and field are improved grassland, with frequent Soft Rush.

Site Access 2  
CH 10140

The banks around the site access are poor semi-improved grassland with very occasional Purple Moor-grass, Heath Bedstraw and Sheep's Sorrel.

2.7a - Over-Run and Passing Place to South of Access 2  
CH 9980 - 10100

The verge here is mainly improved grassland with Soft Rush. Locally there is an area of species-poor marshy grassland with Purple Moor-grass and occasional Star Sedge.

2.7b - Over-Run and Passing Place to East from Access 2 to River  
CH 10100 - 10440

The verge is species-poor, dominated by poor semi-improved grassland, with damper areas dominated by Soft Rush, Nettle and locally Purple Moor-grass.

2.8 - Over-Run and Passing Place  
CH 10410 - 10500

The verge is species-poor acid grassland. Beyond the fence the area to be affected is mostly bare soil.

2.9 - Over-Run and Passing Place Adjacent To River Bed  
CH 10480 - 10530

A poor semi-improved grassland verge with Soft Rush.

2.10 - Over-Run Area to North  
CH 10530 - 10610

The verge and area beyond the fence are species-poor semi-improved damp grassland with Tufted Hair-grass and Soft Rush.

2.11 - Over-Run Area to North West Of Cattle Grid  
CH 10620 - 10730

The verge is poor semi-improved grassland with Soft Rush. The ditch is species-poor and recently cleared, with Soft Rush and a little Lesser Spearwort.

2.12 - Culvert Widening and Passing Place  
CH 10750 - 10800

Water by culvert is species-poor with an area of Reed Canary-grass. The verge is improved grassland.

2.13 - Over-Run and Passing Place  
CH 10675 - 10950

The verge is poor semi-improved grassland with Soft Rush.

2.14 - Over-Run Area  
CH 10920 - 11120

The verge and field to rear are improved grassland.

2.15 - Over-Run and Passing Place  
CH 11100 - 11390

The verge is improved grassland. The culvert is species-poor with Soft Rush.

2.16a - Over-Run and Passing Place  
CH 11390 - 11430

The verge is improved grassland with Soft Rush.

2.16b - Over-Run and Passing Place

CH 11430 - 11640

The verge is improved grassland with Soft Rush.

2.16c - Over-Run and Passing Place

CH 11640 - 11700

The verge is improved grassland with Soft Rush.

2.16d - Over-Run and Existing Passing Place Improved

CH 11700 - 12000

The verge is improved grassland with Soft Rush.

2.17 - Over-Run and Passing Place

CH 12000 - 12390

The verge is semi-improved grassland overall. Within this section a short stretch of verge is reasonably diverse, damp unimproved neutral grassland, with Devil's-bit Scabious and Meadowsweet (approximately a tenth of the 400m section). There is a small area of Blackthorn scrub towards the end of this section. The ditch is species-poor.

Site Access 4

CH 12390

The verge and field to rear are improved grassland with Soft Rush.

### SECTION 3

3.1a - Existing Passing Place

CH 12700

An existing passing place with no vegetation.

3.1b - Existing Passing Place, Improved

CH 12950

The ditch is species-poor with abundant Rosebay Willowherb. The verge is poor semi-improved grassland and the area beyond the fence is improved grassland with abundant Soft Rush. There is a narrow strip of Purple Moor-grass between the fence and the ditch.

3.1c - Existing Passing Place, Improved

CH 13160

The ditch is species-poor and dominated by Reed Canary-grass. The verge is poor semi-improved grassland.

3.1d - Existing Passing Place

CH 13330

An existing passing place, so no significant vegetation impacts.

3.2a - Existing Passing Place, Improved

CH 13460

The verge is poor semi-improved grassland.

3.2b - Existing Passing Place

CH 13550

An existing passing place, so no significant vegetation impacts.

3.3 - Existing Passing Place, Improved

CH 13700

The verge and adjacent field are improved grassland.

3.4 - New Passing Place At Access

CH 13840

The verge and adjacent field are improved grassland.

3.4a - New Passing Place

CH 13950

The verge is improved grassland.

3.5 - Existing Passing Place, Improved

CH 14075

The verge and adjacent field are improved grassland, with Soft Rush.

3.6 - Existing Passing Place

CH 14250

An existing passing place, so no significant vegetation impacts.

3.7 - Existing Passing Place At Cattle Grid

CH 14300

An existing passing place, so no significant vegetation impacts.

3.8a - Existing Passing Place, Improved

CH 14520

The verge is improved grassland.

3.8b - New Passing Place

CH 14620

The verge is improved grassland.

3.9 - Existing Passing Place at Access, Improved

CH 14695

An existing passing place, so no significant vegetation impacts.

3.10 - Existing Passing Place at Access

CH 14850

An existing passing place, so no significant vegetation impacts.

3.11 - Existing Passing Place

CH 15000

An existing passing place, so no significant vegetation impacts.

3.12 - Existing Passing Place

CH 15150

An existing passing place, so no significant vegetation impacts.

3.13 - Existing Passing Place at Accesses

CH 15350

An existing passing place, so no significant vegetation impacts.

3.14 - New Passing Place

CH 15570

The verge is improved grassland.

3.15 - Existing Passing Place, Improved

CH 15780

The verge is improved grassland, leading to Bramble and willow scrub. The culvert is species-poor.

3.16 - Existing Passing Place, Improved

CH 15950



The verge is poor semi-improved grassland. The hedge is mixed Hazel, willow and birch.

3.17a - New Passing Place  
CH 16275

The verge is improved grassland. The hedge is mainly Hazel.

3.17b - Existing Passing Place, Improved  
CH 16370

The verge and adjacent field are improved.

3.18 - Existing Passing Place at Pantglas Farm  
CH 16480

An existing passing place, so no significant vegetation impacts.

3.19 - New Passing Place  
CH 16550

The verge is poor semi-improved grassland.

3.20 - Existing Passing Place, Improved  
CH 16715

The verge is improved grassland. There is a short stretch of mixed small saplings, including oak and Hazel.

3.21 - Existing Passing Place, Improved  
CH 16855

The verge is poor semi-improved grassland. The trees in the adjacent improved field are oak and birch.

3.22a - Existing Passing Place, Improved At Existing Cattle Grid.  
CH 17080

The verge and field are improved grassland. The mixed hedge is of Hazel, Holly, Hawthorn, birch and willow.

3.22b - Existing Passing Place, Improved  
CH 17200

The verge is improved grassland.

3.22c - New Passing Place  
CH 17290

The verge is poor semi-improved grassland.

3.23 - New Passing Place  
CH 17450

The verge is poor semi-improved grassland with Nettle and Soft Rush. There is a short remnant of a previously laid hedge, mainly of Hazel, which has died back at the northern end. There is also one spindly Rowan.

Talerddig Junction works

The banks to the south of the road are semi-improved grassland with a patch of Bramble by the wire fence. To the north of the road the verge is semi-improved grassland dropping to a gappy hedge of Hawthorn with sections of Bramble. The field below is improved grassland.

## APPENDIX 2.2: VEGETATION AND PEAT SURVEYS AT NEINTHIRION

### A: NVC Survey

The site of the Neinthirion ‘bypass’ was revisited on 27<sup>th</sup> November, 2013. The proposed route of the bypass was walked from the main road to the poor semi-improved grassland beyond (i.e. north west of) the mire area. As the proposed bypass leaves the main road, heading north west, it crosses an area of semi-improved grassland. This is best classified as MG6 *Lolium perenne* - *Cynosurus cristatus* grassland. The route crosses a small ditch (supporting soft rush *Juncus effusus*). It then enters an area of mire/damp grassland vegetation. The current proposed route crosses the edge of this mire/damp grassland. An NVC map of the section surveyed is given below.

Notes were taken on the vegetation in this mire/damp grassland section, and a quadrat carried out at SH96330 06358. This was found to support occasional to frequent *Aulacomnium palustre*, abundant *Juncus squarrosus*, rare *Sphagnum capillifolium*, frequent *Polytrichum commune*, occasional *Hypnum jutlandicum*, rare to occasional *Polytrichum strictum*, frequent *Pleurozium schreberi*, occasional *Eriophorum vaginatum*, frequent *Molinia caerulea* and occasional *Sphagnum fallax*. Based on this assessment and taking into account the vegetation to the south west of this location, this area is best classified as either U6 *Juncus squarrosus* - *Festuca ovina* grassland or as M17 *Trichophorum cespitosum* - *Eriophorum vaginatum* mire. The abundance of *Juncus squarrosus* and pleurocarpous mosses suggests strong affinities with U6. However, the presence of *Molinia caerulea* and *Eriophorum vaginatum* places it in the M17c *Juncus squarrosus* - *Rhytidiadelphus loreus* sub-community. NRW have classified this area as M17c. However, it is variable in quality, with the central core of the vegetation to the south west of the proposed bypass falling into M17. Areas towards the periphery (along the bypass route itself) of the vegetation are much more impoverished examples of this sub-community and are arguably classifiable as U6. Representative photos of the core area of M17 are provided as Photos 1 and 2.

Approximately 10m to the north east of the quadrat described above, the vegetation changes. *Molinia caerulea* becomes more dominant, *Sphagnum capillifolium* disappears and *Sphagnum fallax* becomes the main sphagnum species. A quadrat taken at SH96339 06366 recorded *Molinia caerulea* as the dominant species, with frequent *Juncus squarrosus*, frequent *Sphagnum fallax*, occasional *Carex echinata*, frequent *Polytrichum commune* and rare *Sphagnum palustre*. *Eriophorum vaginatum* appeared to be in very small quantity in this area. It is suggested that this area should be categorised as M25 ‘species-poor’. A photo of this area is provided as Photo 3. The marked transition between the two vegetation types is clearly shown in this photo.

Further to the north east, the vegetation changes again. A ditch supporting abundant *Sphagnum denticulatum* and *Juncus effusus*, with occasional to frequent *Molinia caerulea* and occasional *Glyceria fluitans* is best categorised as M6c *Carex echinata* - *Sphagnum fallax* / *Sphagnum denticulatum* mire *Juncus effusus* sub-community, though there is also some *Juncus acutiflorus* here, suggesting referral to the M6d sub-community. The vegetation to the north west of this point is similar, and dominated by *Juncus effusus*. This is species-poor M6 vegetation and is of lesser ecological value. A photograph (photo 4) of this area is provided. The vegetation becomes drier here, between the *Juncus effusus* tussocks. The vegetation in the next field compartment is species-poor MG6 grassland, as shown in Photo 5.

Photo 1: Main 'peat body' supporting M17 vegetation (photo taken from current route of bypass)



Photo 2: Showing main M17 - type vegetation





Photo 3: M25 '*Eriophorum vaginatum* variant' vegetation to north east of U6/M17 vegetation (note obvious transition, with greater *Molinia caerulea* dominance)



Photo 4: Showing *Juncus effusus*-dominated vegetation to the north east (M6c)

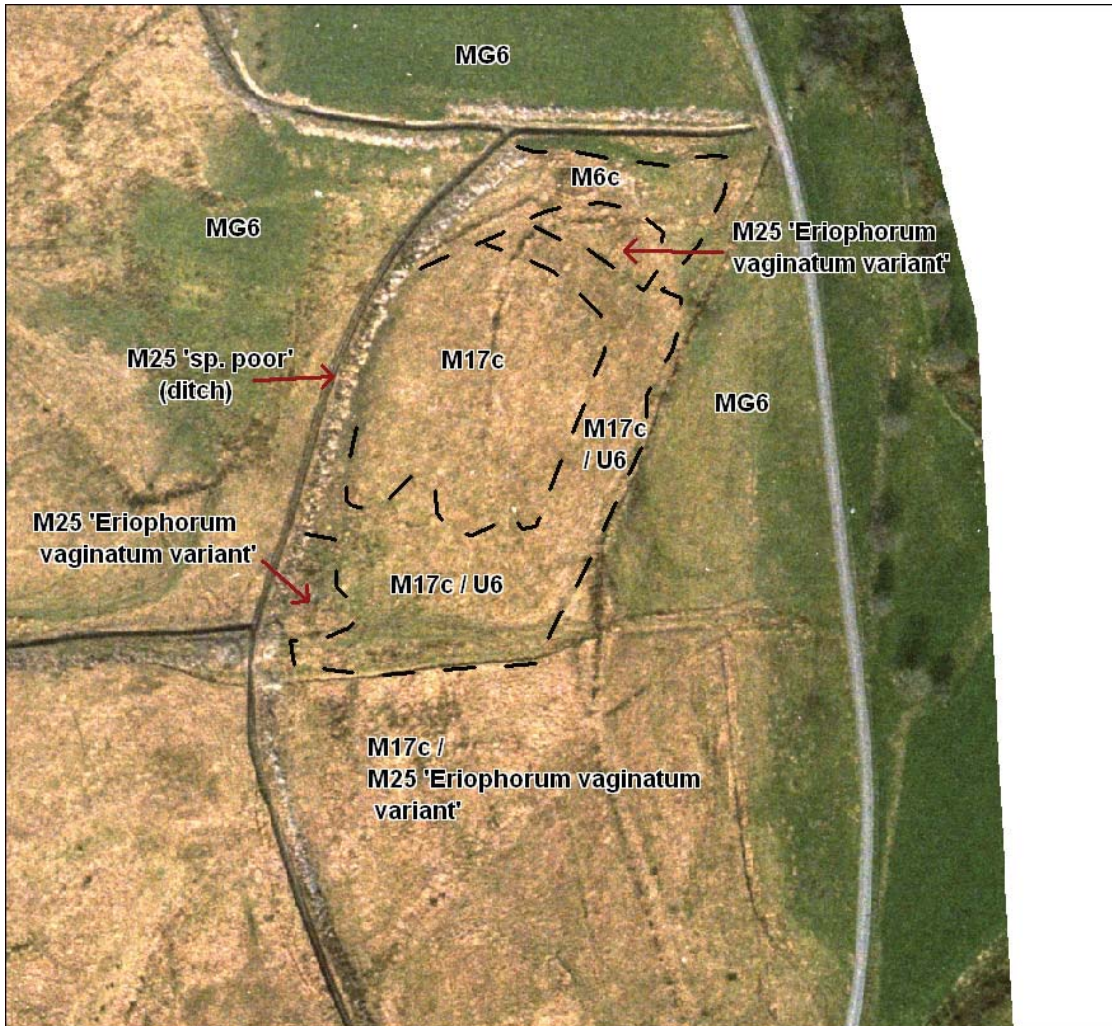


Photo 5: *Juncus effusus*-dominated vegetation with MG6 grassland beyond





NVC map of proposed bypass area



## B: Peat survey

The impact of the Neinthirion Bypass (“the bypass”) on peat was surveyed specifically as part of the peat assessment process, along with a habitat assessment, as part of the access route assessment in spring 2013. Peat probing along the route of the bypass was undertaken by Ecology Matters as part of the wider survey and assessment of the site in February and March 2013. Further habitat assessment was undertaken in May 2013.

The peat depth was assessed by probing with a cane as outlined in the CCW guidance note<sup>3</sup> and the methodology employed followed that guidance. The need for peat probing was determined by a peat assessment process which comprised the following:

The area of ground from the existing minor road to the rising drier ground was assessed for the potential for the occurrence of peat based on:

- (i) the plant species which were present,
- (ii) a consideration of drainage,
- (iii) wetness and
- (iv) elevation;

Probes were taken approximately every 10 meters from the existing road along the line of the proposed bypass, where it crosses a section of peat. The location of the probes and the relevant depth of peat are shown in Figure 2.

While the remainder of the access route was assessed for the presence of peat, no further probing took place (outside the route of the Neinthirion bypass) because no peat was found and no further probing was necessary. At Ch 6504 of the bypass, there was a narrow strip of purple moor-grass, which can be indicative of peat. This was specifically assessed and found to be on mineral soil.

The results were as follows:

Easting	Northing	Soil depth and type
296371	306334	5cm mineral soil
296363	306342	10cm mineral soil
296355	306351	10cm mineral soil
296345	306356	30cm peat
296333	306361	50cm peat
296323	306368	50cm peat
296315	306379	30cm peat
296294	306386	15cm mineral soil

From the extensive peat probing across the whole of the application site, it is clear that peat depths are highly variable and not homogenous. The area has been deliberately drained (the draining channels are visible on the photo above) by the landowner to allow for the current heavy grazing.

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<sup>3</sup> CCW (2010) Assessing the impacts of windfarm developments on peatland. Guidance Note.





Figure 2: Soil and peat probes

There will be an impact on peat from the bypass in this location. The central section is on 50cm peat (just within the CCW / NRW classification of deep peat). On the basis of the two depths of 30cm and two depths of 50cm recorded within the red line of the bypass alignment (a length of 50m in the peat), a bypass width of 6m and peat depth of 0.5m, the development will disturb between 100-200 m<sup>3</sup> of peat.

Such an impact needs to be considered in the context of a total estimated peat disturbance impact across the application site of 120,000 m<sup>3</sup>. The volumes do not take account of the likely overestimate of peat depths nor to micro-siting of track and turbines away from peat >0.5m subject to other constraints. The assessment of this impact has a margin for error of 10-15%. Accordingly, the impact of the development on peat at Neinthirion is estimated to be less than 0.2% of the total estimated impact and well within the margin for error.

The Habitat Management Plan and Peat Management Plan (appended to Chapter 5 and 8 of the CSEI) propose mitigation measures that will further minimise any impacts from loss of peat habitat, peat excavation and dewatering. They also outline long term habitat restoration and management compensation measures designed to enhance the peat on the site. The area of peat restoration to compensate for the volume of peat dewatered through the installation of any windfarm infrastructure is 347 ha for blanket bog and mire restoration (including the addition of HMA 3 into the peat restoration programme as requested by NRW). Also, 149 ha of plantation on former peat habitats will be removed and additional habitats of conservation importance restored.

The consequent peat habitat restoration is substantially greater than the area of peat habitat that will be lost. Therefore, the residual predicted impact of the development (taking into account the non-material impact to peat at Neinthirion) is actually a net gain.



## APPENDIX 3.1: BAT SURVEYS - PHOTOGRAPHS

### *Glen Menial Bridge*

Photograph 1



Photograph 2



Photograph 3



Photograph 4





*Trees at Gosen Bridge*

Photograph 5



Photograph 6



Photograph 7





Photograph 8 - north facing bridge arch





Photograph 9



## APPENDIX 4.1: NVC SURVEY DETAILS

### NVC SURVEY DETAILS

Detailed NVC Survey results are given below. Maps of the areas are given in Figure 6.1

#### SOUTH ROUTE

##### Introduction

A National Vegetation Classification (NVC) survey was carried out of vegetation to the east of Turbine R8 (Llanbrynmair), as part of an investigation into the potential impacts from an access track approaching from the east. The results are detailed below.

##### Results

The area to the west of the point at which the existing tracks fork, on the break of slope and to the immediate north of here, is a mosaic of U5 *Nardus stricta*- *Galium saxatile* grassland and U6 *Juncus squarrosus*- *Festuca ovina* grassland. Mat-grass *Nardus stricta* is abundant here, and this shares dominance with heath rush *Juncus squarrosus*. Other species present along the break of slope here and the immediate flatter area to the north are *Rhynchospora squarrosus* and rare *Sphagnum fallax*. The vegetation as a whole should be placed in either the U5b *Agrostis canina*- *Polytrichum commune* sub-community or in the U6d *Agrostis capillaris*- *Luzula multiflora* sub-community. Either way, it is very species-poor and of little ecological value. A photo of this grassland is provided as photo 1. A small area of soft rush *Juncus effusus* is also present in the east of this area. This vegetation continues towards the west, more or less unbroken, until it reaches the proposed location of R8. On the flatter ground to the north of this vegetation is good quality blanket bog. This appears to best fit the M18 blanket bog community, and more specifically, M18a *Erica tetralix*- *Sphagnum papillosum* raised and blanket mire, *Sphagnum magellanicum* - *Andromeda polifolia* sub-community. It supports abundant *Sphagnum fallax*, occasional *Sphagnum papillosum*, frequent *Sphagnum capillifolium* and locally abundant *Sphagnum cuspidatum*. This last is found particularly in areas resembling bog pools. Other species found in this high quality bog are frequent to abundant *Polytrichum strictum*, abundant cranberry *Vaccinium oxycoccus*, abundant hare's-tail cottongrass *Eriophorum vaginatum* and frequent to abundant cross-leaved heath *Erica tetralix*. Previous survey in this area recorded frequent round-leaved sundew *Drosera rotundifolia* and frequent bog asphodel *Narthecium ossifragum*. A photo of this blanket bog is provided as photo 2. This is high quality bog, and should be avoided. The area of good quality bog is clearly visible on the aerial photo. A further area of M17 (possibly M18) is found to the west.



Photo 1: Showing area of U5b/U6d grassland



Photo 2: Showing area of M18 blanket bog



## NORTH ROUTE

### Introduction

A National Vegetation Classification (NVC) survey was carried out of vegetation to the north of Turbine R27 (Llanbrynmair), as part of an investigation into the potential impacts from a connecting track between here and T21 (Carnedd Wen). Two potential routes were examined and the results are detailed below. The second route detailed below through the forestry has been chosen as having the least impact.

### Results

The area to the immediate west of the turbine location and typifying the higher ground of the rocky ridge here, is U5 *Nardus stricta* - *Galium saxatile* grassland. This is characterised by frequent to abundant mat-grass *Nardus stricta* and occasional *Pleurozium schreberi*. Although generally a relatively dry vegetation community, the presence of frequent purple moor-grass *Molinia caerulea* and occasional *Polytrichum strictum* indicates that the underlying substrate is damp. The U5 grassland is of the Species-poor sub-community, U5a. To the east of this ridge is an area largely comprising an M6c *Carex echinata* - *Sphagnum fallax/denticulatum* mire, *Juncus effusus* sub-community. This supports dominant *Sphagnum fallax*, occasional hare's-tail cottongrass *Eriophorum vaginatum*, occasional *Polytrichum strictum* and frequent to abundant soft rush *Juncus effusus*. Towards the southern section of this flush, the vegetation gradually changes to a more mixed community, with more elements of M17a *Trichophorum cespitosum* - *Eriophorum vaginatum* blanket mire, *Drosera rotundifolia* - *Sphagnum* species sub-community present. These include an increase in other species of sphagna including *Sphagnum capillifolium* and also of cranberry *Vaccinium oxycoccus*. A photo of this community is provided as photo 1. This mosaic of vegetation up slope here soon becomes a single vegetation type comprising M17a. The flatter plateau to the north is entirely dominated by this vegetation type. The track will not impinge on this M17a area. Where the proposed track crosses the small watercourse, to the west of here (south side of stream), the vegetation again resembles M17a, with frequent cranberry, frequent cross-leaved heath *Erica tetralix*, frequent to abundant *Sphagnum palustre* and frequent *Sphagnum capillifolium*. Devil's-bit scabious *Succisa pratensis* is also occasional here. This area is only small in extent and to the immediate west (between the forestry and the south side of the watercourse) becomes species-poor M6d *Carex echinata* - *Sphagnum fallax/denticulatum* mire, *Juncus acutiflorus* sub-community. Here, *Sphagnum palustre* is occasional (abundant towards the forestry edge), sharp-flowered rush *Juncus acutiflorus* is frequent to abundant and purple moor-grass is abundant to dominant. A photo of this community is provided as photo 2. On the north side of the stream here, the vegetation is similar, though more closely resembles M23a *Juncus effusus/acutiflorus* - *Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community. Sharp-flowered rush is again a dominant species here, with frequent purple moor-grass. However, sphagna is largely absent, with only a few clumps of *Sphagnum palustre*, and other mosses are more prominent - *Rhytidiadelphus squarrosus* (frequent) and *Kindbergia praelonga* (abundant). Herbs are frequent here, including occasional common sorrel *Rumex acetosa* and frequent marsh thistle *Cirsium palustre*. A photo of this sub-community is provided as photo 3. Finally, on the south side of the stream, at the point where the stream turns in a right angle to the south, is a clump of four or five large tussocks of greater tussock-sedge *Carex paniculata*.

An alternative route into the forestry was also investigated. This lies to the west of Turbine R27, and heads north east directly into the forestry from the location of a previously proposed access track running south-east - north-west. The main vegetation type here is M25 *Molinia caerulea* - *Potentilla erecta* mire 'Eriophorum vaginatum variant'. The vegetation here is a species-poor community. It is relatively dry (certainly based on the species present), and comprises dominant purple moor-grass, occasional mat-grass, occasional *Pleurozium schreberi*, occasional *Polytrichum commune* and occasional *Polytrichum strictum*. Hare's-tail cottongrass is at a relatively low frequency here. Small areas of soft rush are also present.

Of the two options, in terms of their vegetation communities, this second is preferable, as it completely avoids any areas of M17, and it also does not involve crossing the M6c/M17 flush.



Photo 1 M17a sub- community



Photo 2 Photo 2 M6d sub- community





Photo 3: M23a sub-community



## APPENDIX 8.1: PEAT VOLUME CALCULATION

### Peat excavation volumes

The peat excavation volumes associated with the project have been calculated using the GIS package ArcGIS based on the following data and assumptions:

- A contour map of assumed peat depth based on interpolation of values from probing across the site;
- Dimensions of the proposed areas for excavation for site infrastructure;
- An estimated acrotelm depth of 0.2m across the site based on observations from cores (Appendix III of the SEI 2013); and
- An assumption that the probe depth is representative of the actual depth of the peat.

The peat depth map has been created based on almost 5,000 locations where a probe has been used to ascertain the depth of penetration to 0.1m accuracy. The frequency of the probing is:

- Tracks - at the centre line of the track and 10m either side at 25m intervals;
- Turbines - at the centre of each turbine base and then at each of the cardinal points at 25m and 50m distance from the centre (9 probes per turbine base);
- Other infrastructure - probing as deemed necessary to characterize the footprint; and
- Areas away from proposed infrastructure with no other overriding constraints - these include steep gradients, noise constraints, ornithological constraints, watercourse buffers, landscape constraints etc. Probing was conducted on a 100m grid.

This data has allowed a contoured plot of the peat surface to be constructed in the areas where probing has been completed (Figure 8.2a, 8.2b and 8.2c).

Coring has also been undertaken at 117 locations to compare the probe penetration depth with the actual depth of the peat. The coring has demonstrated that soft clay is present in many areas of the site and is not distinguishable from the peat when using the probe. This has likely led to a substantial over estimate in peat depths and therefore a subsequent substantial overestimate in excavated peat volumes (Appendix III of the SEI 2013).

The excavation footprint of all proposed infrastructure are presented in Table 1.

**Table 1 Infrastructure dimensions**

Infrastructure	Excavated Dimensions (m)	Number or length in the case of tracks	Total Area (m <sup>2</sup> )
Tracks	Width of 7.5m which includes 5.5m running width and 1m of drainage on either side of track	15,865 m of new track and 2,258m of existing track to be upgraded (where a track crosses a crane pad, turbine base or other infrastructure it is assumed that there is no track in these areas)	111,215 m <sup>2</sup> of new track and 16,933 m <sup>2</sup> of existing track
Borrow pits	60m x 60m	5	18,000 m <sup>2</sup>
Site construction compounds	50m x 60m	5	15,000 m <sup>2</sup>
Batching Plant	80m x 80m	1	6,400 m <sup>2</sup>
Welfare Buildings	5m x 4m	2	40 m <sup>2</sup>
Turbine base and	4,765m <sup>2</sup> (area as irregular	30	142,968 m <sup>2</sup>



Infrastructure	Excavated Dimensions (m)	Number or length in the case of tracks	Total Area (m <sup>2</sup> )
crane pad	dimensions)		
Substation	65 x 62	1	4,030 m <sup>2</sup>
Met mast base and associated crane pad	6 x 6 and 20 x 20	1	436 m <sup>2</sup>
<b>Total</b>			<b>315,022 m<sup>2</sup></b>

It is assumed that any peat excavated for cable trenches is stored adjacent to the trench while the track is laid and then replaced, therefore this volume is not applicable to the excavated volume. The contoured surface of the peat created has then been used to determine the average depth of peat under the excavation footprint of all proposed infrastructure and therefore the total volume of peat to be excavated as well as the volume of acrotelm and catotelm. These data are presented in Table 2.

**Table 2 Excavated volumes for all infrastructure**

Name	Peat Depth Average (m)	Area (m <sup>2</sup> )	Acrotelm volume (m <sup>3</sup> )	Catotelm volume (m <sup>3</sup> )	Total Volume (m <sup>3</sup> )
Met Mast and associated crane pad	0.18	436	78	0	78
Substation	0.16	4,028	644	0	644
Welfare Building (south)	0.18	20	4	0	4
Welfare Building (north)	0.65	20	4	9	13
Construction Compound 1	0.22	3,000	600	60	660
Construction Compound 2	0.41	3,000	600	630	1,230
Construction Compound 3	0.14	3,000	420	0	420
Construction Compound 4	0.51	3,000	600	930	1,530
Construction Compound 5	0.05	3,000	150	0	150
Borrow Pit 1	0.00	3,600	0	0	0
Borrow Pit 2	0.08	3,600	288	0	288
Borrow Pit 3	0.13	3,600	468	0	468
Borrow Pit 4	0.55	3,600	720	1,188	1,908
Borrow Pit 6	0.05	3,600	180	0	180
Batching Plant	0.05	6,400	320	0	320
Turbine R4 including crane pad	0.46	4,765	954	1,240	2,193
Turbine R5 including crane pad	0.40	4,765	954	954	1,907
Turbine R6 including crane pad	0.43	4,765	954	1,097	2,050
Turbine R7 including crane pad	0.29	4,765	954	429	1,383
Turbine R8 including crane pad	0.14	4,765	668	0	668
Turbine R9 including crane pad	0.41	4,765	954	1,001	1,955
Turbine R12 including crane pad	0.53	4,765	954	1,573	2,527
Turbine R13 including crane pad	0.22	4,765	954	95	1,049
Turbine R14 including crane pad	0.21	4,765	954	48	1,001
Turbine R15 including crane pad	0.49	4,765	954	1,383	2,336
Turbine R16 including crane pad	0.31	4,765	954	524	1,478

Name	Peat Depth Average (m)	Area (m <sup>2</sup> )	Acrotelm volume (m <sup>3</sup> )	Catotelm volume (m <sup>3</sup> )	Total Volume (m <sup>3</sup> )
Turbine R17 including crane pad	0.56	4,765	954	1,716	2,670
Turbine R18 including crane pad	1.13	4,765	954	4,434	5,388
Turbine R19 including crane pad	0.42	4,765	954	1,049	2,003
Turbine R23 including crane pad	0.04	4,765	191	0	191
Turbine R24 including crane pad	0.07	4,765	334	0	334
Turbine R25 including crane pad	0.61	4,765	954	1,955	2,908
Turbine R26 including crane pad	0.51	4,765	954	1,478	2,432
Turbine R27 including crane pad	0.23	4,765	954	143	1,097
Turbine R31 including crane pad	0.53	4,765	954	1,573	2,527
Turbine R32 including crane pad	0.09	4,765	429	0	429
Turbine R35 including crane pad	1.53	4,765	954	6,341	7,295
Turbine R36 including crane pad	1.03	4,765	954	3,957	4,911
Turbine R37 including crane pad	0.51	4,765	954	1,478	2,432
Turbine R38 including crane pad	0.64	4,765	954	2,098	3,052
Turbine R39 including crane pad	0.62	4,765	954	2,003	2,956
Turbine R40 including crane pad	0.42	4,765	954	1,049	2,003
Turbine R41 including crane pad	0.23	4,765	954	143	1,097
Turbine R42 including crane pad	0.38	4,765	954	858	1,812
Turbine R43 including crane pad	0.06	4,765	286	0	286
<b>Total</b>			<b>30,104</b>	<b>39,854</b>	<b>69,958</b>

<b>Track</b>			<b>7,878</b>	<b>31,511</b>	<b>39,389</b>
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<b>Total Volume infrastructure + Tracks</b>			<b>37,982</b>	<b>71,365</b>	<b>109,347</b>
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The total calculated excavation volumes are:

- Total volume of peat excavated = ~109,300m<sup>3</sup>
- Total volume of acrotelm excavated = ~38,000 m<sup>3</sup>
- Total volume of catotelm excavated = ~71,400 m<sup>3</sup>

These values are estimates based on the available data and the above assumptions. As coring has verified, actual peat depths particularly those related to the probe penetration depths of 0.5m to 1m are significantly less.

## APPENDIX 8.2: WATERCOURSE CROSSING ASSESSMENT

### WATERCOURSE CROSSING No 23



**Photo 1.** Nant Ffriddycastell watercourse at SH 96360 09200. Watercourse crossing No 23.



**Photo 2.** Looking upstream from SH 96360 09200



**Photo 3.** Looking downstream from SH 96360 09200

#### Watercourse details

The channel width of the Nant Ffriddycastell watercourse at the proposed crossing location, SH 96360 09200 is approximately 1.0 to 1.2m. The depth to the bank is about 0.5m and at the time of the survey had about 0.15m depth of water with a streamflow of about 1m/s and therefore an approximate flow of about 150 L/s.

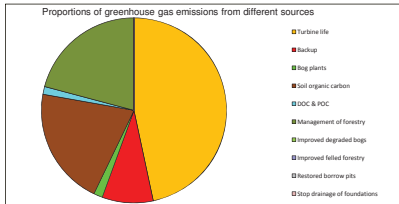
## APPENDIX 10.1: CARBON CALCULATOR

**Results**  
**PAYBACK TIME AND CO<sub>2</sub> EMISSIONS**  
 Note: The carbon payback time of the windfarm is calculated by comparing the loss of C from the site due to windfarm development with the carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

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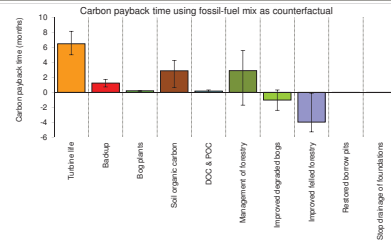
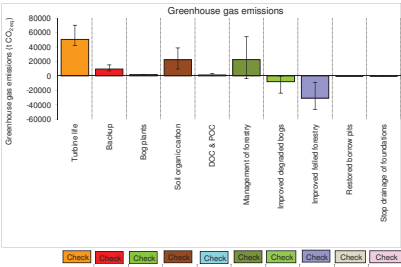
	Exp.	Min.	Max.
<b>1. Windfarm CO<sub>2</sub> emission saving over...</b>			
...coal-fired electricity generation (tCO <sub>2</sub> yr <sup>-1</sup> )	132034	96822	201373
...grid-mix of electricity generation (tCO <sub>2</sub> yr <sup>-1</sup> )	66017	48411	100687
...fossil fuel - mix of electricity generation (tCO <sub>2</sub> yr <sup>-1</sup> )	93191	68338	142132
<b>Total CO<sub>2</sub> losses due to wind farm (t CO<sub>2</sub> eq.)</b>			
2. Losses due to turbine life (eg. manufacture, construction, decommissioning)	50444	42035	70065
3. Losses due to backup	9631	6784	15200
4. Losses due to reduced carbon fixing potential	1687	1231	2186
5. Losses from soil organic matter	22339	9631	38719
6. Losses due to DOC & POC leaching	1443	237	3109
7. Losses due to felling forestry	22538	-3685	54125
<b>Total losses of carbon dioxide</b>	<b>108082</b>	<b>56232</b>	<b>183404</b>
<b>8. Total CO<sub>2</sub> gains due to improvement of site (t CO<sub>2</sub> eq.)</b>			
8a. Gains due to improvement of degraded bogs	-7926	-298	-23915
8b. Gains due to improvement of felled forestry	-30651	-8760	-48218
8c. Gains due to restoration of peat from borrow pits	-11	-9	-73
8d. Gains due to removal of drainage from foundations & hardstanding	-23	-9	-219
<b>Total gains</b>	<b>-38611</b>	<b>-9076</b>	<b>-70425</b>

<b>RESULTS</b>	Exp.	Min.	Max.
<b>Net emissions of carbon dioxide (t CO<sub>2</sub> eq.)</b>	<b>69471</b>	<b>-14194</b>	<b>174328</b>
<b>Carbon Payback Time</b>			
...coal-fired electricity generation (years)	0.5	-0.1	1.8
...grid-mix of electricity generation (years)	1.1	-0.1	2.6
...fossil fuel - mix of electricity generation (years)	6.7	-0.1	2.6



Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions	Exp.	Min.	Max.
Turbine life	50444	42035	70065
Backup	9631	6784	15200
Bog plants	1687	456	499
Soil organic carbon	22339	12708	16380
DOC & POC	1443	1206	1667
Management of forestry	22538	26224	31587
Improved degraded bogs	0	0	0
Improved felled forestry	0	0	0
Restored borrow pits	0	0	0
Stop drainage of foundations	0	0	0



Data used in barchart of carbon payback time using fossil-fuel mix as counterfactual

Greenhouse gas emissions	Exp.	Min.	Max.	Exp.	Min.	Max.
Turbine life	50444	42035	70065	6	1	2
Backup	9631	6784	15200	1	1	0
Bog plants	1687	456	499	0	0	0
Soil organic carbon	22339	12708	16380	3	2	1
DOC & POC	1443	1206	1667	0	0	0
Management of forestry	22538	26224	31587	3	5	3
Improved degraded bogs	-7926	-298	-23915	-1	-1	-1
Improved felled forestry	-30651	-8760	-48218	-4	-4	-1
Restored borrow pits	-11	-9	-73	0	0	0
Stop drainage of foundations	-23	-9	-219	0	0	0
	69471			9		

**Results**  
**PAYBACK TIME AND CO<sub>2</sub> EMISSIONS**  
 Note: The carbon payback time of the windfarm is calculated by comparing the loss of C from the site due to windfarm development with the carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

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