

# Visual Impact Provision (VIP)

## Snowdonia Project

### Options Appraisal 2020

National Grid  
National Grid House  
Warwick Technology Park  
Gallows Hill  
Warwick  
CV34 6DA

March 2020

---

# Table of Contents

	Page
1 Introduction.....	2
2 Methodology.....	7
3 Baseline Environment.....	8
4 Undergrounding Options.....	11
5 Tunnel Alignment.....	19
6 Infrastructure Western Side of the Cable Tunnel.....	21
7 Infrastructure Eastern Side of the Cable Tunnel.....	29
8 Overhead Line and Pylon Removal Options.....	30
9 Conclusion.....	31

## 1 Introduction

- 1.1 Ofgem has agreed a set of price controls and incentives for the period from April 2013 to March 2021. This includes a provision of £500 million for electricity transmission owners to mitigate the visual impact of existing electricity infrastructure in nationally protected landscapes in Great Britain. For National Grid, which is the transmission owner in England and Wales, this means considering the effects of existing infrastructure on the visual amenity and landscapes of National Parks and Areas of Outstanding Natural Beauty (AONBs). National Grid has referred to this as the Visual Impact Provision (VIP).
- 1.2 National Grid has 571km of overhead line (OHL) which passes through AONBs and National Parks (approximately 7% of the network). This infrastructure mainly comprises existing high voltage (400,000 and 275,000 Volt) OHL.
- 1.3 In identifying the current VIP Projects National Grid has gone through a detailed landscape assessments and site selection process to deliver projects that will achieve the maximum benefits from the financial provision. The project's national Stakeholder Advisory Group (see below) was established in April 2014 to advise National Grid on the evaluation and ultimate selection of potential projects. Projects prioritised for further development have also benefited from the guidance of local technical Stakeholder Reference Groups. The stages of project identification included:
- 1) Identification of eligible infrastructure within and affecting the setting of AONBs and National Parks.
  - 2) Assessment of the landscape and visual impacts of all eligible infrastructure.
  - 3) Identification of mitigation options.
  - 4) Prioritisation of selected sections of OHL for further project development in conjunction with the Stakeholder Advisory Group.
  - 5) Detailed project development by National Grid, guided by national and local stakeholders including technical Stakeholder Reference Groups and feedback from the public.

### *Stakeholder Advisory Group*

- 1.4 A national Stakeholder Advisory Group (SAG) was set up by National Grid in April 2014 and comprises organisations dedicated to conserving the landscape and countryside throughout England and Wales. Representatives from a range of organisations form the group including Historic England, Natural England, Natural Resources Wales, the Landscape Institute, National Trust, CPRE, CPRW, the Ramblers Association, National Parks Wales and National Parks England. This group was established to help National Grid to identify and select those projects which use the provision in the most efficient way and deliver maximum benefit in terms of enhancing the landscape. The SAG helps National Grid to make decisions according to the guiding principles set out in the VIP policy document (published by National Grid in 2013, reviewed 2017 to ensure that it remains fit for purpose). The guiding principles are to prioritise potential projects which:
- Result in greatest landscape enhancement benefits.
  - Result in greatest opportunities to conserve and enhance natural beauty, wildlife and cultural heritage whilst avoiding unacceptable impacts on the natural and historic environment.
  - Result in greatest opportunities to encourage public understanding and enjoyment of the protected landscapes, including positive socio-economic impacts.
  - Are technically feasible in the context of the wider transmission system.
  - Are economical and efficient.
- 1.5 This approach ensured fairness and balance in decision making to help select projects to prioritise for further development.

- 1.6 National Grid research indicated that the majority of consumers favoured 'undergrounding' to mitigate visual impact, followed by screening with trees, use of an alternative 'T-pylon' and re-routeing.

### *Assessment of Landscape and Visual Impacts in Priority Areas*

- 1.7 To determine the VIP Projects to be taken forward, National Grid appointed expert landscape consultants to carry out landscape assessments of its overhead line in English and Welsh AONBs and National Parks.
- 1.8 Following the results of the landscape and visual impact assessment (National Grid Visual Impact Provision Landscape and Visual Impact Assessment of Existing Electricity Transmission Infrastructure in Nationally Protect Landscapes in England and Wales – Technical Report 2014<sup>1</sup>), covering all 571km of OHL within the scope of the VIP project, those sections of OHL which had the greatest visual impact on the surrounding landscape were identified.
- 1.9 The SAG reviewed the report and endorsed its findings, short listing 12 sections of OHL in eight AONBs and National Parks as having the most significant landscape and visual impact. Each of the short-listed AONBs and National Parks were studied to examine their ecology, archaeology, land ownership, geology and a range of other important factors including views obtained during stakeholder engagement.
- 1.10 Stakeholder Reference Groups (SRG)<sup>2</sup> were formed in the eight shortlisted areas to provide additional technical guidance and local insight on the potential projects.

### *Options Appraisal and Final Selection*

- 1.11 An Options Appraisal (OA) report was prepared (May to July 2015) for each of the 12 shortlisted areas to consider all available options. A further short list of the projects was prioritised for further detailed work by the SAG. The SAG considered a wide range of factors and in September 2015 recommended that the following four projects be taken forward for potential engineering work:
- Dorset Area of Outstanding Natural Beauty (AONB)
  - New Forest National Park
  - Peak District National Park
  - Snowdonia National Park
- 1.12 Snowdonia National Park is crossed by four National Grid OHLs. In particular, subsection 4ZC.1 runs from the west coast at the Dwryd Estuary near Porthmadog past Cilfor before climbing up towards the summit of Moel Tecwyn and beyond, finishing at the western side of Ceunant Llennyrch Valley. The independent landscape assessment concluded that this section of OHL has landscape impacts of very high level of importance on the Arduwy Coastal Hinterland and a part of Morfa Harlech landscape. High level visual impacts are particularly evident on people using the Wales Coast Path regional trail, National Cycle Route 8, local rights of way and Open Access Land, due to close up and frequent views of the pylons and OHL.
- 1.13 At the SAG meeting in September 2015, the section of OHL near Porthmadog (subsection of 4ZC.1) in Snowdonia National Park was prioritised as one of the four sections of OHL to be taken forward as a potential undergrounding project. The SAG continued to work with National Grid in developing the Proposed Project to ensure the provision was maximised in terms of enhancing the landscape, whilst no significant negative impacts on sensitive environments occur as the enhancements are made.

---

<sup>1</sup> National Grid Visual Impact Provision Landscape and Visual Impact Assessment of Existing Electricity Transmission Infrastructure in Nationally Protect Landscapes in England and Wales. (<https://www.nationalgridet.com/document/84141/download>)

<sup>2</sup> To guide the project at a local level, an independent Stakeholder Reference Group (SRG) was established to create open dialogues with local stakeholders, benefit from local knowledge of the area, keep them informed about the project and establish their priorities for using the Visual Impact Provision funding.

### *OHL Subsection 4ZC.1 (Snowdonia National Park)*

- 1.14 The existing 4ZC.1 route connects Pentir and Trawsfynydd 400kV substations. The OHL was constructed in 1966 with standard lattice pylon design with twin and quad conductor (wires) bundles along various sections. Currently, the pylons operate with one circuit at 400kV, while part of the other side operates at 132kV as part of the distribution network operators (DNO) system. There is an existing section of underground cables across the Glaslyn estuary. The location of the National Grid 4ZC.1 OHL in relation to the National Park boundary are shown in Figure 1.1.
- 1.15 The section of 4ZC.1 OHL taken forward for engineering works (here on referred to as the VIP Subsection) is approximately 3.5km in length and runs from Garth Sealing End Compound (SEC) near Minffordd (to the east of Porthmadog) across the Dwryd Estuary (see Figure 1.1) where it enters the western edge of the Snowdonia National Park. It then continues past the small settlement of Cilfor.

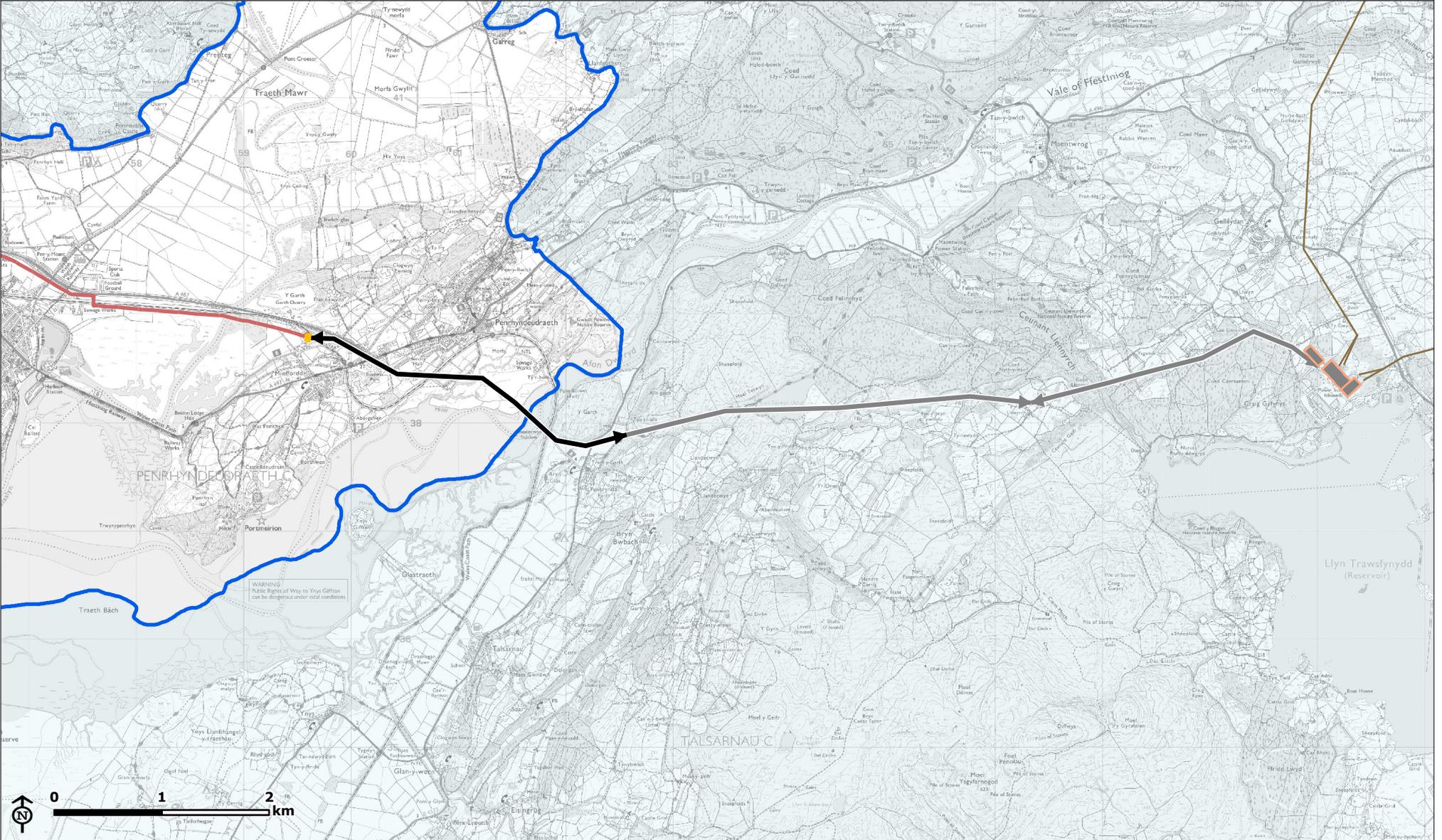
**NATIONAL GRID  
SNOWDONIA NP  
VIP PROJECT**

- Snowdonia NP
- National Grid Garth SEC
- VIP subsection
- Trawsfynedd Power Station
- 4ZC overhead line
- Underground cable route
- Other OHL



**Figure 1.1: 4ZC Overhead Line and VIP Subsection within and adjacent to Snowdonia NP**

Source: Natural Resources Wales, National Grid



### *Proposed Project Options Appraisal (2015 – 2020)*

- 1.16 This Options Appraisal Report (2020) summarises the options considered during further project development of the selected subsection of 4ZC.1 taken forward by the SAG. It follows on from the previous reports referenced including the National Grid Visual Impact Provision Snowdonia Options Appraisal Study (2015) and National Grid Visual Impact Provision Landscape and Visual Impact Assessment of Existing Electricity Transmission Infrastructure in Nationally Protect Landscapes in England and Wales – Technical Report (2014) and National Grid Visual Impact Provision Policy Document (published by National Grid in 2013, reviewed 2017 to ensure that it remains fit for purpose). This suite of documents provides the detailed background to the VIP Project and contains relevant information on how the VIP Subsection was chosen for undergrounding works.
- 1.17 The contents of this report are structured as follows:
- Section 2 - Methodology;
  - Section 3 – Baseline Environment
  - Section 4 – Undergrounding Options
  - Section 5 – Tunnel Alignment
  - Section 6 - Infrastructure Western Side of the Cable Tunnel
  - Section 7 - Infrastructure Eastern Side of the Cable Tunnel
  - Section 8 – Overhead Line and Pylon Removal Options
  - Section 9 - Conclusions

## 2 Methodology

- 2.1 This appraisal follows the general principles set out in National Grid's document 'Our approach to Options Appraisal' (2012). Options appraisal provides a framework against which technical, socio-economic, environmental and cost topics can be considered in selecting project options. The topics and subtopics set out in 'Our approach to Options Appraisal' are presented in Table 2.1.

**Table 2.1: Option Appraisal Topics and their constituent sub-topics for consideration as relevant**

Topic	Subtopic
Environmental	Landscape and Visual Amenity; Ecology; Historic Environment; Local Air Quality; Noise and Vibration; Soils and Geology; Water
Socio-Economic	Economic Activity; Traffic and Transport; Aviation and Defence
Technical	Technical Complexity; Construction/Project delivery (including resource use and waste); Suitability of Technology; Network Capacity; Network efficiency /benefits (which includes energy efficiency)
Cost	Capital cost; and Lifetime cost

- 2.2 Only the subtopics that are able to help differentiate between the options are considered. Information from the baseline surveys, desk-based research and engagement with stakeholders was used to inform the options appraisal process.
- 2.3 Cost was not covered as a topic for the options appraisal work undertaken. While cost is an important factor to consider for the project, the highly constrained nature of the site resulted in the technical feasibility and environmental/socio-economic considerations being the overriding factors in terms of decision making. Therefore, the final decision for the preferred option was heavily influenced by the technical and environmental assessments and input from stakeholders.
- 2.4 National Grid aims to be a leader in the development and operation of safe, reliable and sustainable energy infrastructure. One of the cornerstones of its strategy is to stimulate innovation and promote new ideas to work more efficiently and effectively. From the start of the project, the SAG has also challenged National Grid to explore innovative ways of delivering the VIP projects. National Grid has looked at a number of innovative technological solutions alongside conventional XLPE cable for all of the VIP projects. Therefore, although the Options Appraisal work was initially undertaken based on the use of XLPE cable technology, as the project has progressed Gas Insulated Line (GIL) technology has also been considered as an alternative method of electricity transmission for the project where its use is feasible. However, the same engineering challenges and constraints largely applied for GIL as for traditional XLPE cable.

### 3 Baseline Environment

- 3.1 An Area of Search for Permanent Development (hereafter referred to as the 'Area of Search') was established which aimed to provide a large area which could be investigated for its suitability to locate permanent infrastructure associated with the proposed project and take account of potential route alignment options. The Area of Search broadly follows the alignment of the existing 4ZC.1 OHL as shown in Figure 4.1. This Area of Search aimed to provide enough space to feasibly locate infrastructure, without moving too far from the existing OHL which would therefore not necessitate additional lengths of OHL to be constructed to connect into the new electrical infrastructure.
- 3.2 Within the Area of Search were Sealing End Compound/Tunnel Head House Search Areas for where this specific above ground infrastructure could be located. This comprised large areas of land either side of the Dwyryd Estuary close to the OHL where there could be a transition from below ground to above ground electrical cabling. This enabled Sealing End Compound/Tunnel Head House siting options to be considered in the event that engineering or environmental constraints were identified.
- 3.3 An overview of the baseline environment within the Area of Search is provided below.
- 3.4 Although part of the Area of Search falls outside of the National Park boundary, the OHL is considered to have very high impact on the character of the National Park and has therefore was included in the appraisal.

#### *Landscape and Visual*

- 3.5 The landscape within the Area of Search has a strong sense of place, derived from its coastal setting, which consists of a large-scale broad estuary that narrows to the east. The OHL passes through areas regionally characterised in the Gwynedd, and Snowdonia National Park landscape assessments. Most significantly, OHL 4ZC.1, to the west, has a very high scale impact on the Morfa Harlech and Ardudwy Coastal Hinterland LCA. The OHL also influences Seascape character area 21: Dwyryd Estuary and Morfa Harlech. At a more local landscape character level, the OHL is described as running through four distinctive areas.
- 3.6 From Garth SEC the OHL runs south east through Minffordd towards the Dwyryd Estuary. The landscape here is strongly influenced by the townscape of linear settlement, road and railway infrastructure, all of which locally reduce tranquillity. The OHL then crosses over an area of saltmarsh, where it is much more visible, before crossing into the National Park.
- 3.7 The OHL then continues south east and over-sails the railway once again, from here diverting through the rocky landform of Y Garth. The scale and industrial appearance of the pylons conflicts with this landform. The landscape here is strongly influenced by the broad flat Dwyryd Estuary, and associated saltmarshes, and has a greater sense of tranquillity. The OHL here has notably greater impacts on the visual amenity. South east of the estuary the OHL crosses over the A496 and ascends up the complex gorge in the north east direction, towards the summit of Twcwyn and Llyn Tecwyn Uchaf (Reservoir). In order to span this landscape, the pylons are higher than standard, with the steepness and complexity of the terrain requiring more frequently placed pylons.
- 3.8 People within the National Park who experience these views include the residents of Cilfor. Visitors and tourists to the area, enjoying the scenery, beaches or historical sites may also experience the visual impact of the OHL and the gantries at Garth SEC. Users of local A roads, passengers on the Cambrian Coast Railway, cyclists on National Cycle Route 8 and users of the Welsh Coast Path regional trail experience very near views of the pylons due to their relationship and close proximity with the roads and footpaths.
- 3.9 The special qualities of the National Park are outlined in the Snowdonia National Park Management Plan. The plan outlines the importance of the Ardudwy coast to the landscape of the National Park.

#### *Nature Conservation*

- 3.10 The Area of Search comprises European, national and locally designated sites for nature conservation.
- 3.11 The Dwyryd Estuary and river valley is designated as part of the Llyn Peninsula and the Sarnau Special Areas of Conservation (SAC); it is also designated as part of Morfa Harlech Sites of Special Scientific Interest (SSSI) and Morfa Harlech National Nature Reserve (NNR).

- The Llein Peninsula and the Sarnau SAC encompasses areas of sea, coast and estuary and contains large areas of sublittoral sandbanks, bar built estuaries, coastal lagoons, large shallow inlets, bays and reefs and Atlantic salt meadows.
  - The Morfa Harlech SSSI comprises terrestrial habitats including sand dunes and salt marsh; rare plants and animals including breeding bird assemblage, wintering pintail, sand lizard, otter, water vole, and nationally rare mining beetle and invertebrate assemblage).
  - Sand flats and salt marsh in Morfa Harlech NNR form important wildfowl feeding grounds.
- 3.12 Gwaith Powdwr Local Nature Reserve (LNR) is located east of Penrhyndeudraeth adjacent to the Afon Dwyryd. Gwaith Powdwr LNR contains oak woodland and hosts important wildlife such as pied flycatchers, Emperor Dragonflies and nightjars.
- 3.13 Other undesignated areas contain habitat such as: saltmarsh, farmland, hedgerows, coastal heath and grassland and deciduous woodland.

### *Historic Environment*

- 3.14 Parts of the Area of Search contain scheduled ancient monuments and listed buildings including: Scheduled Ancient Monument located in the site of Cei Tyddyn Isa towards the north shore of Dwyryd and Grade II listed buildings include Rhos House near Garth SEC, Minffordd Station and Ysbyty Bron-y-Garth (hospital building) in Minffordd. The Arduwy Registered Landscape of Outstanding Historic Interest is located south of the Area of Search and Aberglaslyn Registered Landscape of Outstanding Historic Interest to the west.

### *Air Quality*

- 3.15 There are not currently any Air Quality Management Areas (AQMAS) in Gwynedd.

### *Geology and Topography*

- 3.16 The River Dwyryd is a meandering channel which runs through the estuary and narrows significantly at the Pont Briwet Bridge to a width of 200m. This is due to the hard rock hillsides on either side of the estuary. A number of rock promontories/tidal islands act as a control on the main channel with the largest rounded outcrop called Ynys Giffan.
- 3.17 The bedrock comprises Upper Cambrian and Lower Ordovician rock of the Mawddach Group which occur on both sides of the Dwyryd Estuary. The group consists of approximately 2km (thickness) of predominantly grey argillaceous rocks interbedded at intervals with mature quartzose sandstone and black pyritic mudstones. Sedimentary structures show that the group represents a complete cycle of deep basin formation and infilling.
- 3.18 A single dolerite intrusion cuts across the Dol Cyn Afon formation to the north of Garth SEC and is orientated approximately east-west. This is currently being extracted by quarrying.
- 3.19 It is likely there are several buried rock islands forming an irregular rock head level with the overlying estuarine sediments.
- 3.20 The area is crossed by three main faults. Two mapped faults to the east of the estuary strike north east – south west and define the boundary between the Ffestiniog Flags and Maentwrog formations. Faulting is also in evidence on the southern slopes of 'Y Garth'. A North-South trending fault intersects the line to the west of the estuary and indicates a downthrow to the north west.
- 3.21 Superficial deposits consist of alluvium/tidal flat deposits (clay, silt and sand) at shallow depths. These overlie older glaciofluvial deposits which are a result of glaciation and high velocity meltwaters during glacial ablation. These deposits are characterised by sands, gravels, cobbles and boulder to thicknesses up to 60m.
- 3.22 There are no known protected geological sites within the Area of Search.

### *Land Use and Soils*

- 3.23 A large area to the north-east of the Dwyryd Estuary is urban, consisting of the settlement of Minffordd as well as the Snowdonia Park Business Park. On the eastern side of the estuary the land is predominantly farmland with the small village of Trem-y-garth lying south of the OHL route.

- 3.24 There are areas of farmland around Minffordd used for sheep and cattle grazing. This comprises individual fields with stone wall or tree lined boundaries. Grazing is also available on the low-lying areas of saltmarsh habitat on both sides of the main channel.
- 3.25 On the south eastern side of the estuary the land is predominantly farmland used for grazing and small pockets of woodland. At the eastern extent of the proposed Development the land starts to rise steeply with gorse and bracken present in extensive areas.
- 3.26 There are a number of Public Rights of Way (PRoW) that dissect the Area of Search, including the Wales Coast Path.
- 3.27 Where soils have formed on the solid geology (i.e. the higher land to both the east and west of the estuary) the soils are mapped as freely draining acid loamy soils overlying rock. Within the low-lying areas (east and west of the estuary) the soils are mapped as saltmarsh soils with loamy textures, subject to tidal flooding (i.e. in places covered at high tide). Where not directly affected by high tides the soils in these low-lying areas will have naturally high groundwater. Peat has been identified across the low-lying land within the eastern parts of the Area of Search.

### *Hydrology and Flood Risk*

- 3.28 The Flood Risk Map shows large areas of 'high risk' zones within the estuary including both sides of the Afon Dwyryd, especially on the salt marshes and reclaimed marshland either side of the river and adjacent to Afon Glaslyn. The area on the east side leading into Cilfor and crossing the A496 also has areas of 'high risk' zones.

### *Tourism and Socio-economic*

- 3.29 Porthmadog (a settlement rich in maritime history) and Portmeirion are situated to the south west of the Area of Search. Porthmadog provides a base for many tourists utilising the many attractions and outdoors pursuits North Wales has to offer. The Area of Search contains tourist accommodation including bed and breakfast/ guest houses and camping and caravan sites.

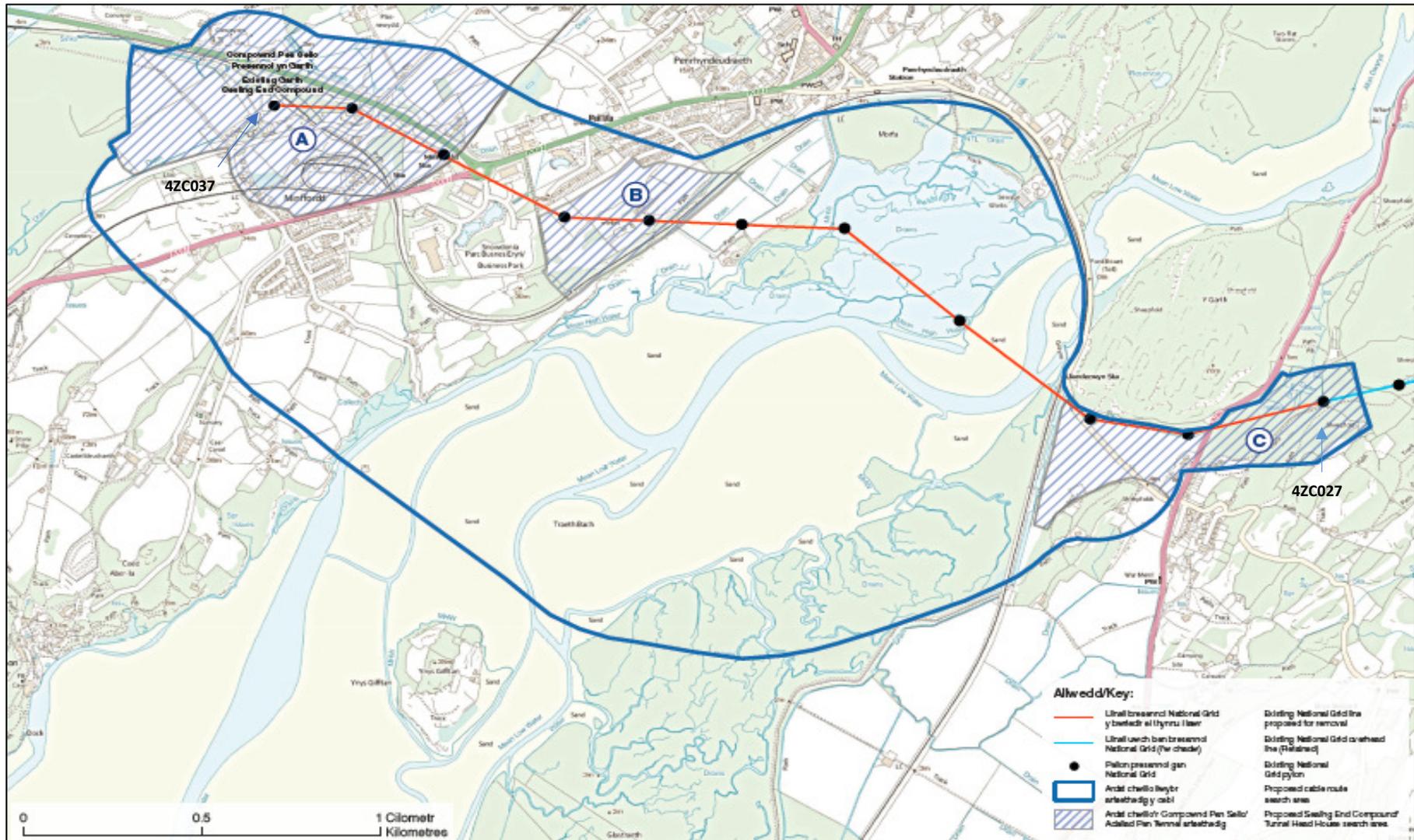
### *Traffic and Transport*

- 3.30 A number of main and unclassified roads and the Cambrian Coast railway are included within the Area of Search. They include:
- A487 (bypassing Porthmadog) and the A497 located to the north of the estuary.
  - There is a network of unclassified roads that support the surrounding farms, scattered properties and Portmeirion.
  - The Cambrian Cost Railway follows the A487 Porthmadog bypass and crosses the estuary at Pont Briwet. Penrhyndeudraeth, Minffordd and Llandecwyn railway stations are located with the Area of Search.

## 4 Undergrounding Options

- 4.1 One of the largest engineering obstacles to constructing the VIP Subsection below ground is the crossing of the Dwyryd Estuary. The estuary widens to the west of Pont Briwet which carries the railway and a local road over the river. At the bridge the estuary is approximately 180m wide and opens out to in excess of 900m. In addition, there are salt marshes at various points on either side of the estuary. The estuary deposits are known to be very deep. Routing options were initially identified by National Grids appointed engineers based on the terminating positions either end of the VIP Subsection and the different methods for crossing the Dwyryd Estuary. Methods initially considered for crossing the estuary included:
- Direct or ducted burial;
  - Horizontal Directional Drilling;
  - Pipe Jacking; and,
  - Tunnelling methods.
- 4.2 It should be noted that the following routes were not considered following initial investigations:
- Cable circuits routed along public highway over Pont Briwet and through Penrhyndeudraeth. This route was not considered due to insufficient space available on the bridge and likely structural issues resulting from the weight of cables. Utility plans show the presence of an existing high-pressure gas pipeline routed within the highway, due to construction proximity distances there would be insufficient space to construct the cables within the highway. Use of the public highway would cause major disruption to traffic and disturbance to residents.
    - Following the termination of the contract to connect Wylfa Newydd and the associated reduction in ratings the above route was considered as the number of cables required had reduced. The summary for this back-check is covered in sections 4.12 – 4.16.
  - Cable circuits routed along the valley to the north of new SEC at Pylon 4ZC027 (east of Y Garth). This route was not considered since it would result in additional disturbance to Snowdonia National Park. The cable would also need to be installed in the A496 for some distance resulting in major disruption to traffic. The overall route length would be increased by more than 5km.
- 4.3 Following consideration of the potential options, taking into account environmental issues, including topography and sediment depth, three potentially viable options were shortlisted for further investigation as follows:
- Option 1 - Cable Tunnel in the vicinity of the existing Garth SEC to Cilfor (between SEC/Tunnel Head House Search Area A (Figure 4.1) to SEC/Tunnel Head House Search Area C);
  - Option 2 – Trenchless Drilling Techniques from the West of Dwyryd Estuary to Cilfor drilling between SEC/ Tunnel Head House Search Area B to Search Area C; and
  - Option 3 – Option 2 (above) with the addition of a direct buried route onshore to the existing Garth SEC (from Search Area B to Garth SEC in Search Area A).
- 4.4 A summary of these options is presented in Table 4.1 below and the Search Areas shown on Figure 4.1.

Figure 4.1: Sealing End Compound/Tunnel Head House Search Areas (A, B and C)



**Table 4.1: Construction Options**

Option (Search Areas shown on Figure 4.1)	Comment/ Constraints	Conclusion
<p><b>1. Cable tunnel (between Search Area A and Search Area C)</b></p> <p>This would involve an underground cable in a tunnel bored at depth beneath the Dwyryd Estuary. This option would comprise:</p> <ul style="list-style-type: none"> <li>• Two tunnel head houses (one at either end of the cable tunnel in Tunnel Head House Search Areas A and C); and</li> <li>• Underground cabling of approximately 3.5km (depending on the detailed design). The majority of the cable would be within a deep tunnel, with short sections of direct burial potentially required between the tunnel head houses and SEC's;</li> <li>• A new SEC and associated replacement terminal pylon in Search Area C to connect the new underground cables to the existing OHL;</li> <li>• Removal of the existing VIP Subsection including ten pylons and approximately 3.5km of OHL.</li> </ul>	<p><b>Technical:</b> Tunnel shafts would be required at either end of the tunnel requiring a tunnel head house for access to the tunnel. A substantial construction compound would be required at each shaft location, and access would be required for bringing in plant and material.</p> <p>The diameter of a cable tunnel is very much dependant on the quantity of cables that need to be installed. It is envisaged that a cable tunnel internal diameter of 3m up to 4.4m is required. Disposal of spoil would be necessary, either on-site, or off-site, necessitating associated vehicle movements.</p> <p>Depending on the tunnel head house locations, some direct burial/ OHL may be required between the tunnel head houses and the existing SEC on the west of the estuary and the new SEC on the east of the estuary. The tunnel head house and shaft would preferably be located in close proximity to the SEC to minimise the length of any direct burial/ OHL required between the tunnel head house and SEC. Direct burial of an underground cable would require a construction corridor up to 60m wide along the length of the cable route, depending on the number of cables required. This construction corridor would accommodate the cable trenches, haul road, storage areas for stripped topsoil and sub soil from the cable trench excavation and inclusion of any temporary and permanent land drainage requirements. There may be a requirement to bury up to twelve cables to maintain circuit capacity.</p> <p>Following completion of the tunnelling, civil works and installation of the cables, the construction compounds would be restored to previous condition/ use, although permanent tunnel head houses and compounds would remain. These buildings would provide maintenance access to the tunnel and contain ventilation equipment to regulate the temperature in the tunnel, a permanent access road would be required.</p> <p><b>Environmental/ Socio-economic:</b> Cable installation works will avoid qualifying features of the statutory designated Dwyryd Estuary, however the removal of two Pylons within the estuary have the</p>	<p><b>Preferred Option</b></p> <p>A decision was made by the SRG in 2016 to take this option forward to remove the maximum number of Pylons.</p> <p>This option has been taken forward for further investigation, tender design and subsequent detailed design and environmental appraisal.</p> <p>Engineering design has confirmed that there is no requirement for the cable tunnel to surface at an intermediate point within the estuary.</p> <p>Although environmental constraints exist in Search Area A in is anticipated that appropriate siting can avoid many of the identified constraints.</p>

Option (Search Areas shown on Figure 4.1)	Comment/ Constraints	Conclusion
	<p>potential to impact on these designated features (common to all options).</p> <p>The western boundary of Search Area A is adjacent to Meirionnydd Oakwoods and Bat Sites SAC, Glaslyn SSSI, Traeth Glaslyn North Wales Wildlife Trust Reserve. An area of ancient woodland is located on the northern boundary of Search Area A. YSBYTY Bron Y Garth SSSI falls within Search Area A.</p> <p>Search Area C falls within Snowdonia National Park and contains areas of open access land.</p> <p>Public Rights of Way are present within Search Areas A and C. National Cycle Route 8 passes through Search Area A and C. The Wales Coastal Paths passes through Search Area C.</p> <p>Both Search Areas A and C contain areas of Flood Risk (Zones 1- 3). A large proportion of both areas are within Zones 3 with the risk reducing on the higher ground leading to pylon 027 on the east side.</p> <p>A listed building is present within Search Area A and on the edge of Search Area C.</p> <p>Hedgerows and other field boundaries would be reinstated. Trees felled would not be replanted over the buried cable but would be replaced locally elsewhere.</p>	
<p><b>2. Trenchless Drilling Techniques (between Search Area B and Search Area C)</b></p> <p>This would involve a trenchless construction technique beneath the Dwyryd Estuary. This option would comprise:</p> <ul style="list-style-type: none"> <li>Two new SECs and two replacement terminal pylons (one at either end of the new underground cable) required to</li> </ul>	<p><b>Technical:</b> Horizontal Directional Drill (HDD) provides a bore beneath a sensitive /difficult area that the cable is then sleeved into a duct using a biodegradable lubricant. The HDD bore would typically be 18 inches in diameter. An available alternative to HDD is a tunnelling system, such as a micro-tunnelling boring machine, with a typical bore range of 375m-2000m. Micro-tunnelling is a remotely controlled, guided, pipe jacking operation for remotely-operated, small-diameter tunnelling.</p> <p>The maximum length that can be achieved with trenchless techniques will be determined by the length of suitably rated cable that can be delivered to site on a single cable drum but is typically between 300m and 800m. Depth of the buried cables will depend on the cable rating,</p>	<p><b>Rejected</b></p> <p>A decision was made by the SAG to reject this option as it does not achieve the maximum landscape benefits from the funding i.e. this option requires two new SEC, removal of six pylons which is removal of less infrastructure than other</p>

Option (Search Areas shown on Figure 4.1)	Comment/ Constraints	Conclusion
<p>connect the new underground cables to the existing OHL;</p> <ul style="list-style-type: none"> <li>Approximately 2.5km of underground cabling, the majority of the cable would be installed using trenchless technology such as HDD, with sections of direct burial required (the length depending on the location of SECs and route of cable alignment); and</li> <li>Removal of the existing VIP Subsection between Search Areas B and C including approximately six pylons and 2.5km of OHL. This option would need to retain three to four pylons and existing OHL between the Garth SEC and Search Area B.</li> </ul>	<p>and the deeper the cables are buried the wider the spacing's between cables needs to be. The wider spacing's are required due to reduced heat dissipation from the ground; cables need to be far enough away from each other so not to allow heat to transfer from one cable phase to the other or from one circuit to another.</p> <p>It may be necessary to surface at an intermediate point within the estuary and/or install an additional short section of cable using direct burial east of the railway line (close to Search Area B), this would be confirmed following further detailed engineering studies.</p> <p><b>Environment/ Socio-economic:</b> There is the potential requirement for the trenchless drilling machinery to surface within the statutory designated Dwyryd Estuary within the marine environment. The Dwyryd Estuary is a Main River which is subject to the following nature conservation designations: SAC, SSSI, and NNR is located downstream.</p> <p>Search Area C falls within Snowdonia National Park and contains areas of open access land. Public Rights of Way are present within Search Areas C as is the National Cycle Route 8 and the Wales Coastal Path. Search Areas C contains areas of Flood Risk (Zones 1- 3). A listed building is present on the edge of Search Area C.</p> <p>Search Area B contains Tree Preservation Orders on its northern boundary, a public right of way, areas of ancient woodland, the Wales Coastal Path and a number of SSSI's are located in close proximity.</p> <p>Following completion of the drill and installation of the cable, the construction compounds would be restored to their previous condition/ use. Hedgerows and other field boundaries would be reinstated. Trees felled would not be replanted over the buried cable but would be replaced locally elsewhere.</p>	<p>options and a smaller stretch of OHL.</p> <p>This option also provided landowner objections, technical difficulties, and potential consenting risks as a result of works that would be required within the statutorily designated Dwyryd Estuary.</p>
<p><b>3. Option 2 (above) with and additional section of direct burial onshore from Search Area B to Garth SEC in Search Area A</b></p>	<p><b>Technical:</b> Technical constraints are as discussed for Option 2 above with the addition of pinch points/ space constraints with the direct burial route. Utility plans show the presence of an existing high-pressure gas pipeline (construction proximity distances) there would be insufficient space to construct the cables. There would need to be</p>	<p><b>Rejected</b></p> <p>This option provided landowner objections,</p>

Option (Search Areas shown on Figure 4.1)	Comment/ Constraints	Conclusion
<p>This would involve a trenchless construction technique beneath the Dwyryd Estuary and onshore direct burial. This option would comprise:</p> <ul style="list-style-type: none"> <li>• One new SEC and replacement terminal pylon in Search Area C required to connect the new underground cables to the existing OHL;</li> <li>• Underground cabling installed using trenchless technology such as HDD, with a section of direct burial on the eastern side of the estuary and a longer section of direct burial on the western side of the estuary. Three direct burial routes were considered: <ul style="list-style-type: none"> <li>• 3a) A direct burial route that behind Bron Y Garth Hospital site and crosses the road/railway back into Garth SEC; and</li> <li>• 3b) A route that goes behind the hospital site and through the quarry that could connect into the Glaslyn cables, if deemed feasible if both projects were to be constructed together.</li> <li>• 3c) Direct Burial Route West of Minffordd</li> </ul> </li> <li>• Removal of the existing VIP Subsection between Search Areas A and C including ten pylons and approximately 3.5km of OHL.</li> </ul>	<p>a number of railway and road crossings. Use of the public highway would cause disruption to traffic and disturbance to residents.</p> <p><b>Environment/ Socio-economic:</b> As with Option 2 there is the potential requirement for the trenchless drilling machinery to surface within the statutory designated Dwyryd Estuary within the marine environment.</p> <p>This option would affect Search Areas A, B and C- the constraints of which are discussed above.</p> <p>A direct burial route could affect Bron Y Garth Hospital which is designated as a SSSI and is sensitive for bats.</p> <p>Following completion of the drill and installation of the cable, the construction compounds would be restored to their previous condition/ use. Hedgerows and other field boundaries would be reinstated. Trees felled would not be replanted over the buried cable but would be replaced locally elsewhere.</p>	<p>technical difficulties, and potential consenting risks</p>

- 4.5 National Grid's appointed Landscape Architects and Heritage Consultants considered Option 1 (Full Tunnel Option, Search Area A-C) and Option 2 (Trenchless drilling techniques, Search Area B-C) and the difference in the beneficial effects on the setting of the National Park, the latter of which would:
- leave in four pylons and 0.5km of OHL up to Garth SEC; and
  - require a SEC and tunnel head house in Search Area B.
- 4.6 The main purpose was to:
- to assess the landscape and visual effects of pylons 4ZC033-037, with particular reference to the estuary and the setting of the National Park; and
  - to understand the likely impacts of removing a section of the 4ZC OHL (from pylon 4ZC027-032) whilst leaving the remaining isolated section of OHL on Minffordd peninsula (4ZC033-037) together with the addition of a new SEC and tunnel head house to the west of the Dwyryd Estuary.
- 4.7 It was concluded that the landscape and visual impacts of pylons 4ZC033-037 extend over a relatively wide geographical area. Furthermore, the retention of the pylons and intermediate spans on the higher ground across the Minffordd peninsula may appear incongruous following the removal of the pylons to the east. This area is framed by the dramatic rising mountains of Snowdonia National Park which wrap around the Glaslyn and Dwyryd estuaries. The Minffordd peninsula (on which 4ZC033-037 are situated) is a distinctive landform in the landscape between the flat expanses of the two estuarine landscapes either side of it. Views from the National Park in the north-west towards the peninsula are wide and extensive as are views from the eastern parts of the National Park looking back towards the west. The rising mountains of the National Park frame views in most directions. The curved boundary of the National Park means that pylons are also prominent in intervisible views between geographically separate areas of the National Park.
- 4.8 The work concluded that the impact of leaving an isolated section of pylons on the Minffordd peninsula (pylons 4ZC033-037) on local communities, visitors and the wider landscape of the National Park is high. The pylons conflict with the character of the landscape and erode the valued characteristics of the National Park and the Porthmadog Landscape Character Area (LCA). Furthermore, there is potential that the addition of a new SEC and tunnel head house in Search Area B would exacerbate landscape and visual effects. The high-quality landscape of the Porthmadog LCA contains many features which contribute to the National Park's 'special qualities' and provide an important setting and gateway to the National Park.
- 4.9 The cultural heritage work concluded that the OHL fails to respect the grain of the historic landscape, bisecting the area within a widely visible setting. The removal of pylons 4ZC033-037 would be of benefit to the value of the registered historic landscapes which form part of the setting of the National Park. Their removal would also improve the setting of listed buildings, and conservation areas flanking the Dwyryd and Glaslyn Estuaries.
- 4.10 The recommendation of the landscape architect and heritage consultants was that pylons 4ZC033-037 should be removed as part of the wider proposal. The removal of these pylons (4ZC033-037) in addition to the OHL from pylon 4ZC027-032 would greatly contribute to fulfilling VIP Policy Criteria/ guiding principles, it would 'result in greatest landscape enhancement benefits.
- 4.11 Option 1 (Full Cable Tunnel with removal of Pylons 4ZC037 to 4ZC028) was therefore taken forward for further engineering design.
- 4.12 As noted in 4.2, following the termination of the contract to connect Wylfa Newydd and the associated reduction in required ratings a 'back-check' was undertaken to ensure that the most appropriate option was being progressed. The back-check reviewed the work undertaken to date and concluded that in most cases no material change had occurred and therefore the conclusions remained valid.
- 4.13 One option which required further consideration was cable circuits routed along public highway over Pont Briwet and through Penrhyndeudraeth. This route was initially not considered due to insufficient space available on the bridge and likely structural issues resulting from the weight of cables, as well as potential interactions with third party services and disruption to traffic.
- 4.14 The reduction in ratings meant that fewer cables would be needed and less space would be required to install them. Whilst other constraints such as traffic disruption and proximity to other utilities

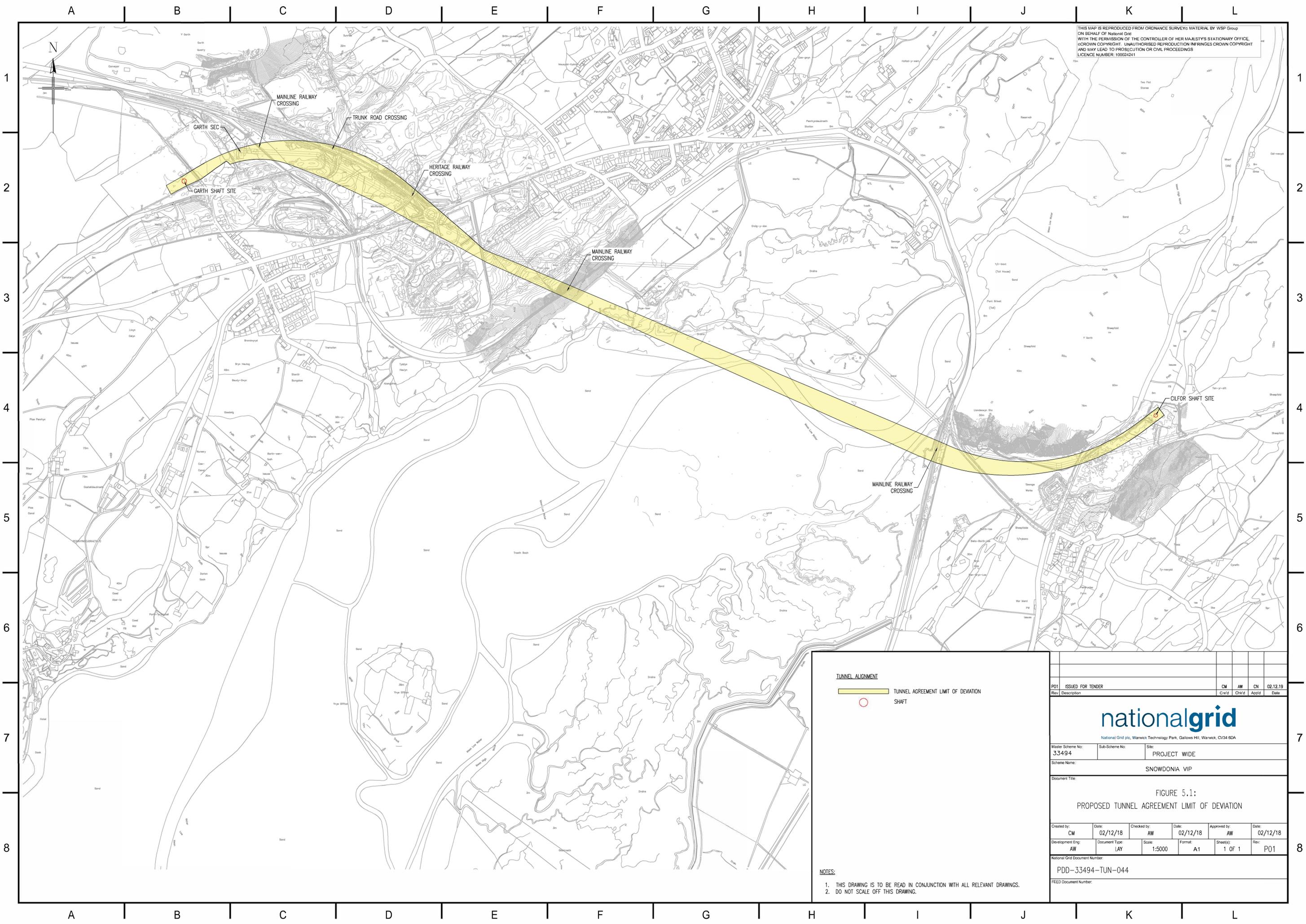
remained it was considered worthwhile reviewing this option as it had the potential to reduce the construction programme and overall cost of the project.

- 4.15 This back-check was undertaken and it concluded that despite the smaller area required to install the cables, the cumulative constraints, risks and complexities of this option meant it should not be taken forwards. Key constraints, risks and complexities were:
- 3rd party utilities
  - 3rd party structures (interaction with / physical constraints associated with)
  - Environmental constraints (e.g. ecological designations, flood plains etc.)
  - Physical constraints (estuary width, road widths, bending radius of cables, existing buildings and developments)
  - Geological conditions, bed rock close to the surface.
- 4.16 The back-check concluded that Option 1 (Full Cable Tunnel with removal of Pylons 4ZC037 to 4ZC028) remained as the preferred option.

## 5 Tunnel Alignment

- 5.1 Following the decision to move forward with a Full Tunnel (Option 1) and with a refined area for Tunnel Head Houses/ SEC, appointed engineers worked with National Grid to understand the required parameters of the tunnel. The tunnel will be of sufficient diameter and length to:
- Accommodate and allow installation of two 400 kV circuits.
  - Provide adequate ventilation conditions to prevent overheating of the cables and fresh air supply to maintenance personnel;
  - Provide safe access through the tunnel for inspection and maintenance;
  - Allow safe and economic construction.
  - It was assumed that the tunnel will be up to 4.4m Internal Diameter.
- 5.2 Following the suspension of work at the proposed Wylfa Newydd power station and the subsequent termination of their contract with National Grid, the rating requirements for the circuits in the tunnel reduced. The tunnel design was revisited to accommodate and allow installation of one 400kV circuit and one 132kV circuit.
- 5.3 The limits of deviation (i.e. the envelope within the which the tunnel will sit) for the horizontal alignment of the tunnel has been determined by considering the following:
- Sites for drive and reception shafts, which are assumed to be vertical;
  - Third party consents, crossings and constraints;
  - Tunnel length;
  - Turning radius of Tunnel Boring Machine (TBM); and,
  - Location of existing ground water and drinking water abstraction points.
- 5.4 The limits of deviation for the vertical alignment of the tunnel have been primarily determined by considering the following:
- Topography;
  - Geology and subsurface conditions;
  - Minimising shaft depth for maintenance;
  - TBM installation gradient;
  - Gradient for drainage;
  - Third party constraints.
- 5.5 In both cases limits of deviation have been developed to allow the contractors who will build the tunnel some flexibility. This enables them to optimise their proposed horizontal and vertical alignments considering all of the above topics alongside safety, cost and their own experiences.
- 5.6 Shafts will be up to 73.5m deep and the top of the outside of the tunnel will remain below a datum which has been determined and set at -15m Ordnance Datum i.e. this allows the contractor to decide whether they will tunnel uphill or downhill and at which end they will build the deeper shaft.
- 5.7 These limits of deviation form the constraints of the tunnel alignment, both horizontally and vertically. The horizontal limits can be seen in Figure 5.1.

THIS MAP IS REPRODUCED FROM ORDNANCE SURVEY'S MATERIAL BY WSP Group ON BEHALF OF National Grid WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE, CROWN COPYRIGHT. UNAUTHORISED REPRODUCTION INFRINGES CROWN COPYRIGHT AND MAY LEAD TO PROSECUTION OR CIVIL PROCEEDINGS LICENCE NUMBER: 10002421



**TUNNEL ALIGNMENT**

TUNNEL AGREEMENT LIMIT OF DEVIATION  
 SHAFT

- NOTES:**
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
  2. DO NOT SCALE OFF THIS DRAWING.

P01	ISSUED FOR TENDER	CM	AW	CN	02.12.19
Rev	Description	C'n'd	Chk'd	Appl'd	Date

**nationalgrid**  
 National Grid plc, Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA

Master Scheme No: <b>33494</b>	Sub-Scheme No:	Site: <b>PROJECT WIDE</b>
Scheme Name: <b>SNOWDONIA VIP</b>		

**FIGURE 5.1:  
 PROPOSED TUNNEL AGREEMENT LIMIT OF DEVIATION**

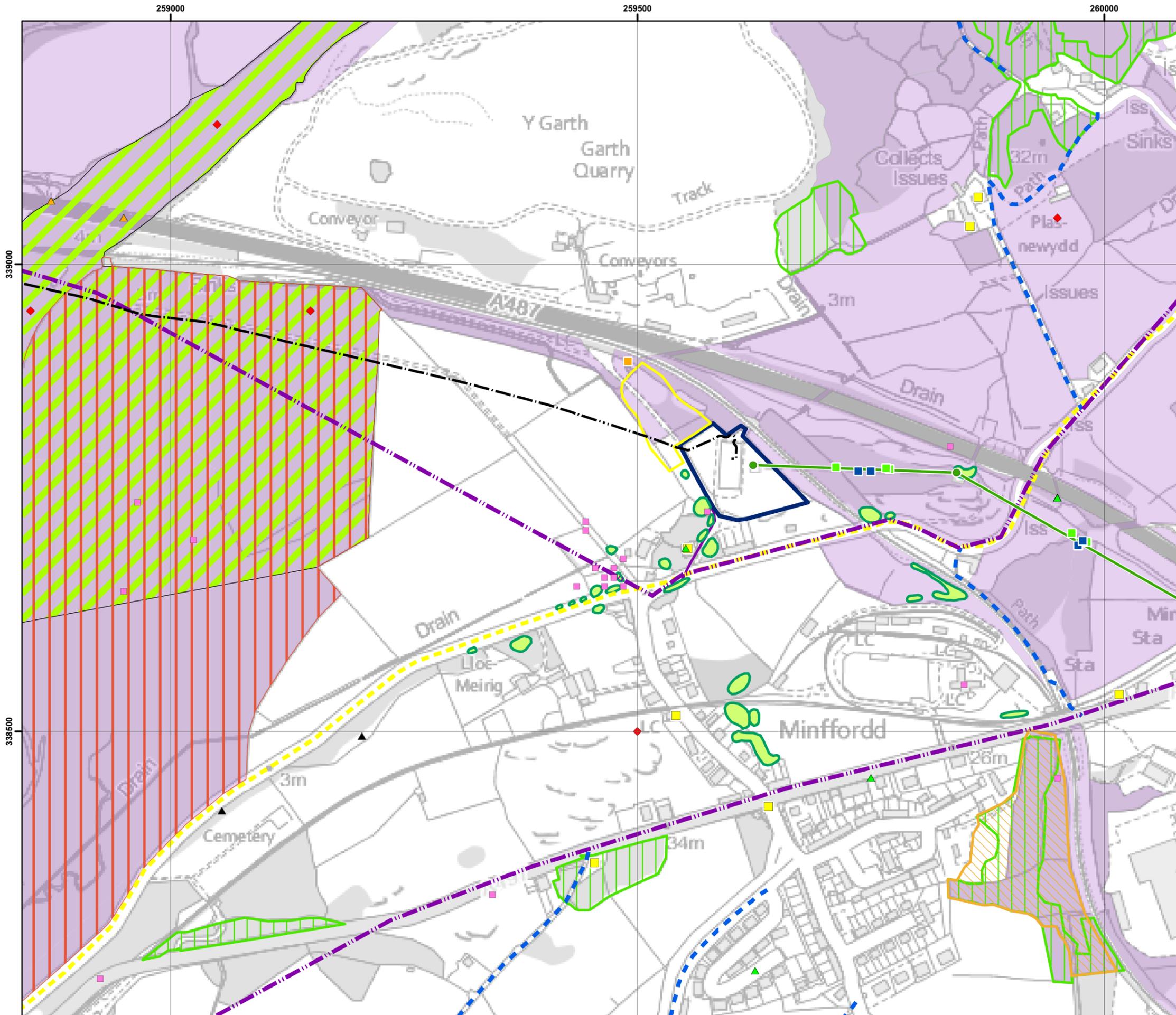
Created by: <b>CM</b>	Date: <b>02/12/18</b>	Checked by: <b>AW</b>	Date: <b>02/12/18</b>	Approved by: <b>AW</b>	Date: <b>02/12/18</b>
Development Eng: <b>AW</b>	Document Type: <b>LAY</b>	Scale: <b>1:5000</b>	Format: <b>A1</b>	Sheets: <b>1 OF 1</b>	Rev: <b>P01</b>

National Grid Document Number:  
**PDD-33494-TUN-044**

FEED Document Number:

## 6 Infrastructure Western Side of the Cable Tunnel

- 6.1 As discussed in Section 1, an Options Appraisal Study was undertaken to identify potential solutions that would mitigate the landscape and visual impact of the 400kV OHL on the National Park, and determine which of these solutions will deliver the greatest landscape and visual benefits to maximise the use of the fund without giving rise to significant adverse impacts greater than those being mitigated. It was agreed with the SAG that the Options Appraisal Study should not include all of subsection OHL 4ZC.1 and that it should concentrate on the central and western parts (pylons 4ZC019-032). This is because the central and western parts of OHL 4ZC.1 were identified as having the greatest visual impacts and the SAG had also raised concerns about the particular sensitivity of habitats to the east of the section of the OHL. The study also included the pylons (4ZC033-037) up to Garth SEC; although lying outside of the National Park boundary.
- 6.2 To facilitate the removal of Pylons the following new infrastructure is required on the western side of the Dwyryd Estuary in the vicinity of the existing Garth SEC to connect into existing electricity network:
- A Tunnel Head House (sited above the shaft);
  - Direct burial of a short sections of underground buried cable to connect into the SEC from the tunnel head house;
  - Reconfiguration of equipment at the existing Garth SEC (this will include the removal of the current gantry at Garth SEC); and,
  - A permanent access.
- 6.3 Key to siting was that the tunnel head house and shaft should be located in close proximity to the existing Gath SEC to prevent the need for a long stretch of direct burial cable or an additional stretch of OHL. As part of the optioneering process, land in the vicinity of the existing Gath SEC has been reviewed taking into consideration environmental and engineering constraints.
- 6.4 The western site will be used as the main construction site for the tunnel and will need to be of sufficient size to house both the shaft and all ancillary construction related items.
- 6.5 Following a review of baseline information, it was confirmed that land in the vicinity of Garth SEC is heavily constrained by both engineering and environmental constraints.
- 6.6 Engineering constraints of particular note are:
- The presence of the railway line to the north and east of Garth SEC;
  - The proximity of existing utilities, in particular the presence of a high-pressure gas pipeline (and its associated exclusion zone for all works and no build zone) , National Grid and SPEN buried cables to the west of Garth SEC and the presence of NG overhead lines.
  - The profile of the solid geology is complex and varied, with rock outcrops visible at the surface near the SEC but areas of deep soft ground developing as you move further West and North from the SEC.
- 6.7 Environmental constraints are shown on Figure 6.1 and 6.2 (Flood Zones). Of particular note are:
- SSSI located to the north and east of the existing Garth SEC;
  - The potential of buried roman road to the west of the existing Garth SEC;
  - The floodplain associated with the Glaslyn Estuary to the west of the existing Garth SEC;
  - Properties to the south of Garth SEC;
  - A Wildlife Trust Site, SSSI and SAC surrounding the Glaslyn Estuary to the west of the existing Garth SEC;
  - Listed buildings; and,
  - The presence of Japanese Knotweed and reptiles in the area.



Overview



Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA

**Legend**

- National Grid Land Ownership Boundary
- Overhead Line to be Removed
- Existing National Grid Underground Cable
- Existing National Grid Pylon to be Removed
- Ancient Woodland
- National Cycle Route 8
- PRoW
- Roman Road
- Listed Building
- Local Wildlife Site
- Common Lizard (Survey Oct 2018 - RSK)
- Invasive Plant Species (survey June 2018)
- Wildlife Trust Site
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)

**Protected Species (Local Records Centre data)**

- Badger
- Bat
- Otter
- Schedule 1 Bird
- Schedule 9 Plant
- Badger Sett (Survey April 2018 - RSK)
- Evidence of Otter (Survey April 2018 - RSK)
- Bat Tree (Moderate) - (Survey April 2018 RSK)

REPRODUCED FROM ORDNANCE SURVEY MAPS, BY PERMISSION OF THE ORDNANCE SURVEY ON BEHALF OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE. © CROWN COPYRIGHT ORDNANCE SURVEY. NATIONAL GRID ELECTRICITY - 100024241. NATIONAL GRID GAS -100024886

02	Proposed Extension Removed	AJ	SR	SR	28/02/2020
01	National Cycle Route 8	NH	SR	SR	04/12/2019
00	First draft	DL	SR	SR	09/04/2019
Rev	Description	Cre'd	Chk'd	App'd	Date



Master Scheme No:	Sub-Scheme No:	Site:
-	-	-

Scheme Name:  
Visual Impact Provision (VIP) Snowdonia Project

Document Title:  
**Figure 6.1:  
Western Tunnel Head House  
Constraints**

Created by: D.Lewis	Date: 28/02/2020	Checked by: H.Cross	Date: 28/02/2020	Approved by: S.Rotherham	Date: 28/02/2020
Development Eng:	Document Type:	Scale: 1:4,000	Format: A3	Sheet(s): 1 of 1	Rev: 02

National Grid Document Number:  
-

FEED Document Number:  
-

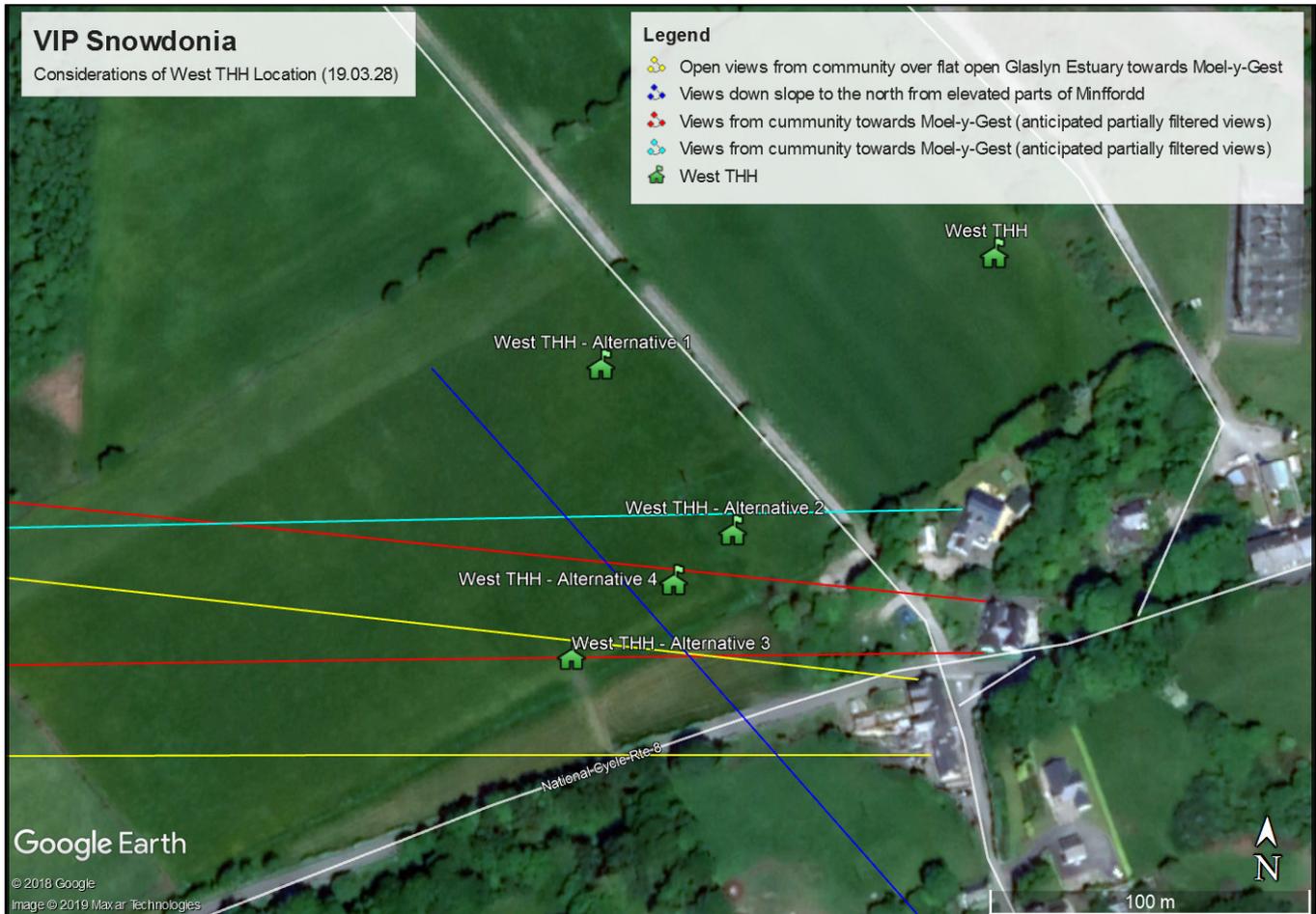
© RSK Group plc.  
This document is issued for the party which commissioned it and for specific purposes connected with the captioned project only. It should not be relied upon by any other party or used for any other purpose. We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to use by other parties.





- 6.8 Bearing in mind the above constraints, National Grid's appointed engineers and environmental specialist have explored the optimum location to locate the tunnel head house. Key to this, and to achieve the objective of the Visual Impact Provision, landscape and visual impacts were considered of great importance to siting the Tunnel Head House. The Tunnel Head House has been designed to be as small as is required to carry out its function and has been designed by architects in consultation with the local planning authority.
- 6.9 The location shown as 'West THH' on the figures below was the proposed location that was shown at public consultation events in 2018, this was the preferred location on landscape and visual grounds. At the time it was assumed that the SPEN cables would need to be replaced as part of the wider reinforcement works that would have been needed to connect Wylfa Newydd, as such it was possible that the project could proceed in proximity to the cables. Similarly, while the high pressure gas pipeline had been identified meetings had not yet been held with the utility provider to understand their exclusion requirements.
- 6.10 Following the consultation and the termination of the contract between Wylfa Newydd and National Grid, as well as the meeting with Wales and West, it was decided that the headhouse location needed to be moved. The exclusion zone around the high pressure gas pipeline is extensive and constructing the tunnel headhouse and shaft in the proposed location would have required a diversion of the pipe which in itself would have been a major project. The SPEN cables would now remain in situ as the reinforcement works for the connection of Wylfa Newydd were no longer needed, this meant that if the location of the tunnel headhouse and shaft remained where it was a project to divert the cables would also be required.
- 6.11 These utility diversions could add up to 18 months to the construction programme and would cause additional disruption, and well as incurring significant additional costs.
- 6.12 The reduction in ratings required as a result of the termination of the Wylfa Newydd contract with National Grid meant that the tunnel head house at the Garth end of the tunnel could be much smaller than previously anticipated. This is because less equipment was required to cool the cables.
- 6.13 Several meetings have been held since late 2018 to progress design. The local planning authority and NRW were keen for a traditional design that mirrored the local vernacular. A dual pitch roof was chosen for both aesthetics and also to enable a lower building height as a single pitch would be higher.
- 6.14 National Grid's appointed landscape architects undertook a review of potential siting locations assuming a Tunnel Head House 15m wide x15m long x 6m high with the need to raise ground levels to 3.2m AOD. This level has been calculated as the minimum level required to prevent flooding during a 1 in 1000year event. The potential locations considered are shown on Figure 6.3 below.

Figure 6.3: Potential Tunnel Head House Locations Western Side of the Dwyryd Estuary



6.15 Table 6.1 below provides an appraisal of the key landscape and visual effects of each of the identified locations together with other key considerations for completeness. This initial appraisal assumed that the design of the Tunnel Head House and its operational compound would incorporate landscape proposals to screen and soften the development to integrate it into the existing environment.

**Table 6.1: Landscape and Visual Appraisal of Options Considered for Tunnel Head House Siting (West)**

Option	Comment/ Constraint	Conclusion
<b>West THH</b>	<p>Close to existing infrastructure (existing sealing end compound, railway, road and quarry).</p> <p>Short stretch of buried cable to connect into Garth SEC.</p> <p>Existing trees in the vicinity to provide existing screening.</p> <p>Permanent access could utilise existing access track.</p> <p>Adjacent to SSSI.</p> <p>Potential for tree loss.</p> <p>Conflict with location of high-pressure gas pipeline.</p>	<b>Rejected</b> based on the proximity of the high-pressure gas pipeline and buried HV cables.
<b>West THH – Alternative 1 (or equally could move further north)</b>	<p>Furthest away from local community of all options considered.</p> <p>More scope for softening/screening the Tunnel Head House and its compound (through additional woodland planting which could tie into adjacent woodland) and more scope for subtle integration of landform changes in design than with other options considered. Avoids impacting on existing trees.</p> <p>Existing access track available which could potentially be used as an access track. If existing access track couldn't be used, then this alternative would require the longest access of locations considered.</p> <p>Conflict with location of high-pressure gas pipeline.</p>	<b>Rejected</b> based on the proximity of the high-pressure gas pipeline and buried HV cables.
<b>West THH – Alternative 2</b>	<p>Would keep built form closer to existing settlement.</p> <p>Closer to the local community than Alternative 1.</p> <p>Alternative 2 and Alternative 4 would be likely to result in similar effects, however it is considered that there is more scope to screen Alternative 4.</p>	<b>Rejected.</b> Similar to Alternative 4; however, Alternative 4 is considered a more favourable location due to its potential ability to screen and its relationship of new built form

Option	Comment/ Constraint	Conclusion
		with the existing settlement pattern.
<b>West THH – Alternative 3</b>	<p>Of all options considered Alternative 3 is closest to road network and a National Cycle Route. There is greater potential to affect the views from people using this route.</p> <p>Proposals to screen and integrate the Tunnel Head House; however, here is more likelihood that this location would affect views to the east from the local community and users of a National Cycle Route (travelling south) over the flat open floodplain towards the distinctive hill of Moel-y-Gest which lies beyond Porthmadog.</p>	<b>Rejected.</b> More potential for impacts on visual amenity than other options.
<b>West THH – Alternative 4</b>	<p>Would keep built form closer to existing settlement.</p> <p>Alternative 2 and Alternative 4 will result in similar effects, however it is considered that there is more scope to screen Alternative 4 and to tie in mitigation proposals with the existing pattern of land cover and built form.</p>	<b>Preferred Option.</b> West THH-Alternative 4 is considered a favourable location due to its potential ability to screen and its relationship of new built form with the existing settlement pattern.

- 6.16 The preferred location on Landscape and Visual grounds is labelled as the 'West THH' location on Figure 6.3 near to the existing Garth SEC; however, the presence of the high-pressure gas pipeline (and the requirement to maintain an exclusion zone for any works) preclude this location from use. The high-pressure gas pipeline also precludes the use of West THH- Alternative 1.
- 6.17 West THH- Alternative 4 (or further east) is considered a favourable location due to its relationship with the existing settlement pattern (in terms of consideration of the grain and pattern of built form and associated vegetation). There are opportunities to reinforce and utilise existing vegetation to filter and screen views of the compound. Furthermore, in relation to valued views from the Cob, a new building in this location would be perceived in relation to existing built form on the Minffordd Peninsula.

## 7 Infrastructure Eastern Side of the Cable Tunnel

- 7.1 As discussed in Section 1, an Options Appraisal Study was undertaken to identify potential solutions that would mitigate the landscape and visual impact of the 400kV OHL on the National Park, and determine which of these solutions will deliver the greatest landscape and visual benefits to maximise the use of the fund without giving rise to significant adverse impacts greater than those being mitigated. It was agreed with the SAG that the Options Appraisal Study should not include all of subsection OHL 4ZC.1 and that it should concentrate on the central and western parts (pylons 4ZC019-032). This is because the central and western parts of OHL 4ZC.1 were identified as having the greatest visual impacts and the SAG had also raised concerns about the particular sensitivity of habitats to the east of the section of the OHL. Since undergrounding was likely to emerge in many cases as a preferred approach, a prime consideration in defining the projects in each case was the potential location of SECs where the transition from OHL to underground cable takes place. The study also included the pylons (4ZC033-037) up to Garth SEC; although lying outside of the National Park boundary. Inclusion of these pylons allowed for consideration of options for the sensitive siting of a tunnel head house and/ or SEC.
- 7.2 The Options Appraisal Study concluded that undergrounding between Cilfor and the western side of the estuary was the option which would successfully remove the landscape and visual impacts currently being experienced (see Section 4 Undergrounding). Longer underground options extending east from Cilfor to Llyn Tecwyn Uchaf were discounted due to significant technical constraints, including the topography of the area. Alternative pylon designs and alternative overhead routes were also discounted.
- 7.3 Given the complexity of the characteristics of the area – such as the local topography, the width of the estuary, the depth of sediment and bedrock within the Afon Dwyryd, and the surrounding statutory designated sites for nature conservation it was not possible to propose a single design option to take forward. Based on the outcome of the Options Appraisal Study and further discussion between the group, the SAG agreed that National Grid should take forward a subsection of OHL 4ZC.1 (between pylons 4ZC027-037) for further investigation in the next stage of the VIP process.
- 7.4 National Grid progressed with undertaking engineering feasibility work on the shortlist of options which emerged from the Options Appraisal Study (2015). These were reviewed for their technical, environmental and socio-economic feasibility. At a Design Review Meeting in May 2016 and subsequent stakeholder discussion, a decision was taken that all remaining options would involve a tunnel solution to cross underneath the estuary. Tunnelling would reduce the number of engineering constraints and avoid direct environmental impact to surface features (including statutory and non-statutory designated sites for nature conservation, protected species and habitat) compared to conventional direct burial methods.
- 7.5 To facilitate the removal of the OHL the following new infrastructure is required on the eastern side of the Dwyryd Estuary in the vicinity of Pylon 4ZC027 to connect into existing electricity network:
- A new SEC to connect the new underground conductor to the remaining existing OHL;
  - A Tunnel Head House (sited above the tunnel shaft);
  - removal and reinstallation of Pylon 4ZC027 with a new Terminal Pylon (4ZC027R)
  - conductor span from the SEC to Pylon 027R and from Pylon 027R to Pylon 028; and,
  - A permanent access.

### Habitats Present at the Proposed Eastern (Cilfor) Tunnel Head House Compound

- 7.6 Section 7 of the Environment Act (Wales) 2016 is a list of the habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales. The Environment (Wales) Act 2016 puts duty on consultees to preserve biodiversity through the planning process.
- 7.7 Phase 1 Habitat Surveys were undertaken in 2016, repeated in 2018 for Search Area C (see Figure 4.1) and further detailed information was collected for the proposed eastern tunnel head house location in March 2019.
- 7.8 The Phase 1 Habitat Survey recorded 'valley mire' at the location of the proposed Eastern (Cilfor) Tunnel Head House Compound. Further detail is contained within target notes (15, 16, 17 and 18).

Figure 7.1: Phase 1 Habitat Survey

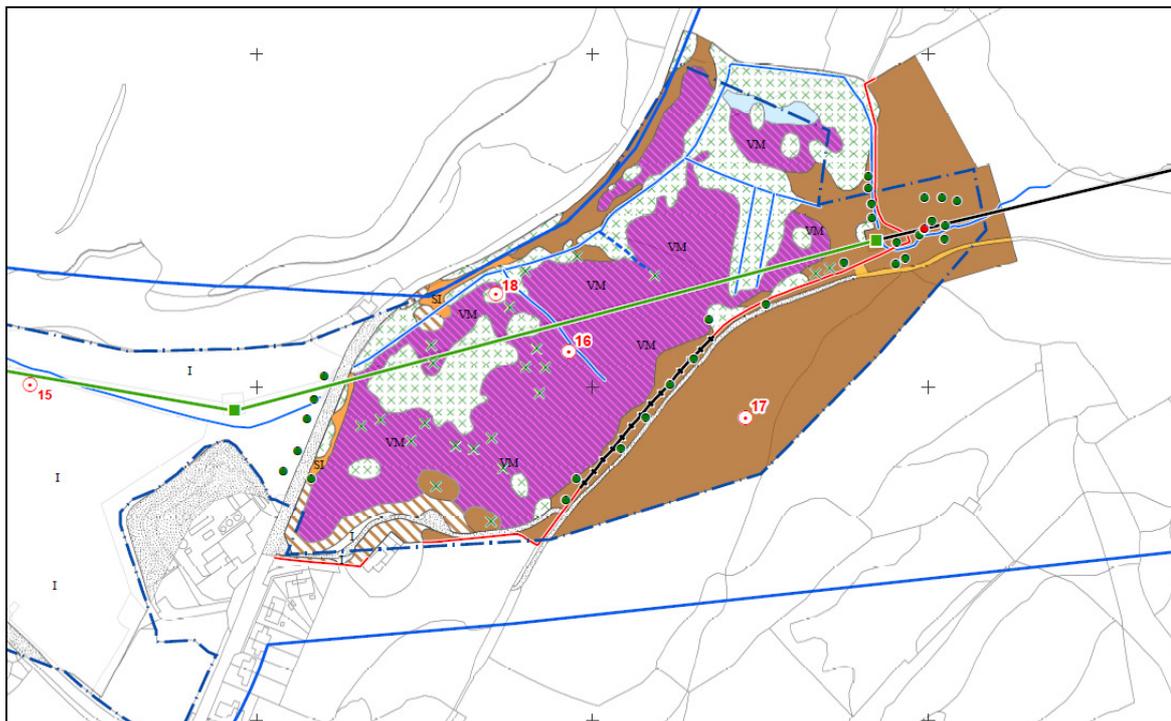


Table 7.1: Relevant Target Notes

Target Note	Description
15 Western side of the A496	Agriculturally improved grassland used for grazing and dominated by grasses such as <i>Agrostis capillaris</i> (Common Bent), <i>Alopecurus geniculatus</i> (Marsh Foxtail), <i>Anthoxanthum odoratum</i> (Sweet Vernal-grass), <i>Lolium perenne</i> (Perennial Rye-grass) and <i>Poa trivialis</i> (Rough Meadow-grass). Less abundant grasses include <i>Agrostis canina</i> (Velvet Bent), <i>Agrostis stolonifera</i> (Creeping Bent), <i>Bromus hordeaceus</i> (Soft-brome) <i>Holcus lanatus</i> (Yorkshire-fog) and <i>Phleum pratense</i> (Timothy). Typical grassland herbs include <i>Bellis perennis</i> (Daisy), <i>Cerastium fontanum</i> (Common Mouse-ear), <i>Plantago lanceolata</i> (Ribwort Plantain) and <i>Trifolium dubium</i> (Lesser Trefoil). Some areas appear more waterlogged, and these include species such as <i>Glyceria fluitans</i> (Floating Sweet-grass), <i>Sagina procumbens</i> (Procumbent Pearlwort), <i>Alopecurus geniculatus</i> (Marsh Foxtail). A c. 1.5m deep ditch dissecting this field is dominated by <i>Phragmites australis</i> (Common Reed) vegetation.
16 Eastern side of the A496	Extensive mire habitats at the bottom of a valley. The substrate is peaty, and in some areas there are large hummocks of <i>Polytrichum</i> and <i>Sphagnum</i> mosses. Young trees have established themselves in some areas, predominantly <i>Salix spp</i> (Willow species), as well as <i>Acer pseudoplatanus</i> (Sycamore) and <i>Betula pendula</i> (Silver Birch). <i>Graminoids</i> are abundant throughout with <i>Molinia caerulea</i> (Purple Moor-grass) forming tussocks towards the north of this area. Other graminoids found here include <i>Agrostis canina</i> (Velvet Bent), <i>Agrostis capillaris</i> (Common Bent), <i>Carex echinata</i> (Star Sedge), <i>Carex nigra</i> (Common Sedge), <i>Eriophorum angustifolium</i> (Common Cottongrass), <i>Holcus lanatus</i> (Yorkshire-fog), <i>Juncus acutiflorus</i> (Sharpflowered Rush), <i>Juncus articulatus</i> (Jointed Rush), <i>Juncus conglomeratus</i> (Compact Rush) and <i>Juncus effusus</i> (Soft-rush). Amongst these is a diverse community of herbs and ferns, including many species typical of marshy areas. Species recorded during the survey include <i>Aegopodium podagraria</i> (Ground-elder), <i>Cirsium palustre</i> (Marsh Thistle),

Target Note	Description
	<i>Digitalis purpurea</i> (Foxglove), <i>Epilobium palustre</i> (Marsh Willowherb), <i>Equisetum fluviatile</i> (Water Horsetail), <i>Galium palustre</i> (Common Marsh-bedstraw), <i>Hydrocotyle vulgaris</i> (Marsh Pennywort), <i>Lotus corniculatus</i> (Common Bird's-foot-trefoil), <i>Lythrum salicaria</i> (Purple-loosestrife), <i>Potentilla erecta</i> (Tormentil), <i>Potentilla reptans</i> (Creeping Cinquefoil), <i>Pteridium aquilinum</i> (Bracken), <i>Ranunculus flammula</i> (Lesser Spearwort), <i>Ranunculus repens</i> (Creeping Buttercup), <i>Rubus fruticosus agg.</i> (Bramble), <i>Rumex acetosa</i> (Common Sorrel) and <i>Viola palustris</i> (Marsh Violet). Surrounding the edges of this habitat are areas of <i>Pteridium aquilinum</i> (Bracken) and <i>Rubus fruticosus agg.</i> (Bramble) scrub.
17 Eastern side of Public Right of Way	An area of dense <i>Pteridium aquilinum</i> (Bracken) dominating the eastern side of the valley. The habitat is homogenous and species-poor, with some <i>Hyacinthoides non-scripta</i> (Bluebell) and <i>Potentilla erecta</i> (Tormentil).
18 Eastern side of the A496	The area of mire drains into a c.2m deep wet ditch. This is well vegetated by species including <i>Glyceria maxima</i> (Reed Sweet-grass), <i>Lycopus europaeus</i> (Gypsywort), <i>Phragmites australis</i> (Common Reed), <i>Potamogeton spp</i> (Pondweed species), <i>Sparganium erectum</i> (Branched Bur-reed), and <i>Typha latifolia</i> (Bulrush).

- 7.9 National Vegetation Classification Surveys were also undertaken in this area.
- 7.10 As peat was identified by the phase 1 surveys an additional site walkover was undertaken and confirmed that the extent of the peat body will be constrained on the southern, eastern and north-western sides by rising ground levels.
- 7.11 A Peat Depth Survey (February 2019) was commissioned by National Grid at the Eastern Tunnel Head House Compound to better understand the locations and depths of peat present with the aim of avoiding or reducing impact on this habitat type as far as possible. The thickness of the peat was assessed using a graduated glass fibre peat probe which could be extended to up to 5m depth. The probe was pushed vertically into the ground and the depth of peat recorded. A limited amount of hand augering was also undertaken to assess the nature of the peat (e.g. fibrous etc. and degree of humification based on the Von Post Scale) and to confirm, where possible, the nature of the underlying material. Dynamic Cone Penetration (DCP) tests were undertaken along the proposed access track alignment, excluding the area underneath the OHL (for health and safety reasons). It is considered that sufficient coverage was achieved to provide an understanding of the ground conditions across the survey area. A further survey was undertaken in November 2019 to ensure all relevant areas had been surveyed.
- 7.12 The peat and sediment depth survey provided a greater understanding of the distribution and depth of the peat resource and of the underlying material. The extent of peat is limited to a linear feature running parallel with the southern and eastern boundary of the survey area, potentially representing an old channel within which peat has built up. Elsewhere the peat is very shallow overlying mineral sediments (generally silt and clay overlying sands). The fine nature of the sediments present, the flat topography and the restricted drainage towards the estuary result in an area of wetland that is likely to remain wet for large parts of the year.
- 7.13 The published Ecological Baseline Report (Botanical) (March 2019) forms part of the Environmental Appraisal Report which will be submitted as part of an application for planning permission.

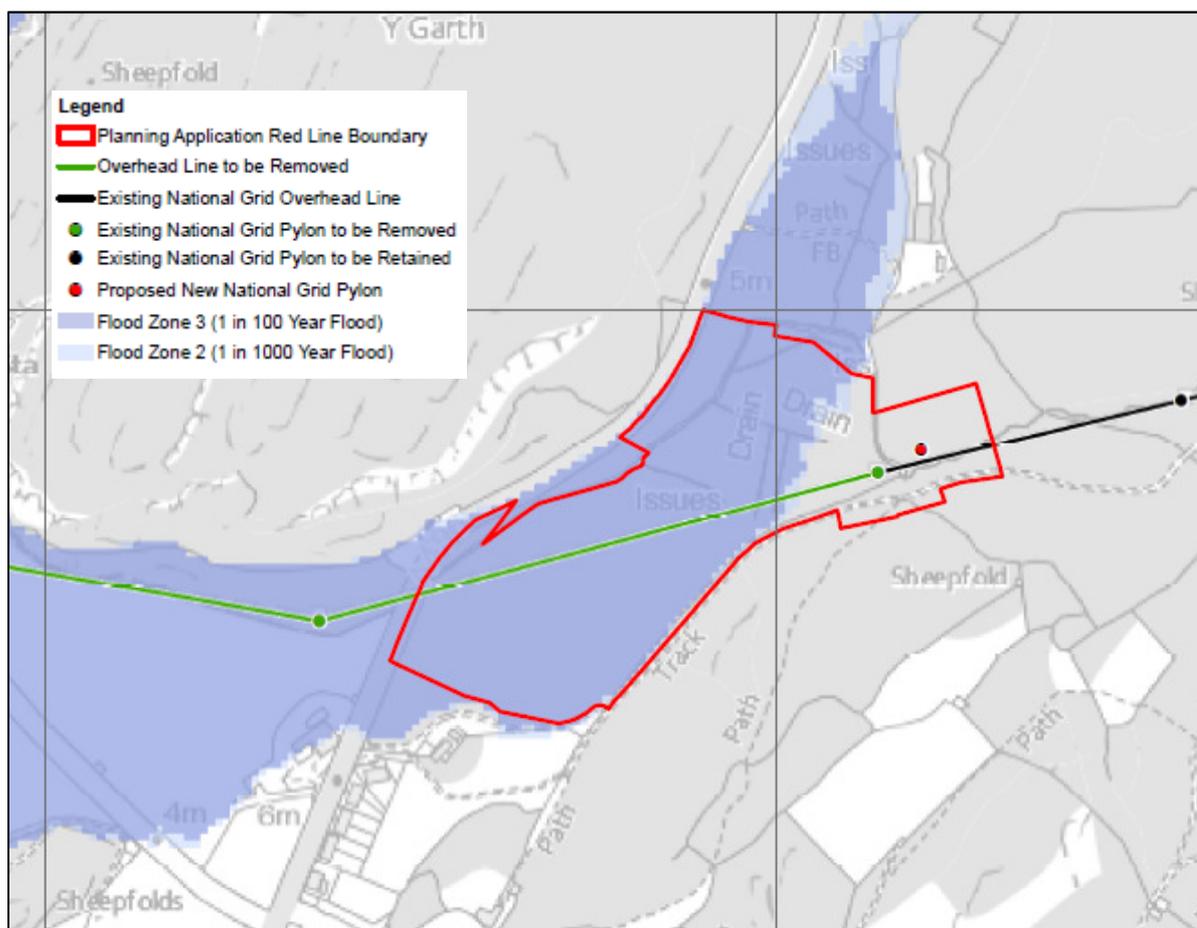
### Mitigation in Design

- 7.14 Technical Advice Note (TAN) 5 notes the development control process is a critical stage in delivering the protection and enhancement of nature conservation required by planning policy. By adopting the five-point approach to decision-making - information, avoidance, mitigation, compensation and enhancement helps to meet the objective of TAN5. National Grid and their appointed environmental specialist have worked with project engineers to embed environmental mitigation into the design of the project from the outset. The key principal is to avoid or reduce environmental impact where possible.

### Land to the Western Side of the A496

- 7.15 A Tunnel Head House on the western side of the A496 was discounted, as a SEC would still be required on the eastern side of the A496 to connect into the existing OHL as pylon 028 was to be removed. The work would require the direct burial (undergrounding) of cables across the A496 from the Tunnel Head House to a proposed SEC location near pylon 027. There was concern regarding the engineering risk of subsidence of the A496 and also the Local Planning Authority were also concerned over road closures in this area. Construction in this area would be very restricted because of the presence of the OHL running across both fields and the A496.
- 7.16 A Tunnel Head House on the western side of the A496 would affect habitats listed under Section 7 of the *Environment Act (Wales) 2016* on both the eastern and western side of the A496 i.e. habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales (see Figure 7.2 above and refer to Target Note 15).
- 7.17 A Tunnel Head House on the western side of the A496 would require land to be raised or defended against flood risk. The field is very wet and low lying (within Flood Zone 3) and constrained further as it contains a watercourse that would have to be culverted or diverted. There is also a tidal sluice gate from the estuary into this field that works by gravity and head of water so closing as the tide is incoming. However, the levels in the adjoining inland ditch are higher so this field is often wetter than it should be.

**Figure 7.2: Flood Risk**



- 7.18 A Tunnel Head House on the western side of the A496 would be much more visible than the eastern side of the A496. It was preferable on landscape and visual grounds to keep infrastructure together.
- 7.19 Infrastructure in the western side of the A496 was discussed and agreed at both the SAG and the SRG in 2016 as it was felt that all infrastructure should be located in close proximity limiting the impact on both environmental and engineering grounds and is therefore not discussed any further.

## Land to the Eastern Side of the A496

### *Access/ Egress to the Site*

- 7.20 National Grids appointed specialists investigated potential access / egress arrangements for the eastern tunnel head house. The existing field access is currently via a gate and track in the south west corner of the site. There is a change in speed limit from 40mph to National Speed Limit adjacent to the site boundary on A496, approximately 90m from the gated access. Four access options were considered for the eastern tunnel head house from A496 (Option 1, 2A, 2B and 3):
- 7.21 Option 1 explored the use of the existing gated access track. This option would require separate access / egress points. Access would be via the existing gated access, which would need to be upgraded to accommodate the anticipated size and number of vehicles needed for construction, including a large crane and HGV to facilitate the removal of the Tunnel Boring Machine. Egress would come from a point 310m north along A496.
- 7.22 Exiting from the existing access was not considered a viable option due to difficulties with visibility to south and turning left out of the site for HGVs given the proximity of third-party land/ boundary. Other disadvantages of using the existing access track to reach a Tunnel Head House/ SEC in this area include:
- Access located close to a number of residential properties, which may give rise to environmental/ amenity effects to residents of adjacent properties;
  - Two separate tracks, one for access from the existing access but egress from a new location may not be suitable for the site;
  - Requires relocation of speed limit change to achieve visibility.
  - Egress would require removal of retaining wall on A496;
  - May be difficult to achieve adequate gradient for egress road to A496 due to level difference;
  - Close to the Welsh Water yard (opposite) and located on a slight incline.
- 7.23 Should the existing access track be upgraded to facilitate construction activities, provision for the Public Right of Way (which follows the alignment of the access track) would need to be accommodated or a closure/ diversion applied for. The footprint of a Public Right of Way diversion is likely to require an alignment within the identified mire habitat.
- 7.24 Due to the steep hill side to the south east of the existing access track, it is likely that the track would need to be widened to the north-west. Widening and reinforcement of the track to the north-west would result in the loss of Section 7 habitat (mire habitat), with confirmed presence of common reptile species, and the likely removal of a tree with moderate suitability for roosting bats.
- 7.25 With the above in mind, it is considered that potential impacts to habits and protected species from Option 1 could occur from upgrading the existing access track for access, creating a separate track for egress and creating a diversion of the existing Public Right of Way.
- 7.26 Option 2A is located approximately 50m north of the existing gated access and could provide access/ egress from the same location. Due to the location of residential properties, there is still the potential for environmental/ amenity effects to residents of adjacent properties but would be an improvement compared with Option 1. To achieve a visibility splay for a 40mph road, approximately 715m<sup>2</sup> of the site will need to remain clear of obstruction.
- 7.27 Option 2B is located approximately 90m north of the existing gated access and could provide access/ egress from the same location. Due to the location of residential properties, there is still the potential for environmental/ amenity effects to residents of adjacent properties but would be an improvement compared with Option 1. To achieve a visibility splay for a 40mph road, approximately 1300m<sup>2</sup> of the site will need to remain clear of obstruction.
- 7.28 Option 3 is located approximately 310m north of the existing gated access and could provide access/ egress from the same location. The location of the access is approximately the same distance to the single residential property on A496 as Option 2, but further away from the residential properties close to the existing gated access. There is the potential for noise, air and vibration pollution, but due to the location, it is likely to be less of an impact compared with Option 1 and 2. Option 3 cannot achieve forward visibility for vehicles turning right into the site. The proposed access location

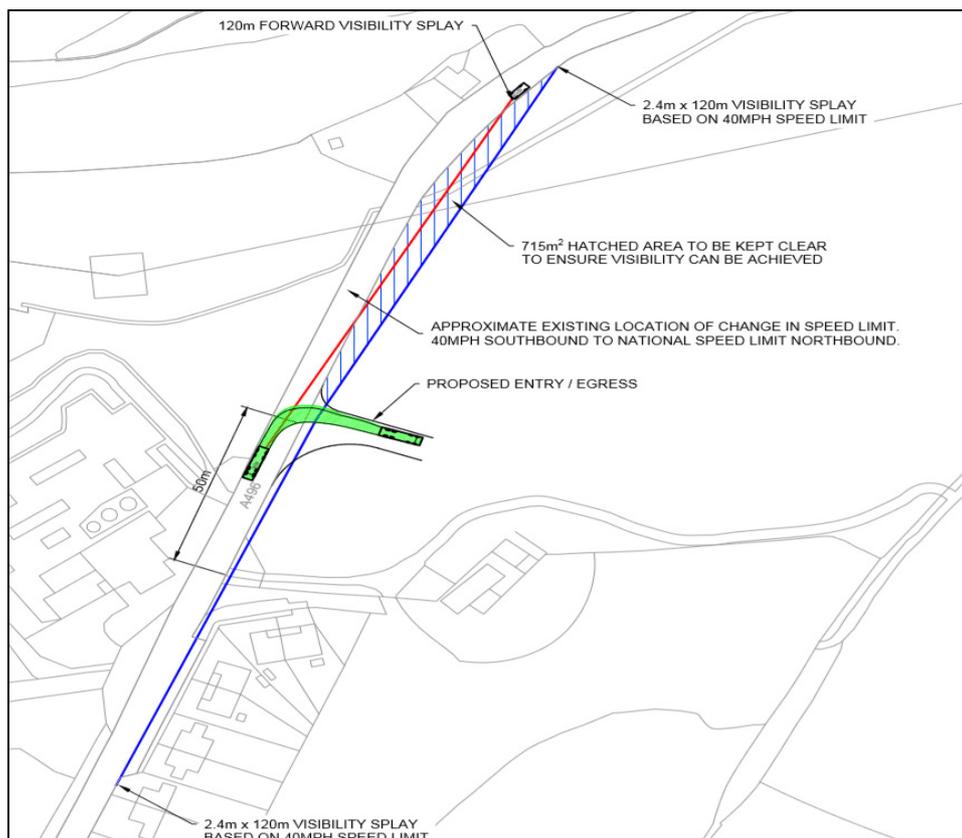
could result in issues relating to the existing watercourse within the site, existing retaining wall on A496 and level differences between the A496 and the site.

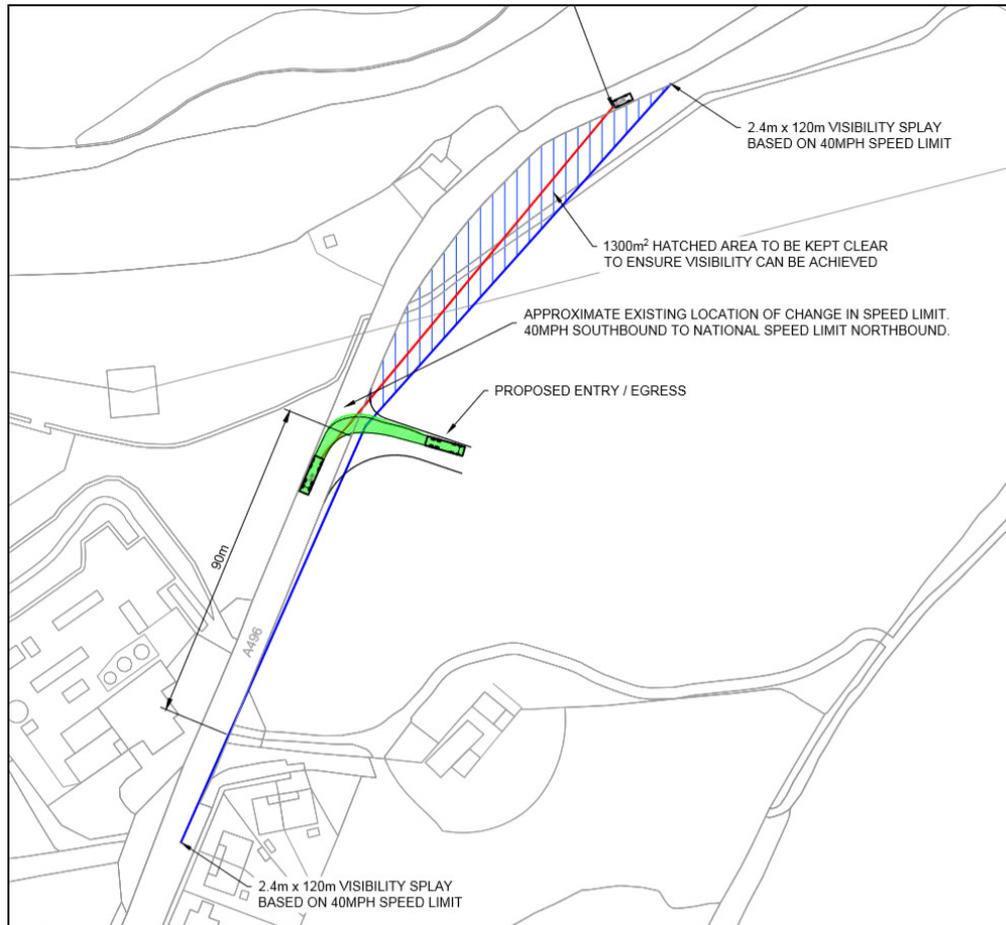
7.29 It was concluded that Options 2A or 2B would appear to be the most suitable junction locations. Consultation with Gwynedd Councils Senior Engineer Development Control Officer who made the following comments:

- Option 1 is located close to dwellings, and nearest to the Welsh Water yard (opposite) and located on a slight incline.
- Option 2A has better visibility, accessing the A road on a straight clear section of highway. The adjacent field is lower and would require a ramped access.
- Option 2B is close to the change of speed limit and would require it to be relocated. Some vegetation in the field would need to be cleared to secure the visibility through the bend northwards.
- Option 3 is located furthest north on the outside of a slight bend in the highway – located beyond the 40mph limit, therefore a temporary speed limit would be required for the proposed splays to be acceptable. Forward visibility through the bend is limited by the rocky outcrop for vehicle waiting to enter the junction.

7.30 It was confirmed that Options 2A and 2B are preferred as the visibility can be secured with minimal vegetation clearance, these options are located on the straighter section of road and are closer to the Llandecwyn/Pont Briwet junction. Traffic would still be restricted to left turns only out of the site onto the public highway. This location also meant that any construction traffic or operational phase traffic would not adversely affect the local residents.

**Figure 7.3: Access Option 2A**

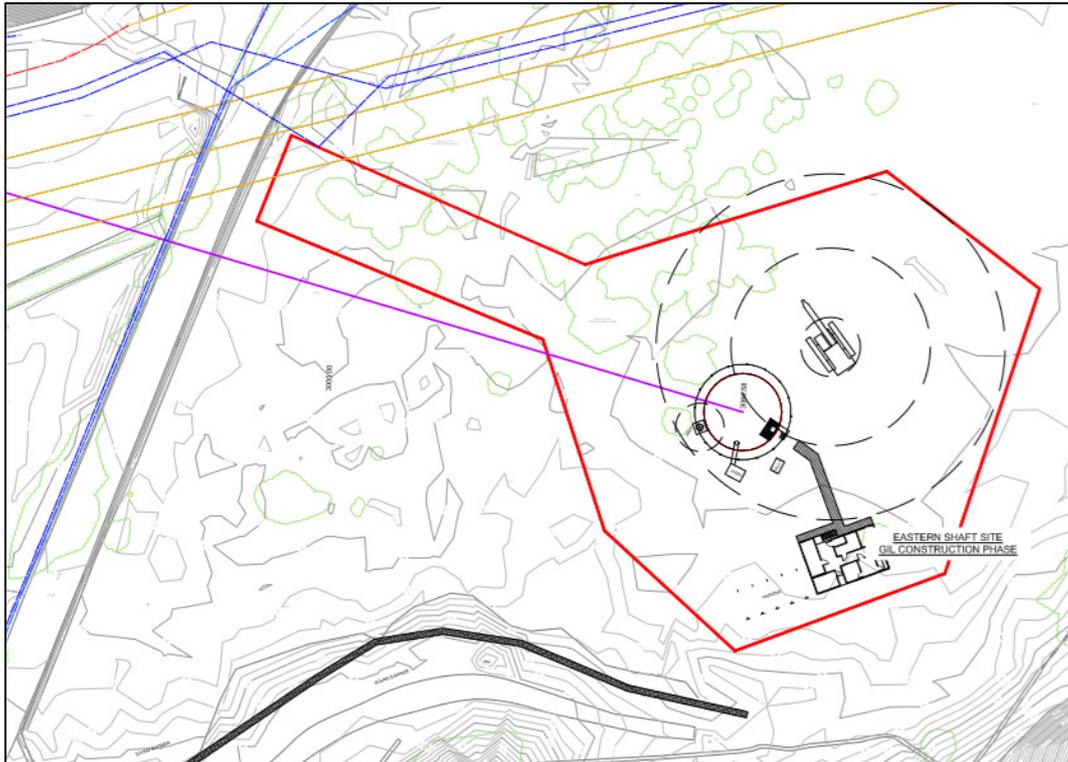


**Figure 7.4: Access Option 2B**

#### *Tunnel Head House Location/ SEC*

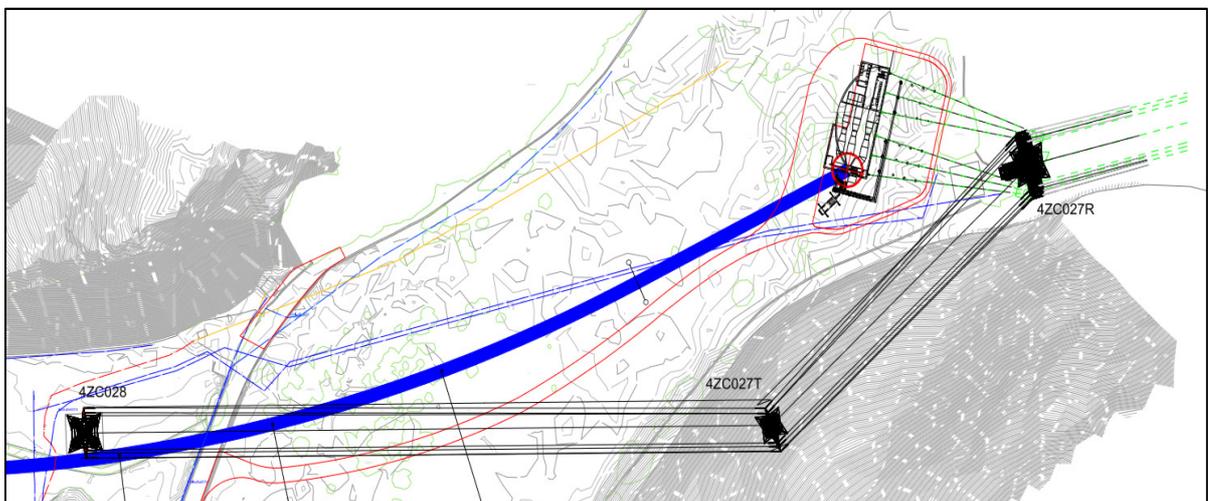
- 7.31 The Tunnel Head House location (in particular the tunnel shaft) is largely influenced by the underlying geology and proximity to fault zones. The initial engineering design located the Tunnel Head House within the field to the east of the A496. The layout shown in Figure 7.5 below was an initial engineering solution for the Tunnel Head House which would have also required a SEC in proximity to pylon 027. This was then reviewed by the consents and environment team to embed environmental mitigation into the initial design.

**Figure 7.5: Initial Engineering Design (March 2018)**



7.32 Following the initial design, with input put from the environmental team it was decided that co-locating infrastructure would reduce the footprint and deliver more landscape benefits while affecting less habitat. Key mitigation was to relocate the Tunnel Head House and SEC infrastructure together and as close to the existing OHL as possible, thus eliminating the requirement for or minimising the extent of any new OHL required to connect with the existing 4ZC OHL. Therefore, a location closer to pylon 027 was explored (Figure 7.6). Whilst the valley mire habitat, (which is listed as a habitat of principal importance a under Section 7 of the Environment Act (Wales) 2016) forms a large continuous but heterogeneous area and cannot be completely avoided, it was felt that an alternative location could reduce effects on this habitat by collocating the tunnel headhouse and SEC, and by looking at innovative designs to minimise the compound size, specifically the integrated gantry design (it should be noted that this habitat type is consistent throughout the field and in proximity to pylon 027).

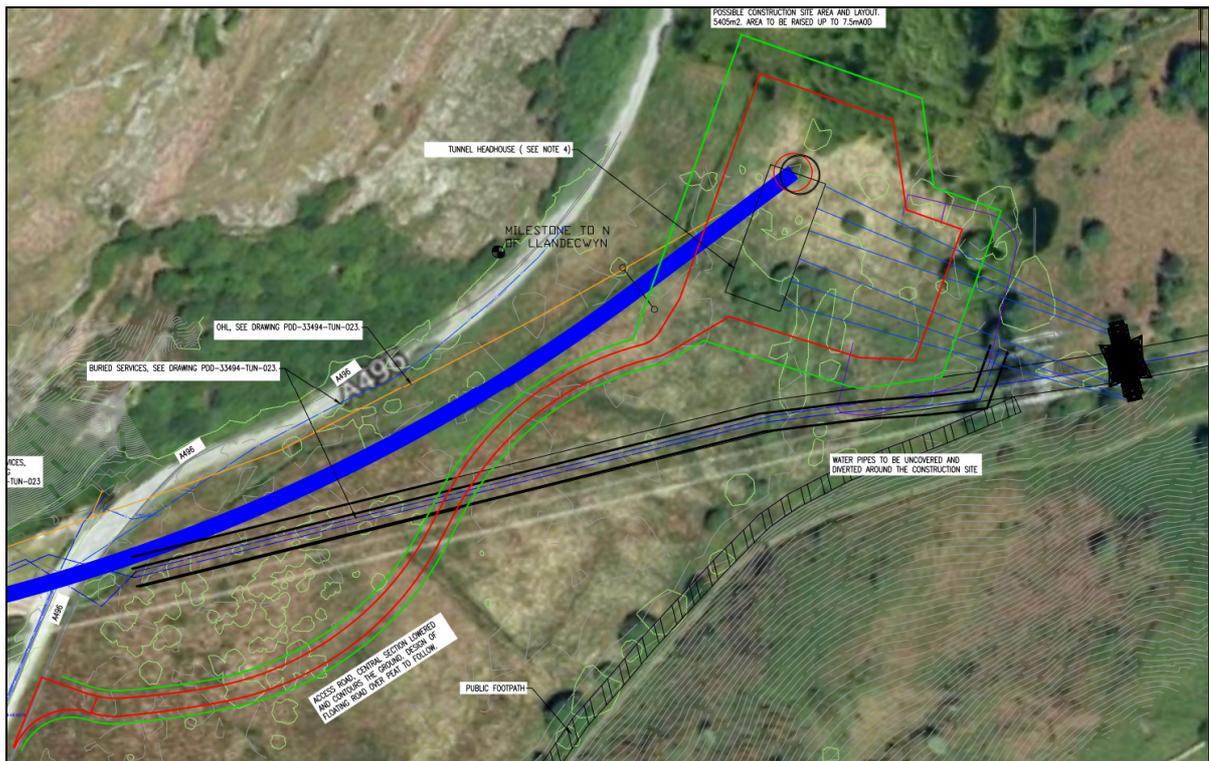
**Figure 7.6: Tunnel Head House/ SEC Sited closer to Pylon 027 to keep Infrastructure Together**



7.33 The Tunnel Head House and SEC were moved up the valley to be closer to pylon 027. The gantry was designed to be part of the building to enable the compound to be smaller.

- 7.34 For health and safety reasons, a temporary pylon and section of OHL was required to prevent excavating the tunnel shaft beneath the existing OHL which would need to remain operational during construction activities. The requirement for the temporary OHL diversion would be for the full duration of construction activities (anticipated to be a period of up to 5 years). For technical reasons the temporary OHL diversion would need to be situated to the south of the existing OHL, the topography of such ground meant that the pylon would be elevated and in habitat suitable for reptile species. Access to the temporary OHL diversion would also be required to facilitate construction activities.
- 7.35 National Grid looked again at the location of the Tunnel Head House/ SEC to see if it could be relocated to remain close enough to pylon 027 to keep ecology and landscape and visual impacts to a minimum, whilst overcoming the requirement for a temporary OHL diversion.

**Figure 7.7: Tunnel Head House/ SEC Sited Further North and Removal Of Temporary Pylon**



- 7.36 It is considered that the current Tunnel Head House/ SEC has been sited in the optimum location in terms of landscape and visual effects which is in accordance with the objectives of the Visual Impact Provision Project.
- 7.37 It is acknowledged that peat and the associated mire habitat is located within the footprint of the Tunnel Head House/ SEC (as it is throughout the field and in proximity to pylon 027), although the selected location is a drier area with lower ecological diversity compared to wetter areas of the site. The disturbance of peat and the associated habitat cannot be avoided completely while still delivering the long-term benefits of the project. However National Grid will follow the peat management hierarchy as set out in the SEPA Peat Management Guidance. The project has been designed to avoid peat as far as possible. Where peat will be affected, the aim is to re-use it on site. Any surplus which had to be removed off site would need to be classed as waste but depending on the nature of the material (and possibly some processing/drying before removal off site) it should be possible to find suitable off-site re-use pathways.
- 7.38 The management of peat on site is being progressed and discussed in consultation with both the National Resources Wales Peatland Officer and SNPA Senior Ecologist.

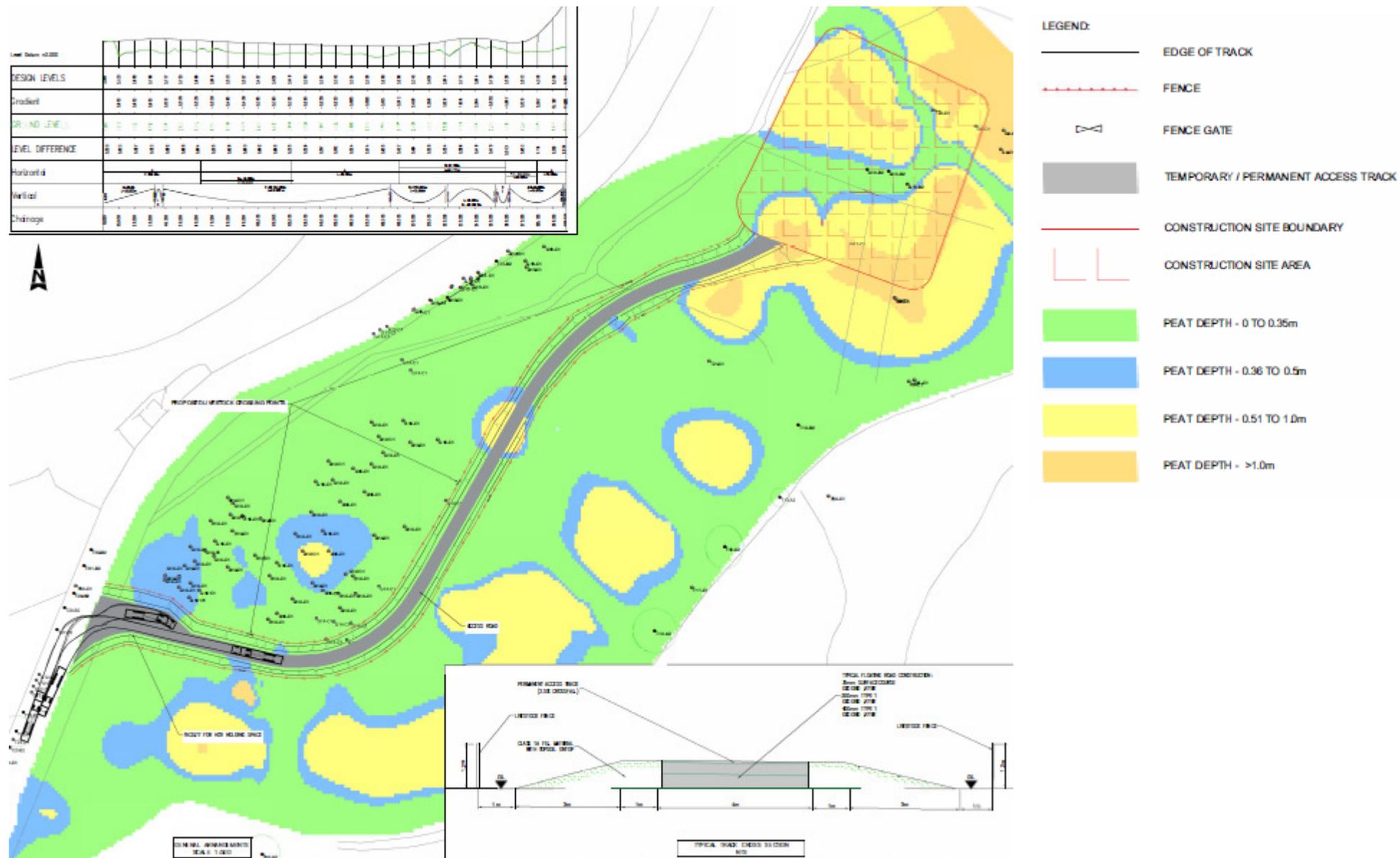
#### *Access Track Alignment*

- 7.39 In the accordance with the findings of access surveys and to reduce effects of the identified Section 7 Habitat it was decided to proceed with a single access track (5m wide with a passing place rather

than being wide enough for two-way HGV traffic) to serve both the temporary construction phase and the operational phase for ingress and egress as opposed to creating separate entrance and exit routes, or diverse temporary and permanent accesses. This will reduce the footprint of the proposed development and impact on the mire habitat.

- 7.40 The initial alignment of the proposed access track connecting access Option 2B (shown on Figure 7.4) to the proposed Tunnel Head House/ SEC is in shown in Figure 7.6. The proposed access track shown in Figure 7.6 was an initial engineering solution, following a reasonably direct route between the highway and the proposed compound. This was then reviewed by the consents and environment team. This was undertaken in consultation with the Landscape Architect at NRW and the Principle Planner at SNPA in December 2018, who requested the access track be more curved than a straight track to look more natural and in keeping with the surrounding topography. This was achieved by keeping the road low and following the vertical topography of the ground and introducing horizontal curves.
- 7.41 While influencing the engineering design the consents and environment team felt it was important to understand more about the peat habitat, and as such a specialist peat survey was undertaken.
- 7.42 The results of the peat survey, along with feedback from landscape stakeholders, were used to micro site the access track to reduce the impacts by:
- Avoiding the deepest peat, staying within the shallowest parts where possible (shown as green on Figure 7.8 below); and,
  - Avoiding the wettest and most ecologically diverse parts of the mire habitat;

Figure 7.8: Proposed Access Track Alignment and Depth of Peat

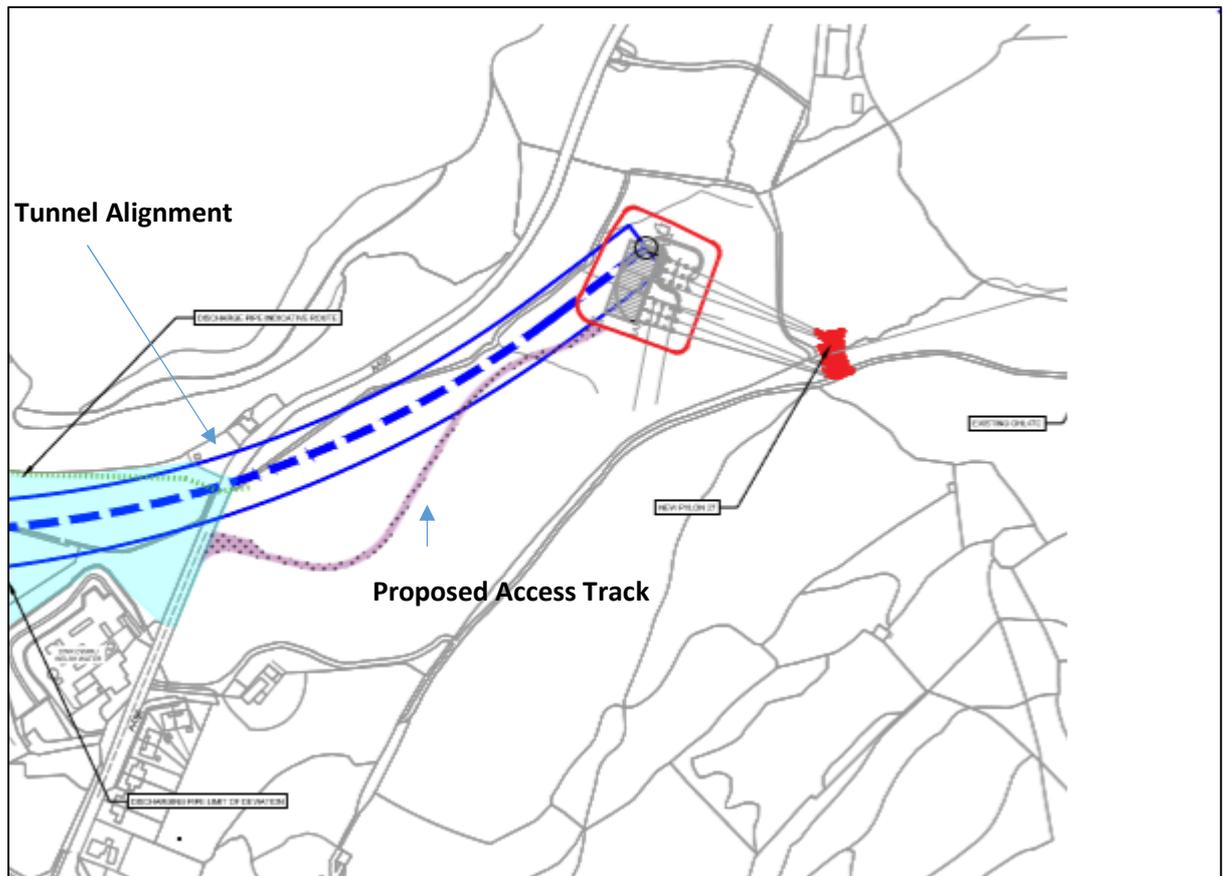


- 7.43 Following the change in alignment, impact upon peat has been further reduced by confirming the road to be a “floating road” or similar to eliminate the need to excavate large amounts of peat. Guidance on this has been provided by NRW and is entitled Floating Roads on Peat: A Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments in Scotland (Prepared by Forestry Civil Engineering and Scottish Natural Heritage. Aug 2010).

### Summary

- 7.44 In summary, the project has been developed considering many options, and considering ecological impacts (as well as other key disciplines) at each stage. National Grid feel that the current location of the tunnel headhouse, sealing end compound and associated access achieves the aims of the Visual Impact Provision project and balances the wide range of environmental and engineering considerations.

**Figure 7.10: Current Proposed Layout**



- 7.45 This report forms part of the Options Appraisal Report and will be submitted alongside the planning application.
- 7.46 Where it has not be possible to avoid environmental impacts, they have been reduced as part of the evolving design. Where potential ecological impacts still remain, they will be highlighted during the environmental appraisal phase and appropriate mitigation put forward to reduce impacts to an acceptable level. Any required measures to provide compensation or enhancement will be committed to in consultation with the relevant authorities.

## 8 Overhead Line and Pylon Removal Options

### *Pylon Removal in the Marine Environment*

- 8.1 National Grid have explored the use of a helicopter to remove pylons in the marine environment (including Pylon 4ZC030R, the foundations of Pylon 4ZC030, Pylon 4ZC031 and Pylon 4ZC032). This would involve the partial dismantling of the pylons and removal by helicopter to a drop zone on the eastern side of the Dwyrud Estuary from where the pylons would be fully dismantled and taken away by Heavy Good Vehicle. The helicopter would be deployed from Harlech and would need to return for overnight storage and to refuel frequently each day.
- 8.2 It should be noted that even if a helicopter was used for pylon removal, construction of, and use of access tracks across the saltmarsh (designated as Special Area of Conservation and Site of Special Scientific Interest) would be required for foundation excavation and removal and removal of some waste associated with this. This has the potential for the compaction of sediment and effects on botanical saltmarsh species however the aim would be to utilise areas of the saltmarsh which have previously been disturbed.
- 8.3 There are both beneficial and negative impacts from the use of helicopter to remove pylons in this environment:
- 8.4 In summary, beneficial effects could include:
- A reduction of vehicles on the Saltmarsh by around 14%;
  - A reduction in duration of works on the Saltmarsh at 4ZC030 by approx. 5 Days; and,
  - A reduction in duration of works on the Saltmarsh at 4ZC031 by approx. 12 Days.
- 8.5 In summary, negative effects could include:
- Noise associated with helicopters movements- works would take place outside of the winter months to avoid the winter bird season, therefore local tourists/ tourist facilities (bed and breakfasts/ caravan/ camp sites) will be a receptor to this noise as well as local residents and livestock.
  - Transport disruption as there will be the requirement for a railway line closure for the helicopter to fly over; a replacement bus service would be required from Harlech to Porthmadog (closure for approx. 10 days however delays could occur if weather is poor).
  - An additional area of land (on the eastern side of the Dwyrud Estuary within the National Park) will need to be established and used for a helicopter landing site, pylon dismantling, skip storage and loading waste onto haulage vehicles for disposal (potential for landscape and visual, noise and archaeological effects which would need to be investigated), introduction of traffic movements from this location (travelling west across Pont Briwet)-an additional landowner would be affected by the Proposed Project.
  - Use of a helicopter would need to be allowed for in any consenting such as an appropriate assessment/ Habitat Regulations Assessment Screening.
- 8.6 The use of a helicopter was discussed with the SRG at a presentation given by National Grid on June 21 2019. The use of a helicopter for pylon removal in the marine environment (largely to mitigate compaction impacts on the saltmarsh) was considered disproportionate to the impacts posed and would in itself bring about potential effects to tourists and the local rail network.

### *Depth of Foundation Removal in the Marine Environment*

- 8.7 National Grid have undertaken discussions with Natural Resources Wales (NRW) and its technical specialists to agree on a depth of foundation removal which would benefit the marine environment, and which are technically feasible to remove without having a detrimental effect on the existing environment.

## 9 Conclusion

9.1 This Options Appraisal follows on from the selection of subsection 4ZC in Snowdonia National Park to be prioritised for further detailed work by the SAG in 2015. It provides detail of the options appraisal work undertaken between 2015 and 2019 in developing the various options for the Proposed Project. As outlined above a full tunnel option (Option 1) with a Tunnel Head House on the west in close proximity to the existing Garth SEC, and a Tunnel Head House on the east near Cilfor was chosen as the preferred alignment and siting option. This option would comprise:

- Two tunnel head houses;
- Underground cabling, the majority of the cable would be within a deep tunnel, with short sections of direct burial between the tunnel head houses and SEC;
- A new SEC and associated replacement terminal pylon on the east to connect the new underground cables to the existing OHL;
- Removal of the existing VIP Subsection including ten pylons and approximately 3.5km of OHL.