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**Afon Claerwen
Hydropower Project**

**Environmental
Statement**

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1 EXECUTIVE SUMMARY

Elan Hydro Ltd is proposing to construct a hydroelectric scheme on the Afon Claerwen watercourse near Elan Village, in Powys. Ellergreen Hydro has prepared this informal and non-statutory Environmental Statement on behalf of Elan Hydro to support a request for planning permission for the proposed scheme.

The proposed scheme will be run-of-river and will be designed with an approximate installed capacity of 1100kW. It will feature the following infrastructure:

- An intake structure on the Afon Claerwen
- A powerhouse containing the turbine, generator and associated equipment.
- A buried pipeline connecting the intake to the powerhouse.
- An open tailrace channel and screened discharge structure.
- Access track to the powerhouse
- Buried power line linking the powerhouse to the local electricity distribution network

The proposed development lies within the jurisdiction of Powys Council. The proposed scheme is in keeping with the relevant national, regional and local plans and policies to meet sustainable development objectives and to increase the amount of renewable energy that is generated.

A scoping study was undertaken to identify key issues associated with the proposed hydro scheme to define the scope of this Environmental Statement (ES) and the parameters that would require further investigation. A scoping report was produced and sent Powys Council who shared with various consultees. The scoping exercise produced the scoping opinion which identified that the ES should additionally provide for the following (in summary but not limited to):

- Construction Environmental Management Plan (CEMP)
- Further work on Bryophytes
- The method of installing the pipeline at Craig Y Mynach.
- An assessment into the potential impact the proposal could have on the fish population of the river.
- Applicant to propose and implement Reasonable Avoidance Measures as part of any works on site to avoid the impact upon Water Voles.
- Construction Pollution Prevention Plan to be provided within the Environmental Statement
- Archeological Walkover to look for any undesignated features of interest
- Clarification on intake compound location and its optimization to avoid unnecessary impact the wet modified bog identified as a feature of the Elenydd SSSI.



2 Introduction

2.1 Outline of Proposed Development

Elan Hydro Ltd wishes to develop a hydro power scheme on the upper reaches of the River Claerwen at Elan Valley, Powys. The proposed location will be positioned downstream of the Clearwen reservoir, and upstream of the Caban-Coch reservoir. The closest settlement is Elan Village located approximately 4km to the North-East. The approximate grid reference for the site is SN889621. A location plan is provided within the design and access statement and key plan drawings, along with detailed planning drawings.

2.2 Importance of Renewable Energy

The UK needs to increase its renewable energy provision to address the projected growth in global energy demand and growing concern over the long term supply of fossil fuels which places our long term energy supply at risk. In addition, global warming and climate change means we have to ensure that we make the most of our renewable resources to provide a secure basis for the UK's future energy needs. These aims were reflected in the 2009 UK Government Energy Strategy White Paper which states within its Executive Summary that:

'We need to radically increase our use of renewable electricity, heat and transport. (The Strategy) sets out the path for us to meet our legally-binding target to ensure 15% of our energy comes from renewable sources by 2020: almost a seven-fold increase in the share of renewables in scarcely more than a decade.'

The government's targets on renewable energy continue to remain the same as those outlined within the 2009 Energy Strategy White Paper.

The Welsh Assembly Government (WAG) Energy Policy Statement produced in March 2010 sets out Wales's renewable energy target which is:

'...to renewably generate up to twice as much electricity annually by 2025 as we use today and by 2050, at the latest, be in a position where almost all of our local energy needs, whether for heat, electrical power or vehicle transport, can be met by low carbon electricity production.'

Technical Advice Note 8 (TAN 8) *Planning for Renewable Energy* sets out WAG's national planning policy for the development of renewable energy. It refers to targets for 2010 and 2020 and states that these should be delivered through the planning system. With regard to hydro electricity schemes, the document states that small-scale 'run of river' schemes, such as that proposed by Hydro Electric Development Ltd on the Claerwen River, are the most likely developments in Wales and are generally supported.

2.3 Purpose of this Report

This Environmental Statement (ES) complies with the EC Directive 97/11/EC *'The assessment of the effects of certain public and private projects on the environment'*, which amended EC Directive 85/337/EC. The amended Directive was implemented in England by the Environmental Impact Assessment Regulations 1999 and advice on the Regulations is provided by Circular 02/1999.

Under the EC Directive, the proposals fall within the scope of a Schedule 2 development, whereby an Environmental Impact Assessment (EIA) is discretionary. This EIA has been produced following a

Screening Opinion from the local planning authority (Powys County Council) which deemed the proposals to be 'EIA development', thereby requiring an EIA as part of the planning process. The resulting ES were undertaken and prepared with due regard to the criteria of Schedule 4 of the Regulations. The ES includes an assessment of the predicted effects of the proposed development, focusing, as required by the EIA Regulations, on those effects that are considered likely to be significant¹. The content of the ES, as well as the overall approach to the EIA, has also been designed to reflect other requirements of the EIA Regulations as well as widely recognised good practice in EIA.

2.4 Elan Hydro Ltd

Elan Hydro Ltd is a joint venture between one of Europe's leading owners and operators of small scale hydropower, the Renfin Group, and Ewan Campbell-Lendrum, a British Hydropower expert. The company is UK based and is led by an industry specialist with over 25 years' experience of Renewable Energy, Civil Engineering and Ecological Protection in the UK. Together we bring the resources and experience necessary to successfully own, maintain and operate hydropower stations in accordance with UK standards, legislation and best practice. Working together we own and operate four hydropower generating stations in the UK, with a capacity of 3.3MW. The size and the distribution of these sites throughout the country provides operational and financial stability to the company, which is further backed up by the Renfin Group.

Renfin and its service arm Hydropol, are Czech based companies with over 20 years' experience of management, operation and ownership of small and medium scale hydro. They operate across Europe as well as in Chile and Indonesia. The Renfin Group is well established in the UK with local operations in Wales, Scotland and England, where they began working with the water utilities in the 1990's. In recent years their expertise, experience and asset base have made them the partner of choice for a growing number of UK hydro developers and owners.

Ewan Campbell-Lendrum is a Chartered Environmental Manager with an MSc in freshwater ecology and over 25 years' experience in the Civil Engineering and Renewable Energy industries. For the last 8 years he has been a senior manager with the UK's largest specialist Renewable Energy Company, Infinis.

3 Environmental Impact Assessment

3.1 Introduction

Environmental Impact Assessment (EIA) is a process by which information about the environmental effects of a project is collected, evaluated and taken into account in its design and the decision as to whether it should be given consent. The developer presents the information on the project and its environmental effects in an Environmental Statement (ES). This forms a basis for consultation and enables decision makers to consider these effects when determining the related development application. The EIA process has a number of key characteristics.

¹ See Schedule 4 of the EIA Regulations and paragraph 82 of Circular 02/99.



- It is systematic, comprising a sequence of tasks defined both by regulation and by practice;
- It is analytical, requiring the application of specialist skills from the environmental sciences;
- It is impartial, its objective being to inform the decision-maker rather than to promote the project;
- It is consultative, with provision being made for obtaining information and feedback from interested parties including local authorities and statutory agencies; and
- It is interactive, allowing opportunities for environmental concerns to be addressed during the planning and design of a project.

3.2 The EIA Process

3.2.1 *Town & Country Planning (Environmental Impact Assessment) (England & Wales) Regulations 1999*

The EIA Regulations require that all Schedule 1 and certain Schedule 2 developments are the subject of environmental assessment. For all Schedule 2 developments where it is decided that the particular development may have significant effects on the environment, whether on account of its nature, scale or location, an EIA is required. Some effects can be positive, representing environmental gain as a result of the development.

The criteria used for determining whether a Schedule 2 development is likely to have significant effects on the environment are not clearly defined and each proposal must therefore be assessed on its merits against various guidelines. It is to be noted that where it has been determined that there may be significant environmental effects, and that an EIA is therefore required, it does not mean that a significant effect is the ultimate conclusion of the ES. The EIA process facilitates identification of the potential for these effects and then allows mitigation to be incorporated into the design of the scheme or the method of construction and operation which may reduce or eliminate any negative impacts or effects.

3.2.2 *Key Steps*

The key steps which should be undertaken as part of the EIA process are summarised in Box 2.1 (these are based on the EIA regulations, Government guidance and good practice).

Box 2.1 Key Steps in the EIA Process

- Defining the project;
- Considering the need for the project and alternatives for meeting this need;
- Deciding on the potentially significant effects which need to be assessed and how this assessment will be carried out (i.e. Scoping);
- Consultation over the scope of the EIA and refining the scope in response to the comments which are received;
- Describing the baseline environment which is relevant to the potentially significant effects (i.e. that existed before commencement of the project and assumed to develop in its absence) and establishing the sensitivity of identified receptors/resources within that environment;
- Identifying measures to mitigate significant effects and liaising with the project design team to incorporate these (where possible) into the proposals;
- On-going consultation with statutory consultees with other interested parties;
- Assessing the magnitude of predicted environmental effects;

- Evaluating the significance of the predicated effects;
- On-going environmental monitoring, assessment and other work, as required following the production of the ES.

3.2.3 The Screening Process

All projects listed in Schedule 1 of the Environmental Impact Assessment Regulations 1999 require EIA. For those listed in Schedule 2, the Local Planning Authority (LPA) has a responsibility to decide whether EIA is required – this is “screening”.

The screening process aims to identify those projects that are likely to have significant effects on the environment. In the UK determining “significance” follows a two-stage approach, firstly by applying ‘exclusive’ thresholds and criteria specified in the EIA Regulations and, secondly, on a case by case basis having regard to the selection criteria specified in Schedule 3 to the EIA Regulations.

3.2.4 The Scoping Process

One of the earliest steps in the process is to define those environmental effects which need to be assessed as part of the EIA. The focusing exercise is part of the process known as scoping. The context for this focusing exercise is provided in the EIA regulations. The ES should include *“a description of the likely significant effects of the development on the environment...”*. This guidance states that *“...in many cases, only a few of the effects will be significant and will need to be discussed in the ES in any depth. Other impacts may be of little or no significance for the particular development in question and will need only very brief treatment to indicate that their possible relevance has been considered”*. The focusing exercise is the means by which the likely significant effects are identified.

Identifying at the early scoping stage, which effects are likely to be significant might be considered to be premature, given that the best way to make this judgement is to assess each effect in detail and then to decide whether or not it is significant. However, in practice, it is unrealistic to do this given the great number of effects which could result from the proposed development; assessing all of these in detail would be impractical.

Against this background, the scoping process therefore plays a critical role in using the best available data to identify these effects which are likely to be of significant concern, which can then be taken forward for more detailed analysis. These effects should include those which are:

- Known or likely to be significant;
- Sufficiently uncertain that it cannot be determined at this stage whether or not they are likely to be significant.

Other aspects are scoped out of the EIA on the grounds that they are known to be irrelevant or that they will give rise to effects of little or no significance.

3.3 The Stages of Development

Potential environmental effects have been considered in relation to the following stages of development:



- **Construction:** effects may arise from the construction activities themselves and associated changes (e.g. changes in road vehicle traffic) including the temporary occupation of land. These effects tend to be of limited duration and for this project the anticipated construction period is between six and nine months;
- **Operation:** the more permanent environmental effects following the completion and commissioning of the turbine whose lifespan is likely to be a minimum of 25 years; and more likely circa 50 years plus.
- **Decommissioning:** it is not proposed to assess effects from decommissioning as these effects will be similar but very much less significant than those that may arise during construction. Additionally the pipeline, as a minimum is likely to an asset retained for further generations to create renewable energy. The long lifespan and long usefulness of the civils infrastructure means that decommissioning is unlikely to take place in the foreseeable future. History has shown that former hydro schemes have become a historical artefact of value and cultural interest so this again make decommissioning unlikely in respect to the civils infrastructure. Decommissioning of the turbine itself does not have any extra impact as the access to the turbine is sufficient for turbine removal without additional impact.

4 The Proposed Development

4.1 Need for the Proposed Development

The proposed development is needed to contribute to the required levels of renewable energy that the UK needs to satisfy its planning and environmental policy and targets as mentioned in Section 2.2. Historically Scotland has been the main area of hydropower development in the UK, however in recent years Northern England and Wales have been slowly increasing the level of hydropower being developed.

Hydroelectric generation is based on harnessing the power of flowing water through water turbines. It is a well-established renewable energy power source and produces no greenhouse gas emissions beyond the initial site construction.

The Afon Claerwen Hydro Project, if developed, will be one of the larger capacity run of river hydropower scheme in England and Wales. A showcase for Welsh hydropower potential and a significant contribution to the Welsh Assembly Governments renewable energy targets.

4.2 Do Nothing Scenario

The do nothing scenario entails no hydro scheme on this stretch of the river Claerwen. This represents a missed opportunity for low impact renewable energy generation and results in higher use of fossil fuels sourced electricity in Wales. No activity has the following disadvantages:

- No 5489MWh a year renewable generation
- Resulting mix of grid electricity higher in fossil fuels than otherwise
- Mix of renewable electricity entering the grid network in Wales less diversified. There is a need for Hydro within the renewable energy mix to smooth the production spikes, for example wind produces electricity in windy weather, solar in sunny weather, hydro is a healthy contributor as produces a more constant and steady supply (water availability varies



much more slowly than wind and sun conditions that are effected by cloud movements and gusts) Additionally the supply of hydro is typically during wet times of years which fit with high usage (Winter months for example). Currently the Wales renewable energy mix is in need of Hydro generation more than any other form of renewable energy to ensure a healthy balance, as the deployment of solar and wind has been far greater.

- Circa 70% of the project costs are spent within Mid Wales boosting the local economy, jobs and affluence. The remaining 30% is greatly within the UK with a large component being the turbine itself, manufactured in Kendal, Cumbria (Gilkes).

Advantages of no activity include:

- No impact to the local habitats and flora within the construction footprint, details of which are within the Preliminary Ecological Appraisal - Afon Claerwen Hydro Scheme - PEA_v2_
- No impact to the surrounding habitats and wildlife

The 'do nothing' advantages of the no impact to local habitats and surrounding wildlife are greatly reduced by the mitigation to be put in place.

4.3 Alternatives Considered During Preliminary Design

Preliminary Design was carried out by Inter Hydro Technology and the work in the main carried out by Chris Brett. Extensive experience of similar hydro projects has been utilised to ensure the most beneficial design in respect to renewable energy production, feasibility of construction and minimised ecological impact. Alternatives considered during the design work include the following details.

Intake location – An alternative intake location was considered with the intake a further 1.5km upstream close to the Afon Clearwen Dam.

This had the following advantages:

- Intake closer to another much larger man made structure
- Water from the Clearwen abstracted earlier increasing the extent of part naturalised watercourse

The following disadvantages rendered the option impractical:

- Only 8m extra gross pressure head from almost doubling the length of pipeline. Therefore the increase in generation capacity was limited.
- Environmental impact of the extra 1.5km of pipeline were high due to the ground conditions being significant bog land with habitat that is a feature of the SSSI. This would be further exacerbated by the necessary elevation levels of the pipe from the intake over the first circa 0.5km which necessitated deep digs.
- Deep dig requirements and the elevations in respect to the watercourse running parallel to the necessary pipe route.
- Costs of extra pipeline and pipeline installation would be very significant leading to questionable business case economics.

Gravity Pipe – The first 100m of pipeline necessitate a deep dig, it was considered whether a gravity pipe would offer some advantages but the advantages were minimal and would require a larger pipe diameter and therefore a pressure pipeline was preferred.

Turbine Choice – hydro schemes of this type with 34m head at 3.6m/s of water flow are able to use a Francis Turbine. Francis turbines can be operated at high efficiency for high flow rates with low heads. Due to the flow regime of the water course which is greatly controlled by the Claerwen Dam upstream it is more efficient to use a Francis machine, which has a better peak efficiency than other hydro turbines and suits the flows that are able to be abstracted, based on the abstraction requirements and details from Natural Resources Wales in the abstraction licence.

4.4 Alternatives and subsequent Changes during planning pre application advice and ecological survey work

The intake construction compound was initially quite large and located over the wet bog adjacent to the watercourse. This has been redesigned and is now smaller and located mainly away from the wet bog with only the edge of the bog within the compound footprint. This edge has been identified of being in poor ecological condition at present and of limited value to avoid. Avoidance is not possible due to the close proximity to the intake. Further details are given in the Ecology chapter of this Environmental Statement.

5 Proposed Development Description

5.1.1 Summary

The scheme proposed by Elan Valley Ltd envisages a hydro-electric scheme operating on the River Claerwen. The estimated maximum output of the generating system would be 1.1 MW.

Electricity would be generated by abstracting water from a location approximately 2 km downstream of the Claerwen Reservoir Dam. A proportion of the flow (agreed with the Natural Resources Wales) will be abstracted from the river. The abstracted water will flow through a 1.8m pipeline. This pipe will be laid underground and its alignment will broadly follow the eastern edge of the unclassified track for approximately 1.8 km at which point it will return to the river via hydro-electric turbines. The planning drawings show the route of the pipe and proposed location of the turbine house.

The turbines will be housed in a small building with approximate dimensions of 9.5m x 13.5m. The building will be clad in larch. An exterior transformer will take the power from the turbines and increase the voltage to 11kV for transmission along a buried power cable to the connection point. There will be no requirement for overhead lines.

Access to this location will be made available by making improvements to an existing agricultural track which falls from the public highway road and would be suitable for vehicular access. This access route will remain after the construction work is complete to allow future vehicular access to the turbine house and transformer compound for maintenance.



5.1.2 Intake Weir

5.1.2.1 Description

The proposed intake infrastructure for the abstraction of water required for the hydroelectricity scheme incorporates a wash-over type screen known as a coanda screen, as illustrated in Figure 1.1. The capacity of the screens proposed for this development is 280 l/sec per linear meter of screen. The design flow of the project is 3.7m³/s to match the discharge from the dam this figure has been confirmed via the abstraction license which has a max abstraction of 3.7m³/s. The turbine is design around this flow such that when fully open it passes this amount, the screen has to be able to also abstract this volume. A screen that is oversized and larger will not abstract more water than this (and any other hydro system (standard design) as it is the turbine that limits the abstraction. The pipeline is full of water at all times and extra water entering the screen spills out of the screen as the tank below the screen is full when the screen as 3.7m³/s or more entering it. The screen effectively become inundated.

Water abstracted through the screens will be conveyed to an intake chamber.

The proposed design ensures that residual flow in the River Claerwen will be achieved by incorporating a compensation notch into the face of the weir design such that no abstraction can take place until the compensation intake is completely filled. Compensation flow will be regulated by means of an open discharge from the foot of the weir, its final design detail will be governed by the Natural Resources Wales impoundment license.

5.1.2.2 Screening

Screens will be proprietary wedge wire 'coanda' type. All screen elements and fastenings will be in stainless steel. In order to minimize the width, and hence height, of the proposed intake structure 'large capacity' screens are proposed. The screen spacing will be 2mm.



Figure 1.1



Outfall screening will be designed to prohibit the entry of species identified as being present in and around the watercourse. The screen spacing will be 10mm and this is as per the NRW abstraction license conditions to ensure no ingress. Additionally the license has a condition that the water velocity coming out of the outfall is no more than 4m/s, this is achieved via the size of the outfall which allows the water to travel under the speed even when the abstraction and resulting discharge is at its maximum.

5.1.2.3 Abstraction Flows

Abstraction is controlled down in the turbine house by the turbine and its control system (internal guide vanes within the turbines control flow rate). The turbines are sized such that the maximum abstraction 3.7m³/s occurs at fully open, this ensures that it is not possible for over abstraction to occur. Abstracted flows under the maximum (fully open) flow of 3.7m³/s is controlled by the guide vanes within the turbines which are in turn controlled by the feedback from the head level sensor within the intake. The control system works to govern this level, so when less flow is available through the screens the level drops and the control system reacts reducing the abstraction to bring the level back up and so on. This is the standard control governing system employed throughout run of river micro hydro schemes of this nature with an intake, pipeline and powerhouse. The head level sensor resides within the intake and this is linked to the powerhouse via a head level sensor cable buried with the pipeline.

The project has details within its abstraction licence from NRW that abstraction will not take place if no discharge of water is occurring at the Claerwen dam. Therefore a water level sensor is to be installed at the dam downstream of the dam hydros outfall. This records the level and after a calibration exercise the system can provide the information such that this hydro scheme can conform to the licence. Communication will use a satellite link such that no cable is required from the sensor to the hydro scheme powerhouse.



Level sensor installed within stilling tube fixed on masonry wall



Similar installation with telecommunications and solar/battery power supply installed by Ellergreen Hydro providing a similar role

Intake compensation notch, the intake includes a compensation notch sized for the compensation flow of 30lps as specified via the NRW licencing. Due to the intake splitting around the small island the comp flow is shared with two notches sized for half the comp flow each. This ensures the compensation flow is met but also provides water both sides of the island to ensure something that is comparable to the natural situations of flows around the island at present. This is as agreed with NRW via correspondence over the impoundment licencing.

5.1.2.4 Intake Operation

As the river level rises water will first pass through the compensation flow notches. This will be the only route for water conveyance initially. Increasing river flow will cause levels on the upstream side of the weir to rise which will result in spill over the main crest of the weir and flow passing over the Coanda screens and into the conveyance channel and pipe. Spill over the main weir crest can only occur once the river flow exceeds the compensation flow.

Once the river flow rises to such an extent that it exceeds both the compensation and abstraction flows, excess flow will pass over the intake screens and stay in the river.

Water harvested from the River Claerwen via the screened intake will be conveyed to a chamber constructed alongside the river on the true left bank (left bank when looking upstream). The chamber will be constructed of reinforced concrete and will incorporate a maintenance access hatch.

5.1.1 Pipeline

From the intake chamber, water passes into a 1.8m diameter pipeline which is laid on the true left side of the river. Final material for the pressure pipe has yet to be selected. It shall be either reinforced concrete or glass reinforce fibre (GRP) or ductile iron. The pipeline is to be buried throughout. This requires a construction corridor to enable safe and appropriate set aside and management on top soil and sub soils. The accompanying technical drawings illustrate the proposed route of the pipeline, which is buried along its full length.

From the intake a pipeline will be laid on the true right bank, following the contours of the river bank above the waterfalls. The associated drawings illustrate the proposed route of the pipe, which will be buried. The pipe will be a syphon for the first section of the pipeline to minimise the depth of dig required in the rock above the waterfalls, as a downhill pipe would need to be buried deeper to function correctly, and would so be more intrusive on the local environment.

Before the ground begins to fall away a syphon chamber is present on the pipeline housing a syhon pump (vacuum pump) and control switchgear. The chamber is a buried concrete chamber 6.6m long by 6.1m wide and 4.5m deep. It is buried about from its top surface and access hatch which is at ground level and will only be visible up close.

The associated drawings illustrate the proposed route of the pipeline, which would be buried throughout. The pipeline runs largely alongside the existing access track, deviating from this line only to avoid steep and rocky ground.

The pipeline will cross a number of small tributaries of the Clearwen, underneath which the pipeline is buried. To do this, the tributaries will need to be diverted locally, to enable the pipe to be installed, before being reinstated over the top.

5.1.2 Powerhouse & Outfall

The powerhouse location is a low lying area of grassland, adjacent to the farm and adjacent to the river. It is, by necessity, a substantial building; though the finish (larch clad) is chosen to be in keeping with the more historic agricultural buildings in the area. The tailrace, conveying discharged water from the powerhouse back to the river, takes the form of a short rectangular concrete channel with rip-rap protection.

5.1.3 Temporary Construction Compounds

As shown on the layout planning drawings is one main construction compound, this located at NGR SN 89570 61805 and is 110m x 50m in size it is located adjacent to the powerhouse location and it upon acid grassland. The location has been sited to minimise ecological impact, with both sites on improved grassland with limited wildlife value. The area is relatively flat land and well suited to be a compound. Much of the area will have its topsoil stripped and set aside and gravel used to the create a suitable compound surface for machinery movement and plant and material storage as well as welfare facilities.

The pipeline will be delivered to site in 6m long sections the entire pipeline will not be delivered at once the pipeline work will progress bit by bit and deliveries will suit the progress week by week.

As well as the main compound the route has a sufficient width for machinery to park overnight at the specific working area and for topsoils to be stored adjacent to the area of pipeline being work upon.

A top compound at the intake will be small and is minimized to keep the site footprint up in that area limited and away from some bog to the side of the watercourse at the upstream end of the development footprint.

The restoration works are to include the landscaping to as before ground profiles before the re-laying of top soils. The compounds will be restored as part of the restoration works aspect of the project at the end of the construction period.

5.1.4 Access Tracks

Within the construction footprint is access room for machinery, this access is along the length of the pipeline and links the intake with the powerhouse. Towards the end of construction this access is removed and the ground restored as parts of the restoration works. The powerhouse building is to have a permanent access track from the existing road as shown within the layout planning drawings. This permanent track is required for maintenance access to the powerhouse building. The track is to be a gravel track and in time will become a typical farm track as per others in the local area, with a grass verge growing down the centre.

The pipeline runs up a public byway track that is maintained by the council further details on this track are outlined in Appendix 2.

5.1.5 Offsite Access

Parts, materials and machinery will be delivered to the site, therefore there is significant potential for increased traffic in the area. Currently an unnamed single track road that splits from the B4518 lead directly to the site, currently the traffic on this road is small. The volume of traffic for this project is moderate due to the gradual nature of the construction it is still a significant daily volume and at times slow moving traffic will be moving. To mitigate any disruption to traffic during the construction phase movement of equipment and material will be moved at specific times. The particular route is shown in figure 2.1 below. The route that is to be used is shown in blue and is from the A470 to the B4518 at Rhayader. It is anticipated that the construction works will extend to between nine and twelve months. Plant and machinery to be used will include small numbers of excavators, concrete lorries, and standard HGVs.

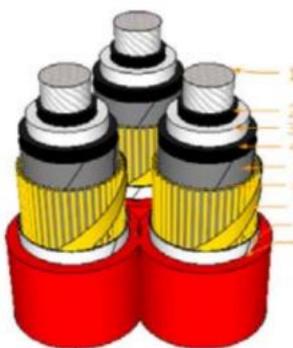
5.1.6 Electricity Connection

The grid connection is fully designed, quoted and paid for to ensure a secure connection for the project from the District Network Operator (DNO), Western Power Distribution. This is necessary to secure the network capacity for the project. If the capacity was left unsecured it would be possible for another development (for example a multi megawatt wind or solar farm) in the vicinity to use up the available capacity.

The connection does not involve any overhead cabling. A grid cable from the hydro powerhouse is to be laid along the route as details within the map below.

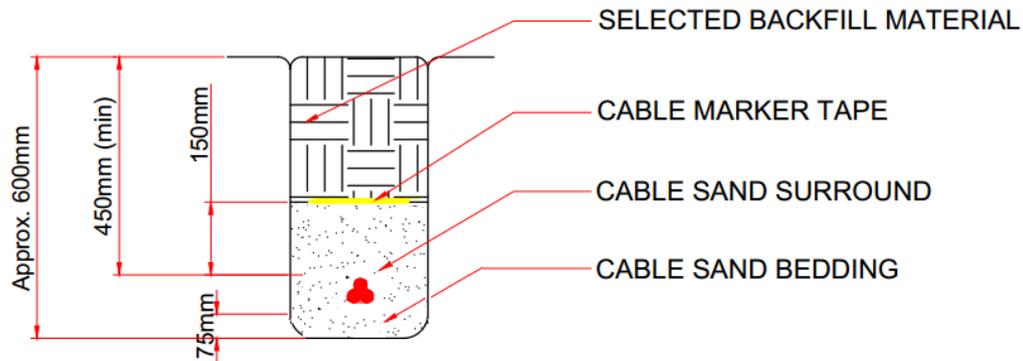


From the substation to the powerhouse will be an underground rather than overhead line and therefore no overhead lines are created as part of this project.



The cable is designed for direct buried with no duct.

Trench Profile



The cable is to be buried with 450mm of cover and to include sand surround (bedding) and marker tape (HV cable safety tape). The final cover will be backfill from the material excavated for the trench. The trench will be approx. 300mm wide.

The installation over this area is expected to be carried out within 1 week from start to finish. The aim being to not leave the heath excavated for any prolonged period, enabling the set aside top soil to be no left aside for any extended periods.

The cable route passes through a section of heath at Craig y Mynach feedback from EIA scoping was received from NRW that further information should be provided to clarify the method of installation of the cable along this area. This method statement is within the appendix of this report. Further evaluation is also provided within the Ecology chapter prepared by Environmental Systems Ltd.

5.1.7 Construction

It is proposed that most of the construction works will take place during the spring/ summer months however there will be a requirement to undertake parts of the construction works outside these seasons It is anticipated that the construction works will extend to between nine and twelve months. Plant and machinery to be used will include small numbers of excavators, concrete lorries, cranes and standard HGVs.

During the laying of the pipeline an excavation corridor of approximately 200 m in length would be in operation at any one time. The average width of this working area is likely to be approximately 20m. The average depth of the excavation is likely to be 3m (maximum diameter of pipe plus 1 m cover) subject to the ground contours. It is anticipated that there will be a greater depth of excavation circa 5m at locations along the pipe route. During excavation works temporary French drains will be provided to divert surface water away from the excavation areas and the total construction corridor, including the areas identified for the temporary deposition of spoil and turfs, could be up to approximately 10-20 m in width.

5.1.7.1 Construction materials

At this stage the exact materials to be used in the construction of this hydroelectric development have not been confirmed however an indicative description of the key material components that are envisaged will be used for the majority of the construction is set out below:

- Turbine house: In-situ block work with larch cladding
- Pressure pipeline: Glass reinforced plastic or Ductile Iron, as well as pipe bedding gravel
- Intake chamber: In-situ concrete
- Weir: In-situ concrete and stainless steel screen

5.1.8 Restoration

One of the primary activities taking place within the working area is the soil strip. This involves stripping the top layer of vegetation and topsoil and setting aside. This will not be done for the whole construction footprint in one go, rather the area being work on (for example a 200m length of pipe installation). The soil strip sets aside the top soils such that during the restoration works on that area there is the topsoil of the specific location to return to the ground reinstating the as before seed bank and top soils. With the exclusion of specific landscaping blending in the edges of the structures being created the aim of the restoration works is to bring the area back into as before condition as closely as possible. The environmental clerk of works is additionally to take up any opportunities for localised improvements and where suitable deviate from as before condition to achieve ecological benefit, a primary example is the removal of invasive species.

5.1.9 Operation

The hydro scheme operates unmanned automatically running on its control logic and safety systems. Operation involves the abstraction of water via the intake coanda screen, diversion of this water down the buried pipeline to the turbine house. Within the turbine house the water flows through branch pipes directly into the Francis Turbine rotating the turbine runner which in turn rotates the generator producing electricity. The water flows out the turbine down the draft tube into the outfall sump. Then the water flows down the tailrace through the outfall screen back into the watercourse.

Maintenance activities include screen cleaning, checking of systems and system tests. The screen cleaning is not likely to be great due to the self-cleaning coanda screens being fitted, but some cleaning is invariably needed especially during periods of trees shedding leaves (Autumn). The amount of trees upstream of the intake is limited at this site to just a handful so screen cleaning is not expected to be regular.

5.1.10 Decommissioning

It is not envisaged that the scheme will be decommissioned in the foreseeable future due to the longevity of the infrastructure being installed, hydro scheme have operation over 100yrs and those that have effectually ceased operation due to not being maintained have typically done so after 60+

years and the infrastructure as remained in place rather than being decommissioned. This for two reasons – the historical value being of interest and the asset being of value to future generations that are able to carry out a restoration project.

6 Scoping & Consultation

6.1 Scoping Report

Under Part IV Section 10 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, a letter and accompanying information seeking formal scoping opinion was sent to Powys County Council in Sept 2017. The Scoping Report was submitted to ensure that this ES contains the information required to evaluate the environmental effects of the proposed development. To assist them in reaching their opinion, and to allow broader consultation on the scope with bodies that may be unfamiliar with the proposals, the following information was provided, which accompanied the letter requesting a Scoping opinion:

- Elan scoping Sep 17 which included:
 - An overview and preliminary evaluation of the main environmental issues, including:
 - Landscape and visual;
 - Historic Environment;
 - Biodiversity;
 - Surface Water and Geomorphology;
 - Noise;
 - Traffic and Transport; and
 - Land Use and Recreation.
 - A summary of the proposed scope of the EIA.

6.2 Scoping Response

The scoping response from Powys Country Council was received on 14th November 2017 Reference SC-2017-0004 River Claerwen, Elan Valley

6.3 Public Consultation

Consultation has been carried out with the Elan Valley Trust landowner and landlord to the several tenant farmers in the valley.



7 Landscape Amenity

Photomontages have been produced to indicate the post construction, operational visual impact of the project. The photomontages have been produced from photo material from other projects and in some cases practical production of the photomontage from what is available has dictated the detail, and therefore the photomontages shown below are an indication only, exact detail is as per the planning drawings rather than photomontages.



Figure 3.1 Intake Photomontage

8 Ecology

This ecology chapter of the Environmental Statement (ES) has been prepared by Environment Systems Ltd and presents the Ecological Impact Assessment (EclIA). The EclIA has been undertaken following guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2016).

The results of a desk-based study and a range of field surveys have been used to establish the baseline conditions of the site. These are assessed against the details of the development to identify effects that may arise from the scheme. The proposed hydro power scheme is detailed in the introduction to the Environmental Statement. Essentially the proposal comprises the installation of a pipeline (known as a penstock) for 1.8km including construction of an intake weir, overflow chamber, power house, pressure station and tailrace.

Where likely significant effects upon species or habitats have been identified as a result of the final design appropriate measures are proposed to reduce or eliminate such effects. These measures are applied prior to and during the construction, operational and decommissioning phases of the development.

The study area includes all areas within the potential zone of ecological influence² of the development. The development is defined as the area within the red line boundary including temporary construction and materials compounds as shown on Figure 1. Baseline surveys were undertaken throughout the red line boundary and within the immediate vicinity of the red line boundary where required and where access permitted.

In summary, the scope of the ecological assessment:

- Identifies statutory and non-statutory designated areas within or up to 10km of the centre of the development;
- Identifies any rare, notable or protected species or habitats present within and up to 2km from the boundary of the development;
- Considers the likely significant effects on valued ecological receptors arising from the development;
- Describes environmental measures which mitigate adverse effects within or adjacent to the site to avoid, reduce or compensate for the effect or offer an opportunity for enhancement; and
- Identifies residual effects, including those considered to be significant, taking into account the above assessment.

The principal ecological issues for consideration are:

- Potential effects on statutory and non-statutory designated areas;
- Long term or short term direct habitat loss due to land take during construction;
- Indirect disturbance effects, i.e. the displacement of species as a consequence of construction work, or due to the operational phase of the development; and
- The potential mortality of ecological receptors vulnerable during the operational phase of the development.

² Defined as the areas/resources that may be affected by the biophysical changes caused by activities associated with a project (CIEEM, 2016)



8.1 Planning and Policy Context

Nature conservation policy in Wales is implemented through a series of areas, habitats and species designated under legislation from international to local level. In relation to the majority of significant habitats and protected species, key legislation and policy relevant to the protection, conservation and enhancement of nature conservation interests associated with the ecological study area is outlined in Table 1.

Table 1: Key legislation and planning policy

Legislation/ Planning Policy	Description
Habitats Directive – European Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna	<p>The Annexes of the Habitats Directive list species and habitats identified as being threatened or of ‘community interest’ and to which the Directive gives protection. Annex I lists habitat types regarded as being of European Importance including ‘priority habitat types’; Annex II lists species of European Importance; and Annex IV(a) lists animal species of community interest needing strict protection.</p> <p>Under this Directive the Commission requires the establishment of a network of wildlife sites to protect examples of species or habitats of value at European level. These sites, called Special Areas of Conservation (SACs), and in conjunction with Special Protection Areas (SPAs) designated under the EC Birds Directive form a network of protected sites across Europe referred to as Natura 2000.</p>
Birds Directive – European Directive 79/409/EEC on the Conservation of Wild Birds	Requires Member States to take measures for the conservation of wild birds by the designation of SPAs. Implementation was primarily through the Wildlife and Countryside Act, 1981, is now fully implemented in the UK through the Habitats Regulations.
Habitats Regulations – The Conservation of Habitats and Species Regulations 2017	The Conservation of Habitats and Species Regulations 2017 (the Habitat Regulations) transpose Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna into English and Welsh law.
The Wildlife and Countryside Act 1981 (as amended) (WACA)	This piece of legislation remains the primary UK mechanism for statutory site designations (e.g. Sites of Special Scientific Interest, SSSI) and the protection of individual species listed under Schedules 5 and 8 of the Act, each subject to varying levels of protection.
The Environment (Wales) Act 2016	The act makes provisions within Wales for the planning and managing of natural resources at national and local level. Section 6 of the act introduces the biodiversity and resilience of ecosystems duty whereby public authorities are required to seek to maintain and enhance biodiversity so far



	<p>as it is consistent with the proper exercise of those functions. Section 7 of the act introduces a list of living organisms and types of habitat in Wales which are considered of key significance to sustain and improve biodiversity.</p>
<p>Planning Policy Wales – Chapter 5 Nature Conservation (8th Ed.; 2016)</p>	<p>Chapter 5 of Planning Policy Wales (PPW) sets out the Welsh Government’s objectives for natural heritage and land-use planning policies. Within chapter 5 it states that ‘Local planning authorities must address biodiversity issues, insofar as they relate to land-use planning, in both development plans and development control decisions’. In addition, PPW requires local planning authorities to set out within their development plans a policy framework for the conservation and enhancement of the natural heritage specific to the local area.</p>
<p>Technical Advice Note 5 - Nature Conservation and Planning</p>	<p>Technical Advice Note 5 (TAN5) contains a set of principles which includes integrating nature conservation into all planning decisions and for development to provide a net benefit for biodiversity conservation with no significant loss of habitat or populations of species, locally or nationally.</p>
<p>Powys County Council – Unitary Development Plan (UDP)</p>	<p>Strategic Policy 3 (SP3) is an overarching approach to safeguarding Powys’ natural heritage with every development proposal expected to protect, conserve and wherever possible enhance sites of importance for, among others, biodiversity, ecological and nature conservation.</p> <p>Several Environmental Policies are present in the UDP which are applicable to the project, including:</p> <ul style="list-style-type: none"> Policy ENV3 Safeguarding Biodiversity and Natural Habitats Policy ENV4 Internationally Important Sites Policy ENV5 Nationally Important Sites Policy ENV6 Site of Regional and Local Importance Policy ENV7 Protected Species Policy ENV8 Tree Preservation Orders Policy ENV9 Woodland Planting <p>In summary of the aforementioned environmental policies developments that have an adverse impact on priority species, habitats and features of recognized importance to biodiversity or nature conservation will not be permitted except where it can be demonstrated that impacts can be satisfactorily mitigated, acceptably minimised or appropriately managed to include net enhancement; or where there are exceptional circumstances where the reasons for the development or land use change clearly outweighs the need to safeguard the biodiversity and nature conservation</p>



	interests of the site and where alternative habitat provision can be made in order to maintain and enhance local biodiversity.														
The Powys Local Biodiversity Action Plan	<p>The national strategy for biodiversity is delivered at local level via Local Biodiversity Action Plans (LBAP). The study area is covered by the Powys LBAP which contains 17 habitats and 28 species action plans. Habitats and species for which the action plans have been prepared and are considered relevant to the study area are:</p> <table border="0"> <tr> <td>Habitats</td> <td>Species</td> </tr> <tr> <td>Coniferous woodland;</td> <td>Brown hare;</td> </tr> <tr> <td>Farmland;</td> <td>Brown trout;</td> </tr> <tr> <td>Linear habitats;</td> <td>Otter;</td> </tr> <tr> <td>Rivers and streams;</td> <td>Red kite; and</td> </tr> <tr> <td>Scrub and ffridd; and</td> <td>Water vole.</td> </tr> <tr> <td>Lowland blanket bog</td> <td></td> </tr> </table>	Habitats	Species	Coniferous woodland;	Brown hare;	Farmland;	Brown trout;	Linear habitats;	Otter;	Rivers and streams;	Red kite; and	Scrub and ffridd; and	Water vole.	Lowland blanket bog	
Habitats	Species														
Coniferous woodland;	Brown hare;														
Farmland;	Brown trout;														
Linear habitats;	Otter;														
Rivers and streams;	Red kite; and														
Scrub and ffridd; and	Water vole.														
Lowland blanket bog															

The key legislation for individual species that are relevant to this EclA is summarised in Table 2.

Table 2: Species legislation

Species	Legislation
Plants	<p>Section 13 (Schedule 8) of the WACA 1981 (as amended) and regulations 42-46 (Schedule 4) of the EC Habitats Directive 1992 identify measures for the protection of wild plants. The legislation together protects all plants listed on Schedule 8 of the WACA and Schedule 4 of the Habitats Directive against:</p> <p>Intentionally picking, collecting, cutting, uprooting or destroying a wild plant listed in the schedules;</p> <p>Selling, offering or exposing for sale, or having in his possession or transporting for the purpose of sale, any live or dead wild plant included in the Schedules, or any part of, or anything derived from, such a plant; or</p> <p>Publishing or causing to be published any advertisement likely to be understood as conveying that he buys or sells, or intends to buy or sell, any of those things.</p> <p>Enforcement provisions were extended by the Countryside Rights of Access Act 2000, Section 81 and Schedule 12.</p> <p>Section 14 of the WACA prohibits the planting in the wild of plants listed in Part II of Schedule 9 or otherwise causing them to grow there. This includes (amongst others) giant hogweed and Japanese knotweed.</p>



<p>Reptiles</p>	<p>All six native reptile species are legally protected in Wales through their inclusion on Schedule 5 of the WACA (as amended) by the CRoW Act 2000 and the Environment (Wales) Act 2016. This legislation contains two levels of protection for reptiles.</p> <p>The four common and widespread reptile species (adder, grass snake, slow worm and common lizard) are protected against killing, injuring and sale.</p> <p>There are also two rarer species, sand lizard (<i>Lacerta agilis</i>) and smooth snake (<i>Coronella austriaca</i>), which are offered additional protection by the Act, but which are not relevant to this project.</p>
<p>Birds</p>	<p>Birds are protected under the WACA and the EC Birds directive 1979 (79/409/EEC). Sections 1-7, the CRoW Act 2000 section 81 and schedule 12, the Birds Directive 2009/147/EC.</p> <p>Part 1 of the WACA is the most important legislation protecting birds. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union directives on the Conservation of Wild Birds and Natural habitats and Wild Fauna and Flora (92/43/FFC) are implemented in Great Britain. Under Part 1, Section 1 it is an offence to:</p> <p>Kill, injure or take any wild bird intentionally;</p> <p>Take, damage or destroy the nest of any wild bird whilst in use or being built; or</p> <p>Take or destroy eggs of wild birds.</p> <p>Birds listed under Annex 1 of the EC bird's directive are subject to special conservation measures. The directive also protects habitats by creating Special Protection Areas (SPA's), these form part of the Natura 2000 network.</p>
<p>All species of British Bat Chiroptera Sp.</p>	<p>All European species of bat are listed on Annex IV of the EC Habitats Directive 1992 as being in need of "strict protection". This is implemented in Britain under Regulation 40 of the Habitats Regulations 2017. All British bats are included on Schedule 5 of the WACA 1981 (as amended) and the whole of Section 9 of the act applies to European bat species. In summary, the above legislation collectively prohibits the following:</p> <p>Deliberate capture, injury or killing of a bat. In a court, 'deliberately' will probably be interpreted as someone who, although not intending to capture/injure or kill a bat, performed the relevant action, being sufficiently informed and aware of the consequence his/her action will most likely have.</p> <p>Intentional or reckless disturbance of a bat in its roost or deliberate disturbance of a group of bats.</p> <p>Damage or destruction of a bat roosting place (even if bats are not occupying the roost at the time).</p>



	<p>Possession or advertisement/sale/exchange of a bat (dead or alive) or any part of a bat.</p> <p>Intentional or reckless obstruction of access to a bat roost.</p> <p>Licenses are issued by Natural Resources Wales for any actions that may compromise the protection of a European protected species, including bats, under the Habitats Regulations 2017. This includes all developments and engineering schemes, regardless whether or not they require planning permission.</p>
<p>Badger Meles meles</p>	<p>Badgers are subject to legislation contained within the Protection of Badgers Act 1992. This means that it is unlawful to kill, capture, disturb or injure any individual or intentionally damage, destroy, or obstruct an area used for breeding, resting or sheltering badgers.</p>
<p>Water vole Arvicola amphibious</p>	<p>The water vole is fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 and is a priority conservation species. This makes it an offence to:</p> <ul style="list-style-type: none"> intentionally capture, kill or injure water voles damage, destroy or block access to their places of shelter or protection (on purpose or by not taking enough care) disturb them in a place of shelter or protection (on purpose or by not taking enough care) possess, sell, control or transport live or dead water voles or parts of them (not water voles bred in captivity) <p>Licenses are not usually issued conflict between presence of water vole and development. However, with the application of sufficient measures to avoid harm and preparation of a working method statement for the construction period then it is likely incidental offences are unlikely to occur. This applies to both permitted development and development requiring planning permission.</p>
<p>Otter Lutra lutra</p>	<p>Otter are a European Protected Species (EPS) and also fully protected under Schedule 5 of WACA. This makes it an offence to:</p> <ul style="list-style-type: none"> capture kill, disturb or injure otters (on purpose or by not taking enough care). damage or destroy a breeding or resting place (deliberately or by not taking enough care) obstruct access to their resting or sheltering places (deliberately or by not taking enough care) possess, sell, control or transport live or dead otters, or parts of otters <p>Licenses are issued by Natural Resources Wales for any actions that may compromise the protection of a European protected species, including otters, under the Habitats Regulations 2017. This includes all developments and engineering schemes, regardless of whether or not they require planning permission.</p>



9 Methodology

9.1 Desk Study

A desk study was completed in 2017 to establish the distribution and sensitivities of sites designated for their biodiversity or wildlife features and to obtain ecological records for the site and wider area which may be affected by the development.

The desk study search for records of statutory and non-statutory sites for nature conservation, protected species and priority habitats and species for nature conservation listed in biodiversity action plans.

The desk study consisted of records obtained from the Biodiversity Information Service for Powys and Brecon Beacons National Park (BIS), the Local Environmental Records Centre. Via the EIA scoping opinion request, Natural Resources Wales (NRW) provided additional information on known locations of water vole and the potential locations of metallophilic lichen species on old mine spoil heaps.

Additional information was obtained from the following publically available sources:

- Maps and citations for SACs, SPAs and SSSIs were viewed on the NRW designated sites webpages;
- The Multi-Agency Geographic Information for the Countryside (MAGIC) website was consulted to identify the presence and confirm the location of designated sites such as National Nature Reserves and Local Nature Reserves
- Biodiversity Action Plans including the UKBAP and the Powys LBAP were consulted in respect of notable habitats and species; and
- The Local Plan was consulted to obtain any information regarding non-statutory designated sites of nature conservation and local policies regarding nature conservation.

The search radius for ecological records was based on buffering the site boundary to 2km and 10km as follows:



- A radius of 10km was used for SACs/SSSIs designated for their bat, otter, water vole and dormouse interest.
- A radius of 2km was used for protected and priority species
- A radius of 2km for local designations.

The distances used for designated sites and species were based on professional judgement of maximum potential impact and relevance to the development.

Limitations of the desk study

Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with field surveys they can contribute to a robust ecological assessment of a site.

9.2 Field Survey

9.2.1 Phase 1 habitat survey

A habitat survey was completed in May 2017 by Laura Cottrell MSc BSc (Hons). The survey involved a site walkover and preliminary assessment of key habitats, land use and ecological features, particularly focussing on areas of semi-natural habitat which will be or may be affected by the development. The main habitats present were recorded using the standard Phase 1 Habitat Survey methodology as described by JNCC (2010).

The site was assessed for its potential to support protected and priority species in order to identify potential ecological constraints and to guide recommendations for further Phase II survey requirements for these species. The site was also inspected for signs of any invasive plant species subject to legal controls. A copy of the survey report including full method is provided the Appendix.

9.2.2 Breeding bird survey

A breeding bird survey of the development site and up to 200m radius of the surrounding land was completed. The survey was completed between April and June 2017 by Dave Thomas MSc BSc (Hons). Dave is an ornithologist with over 25 years of experience including breeding bird and common bird census surveys, upland wader surveys, wetland bird survey and vantage point surveys for a range of projects including

population monitoring for the British Trust for Ornithology, wind farms, hydro schemes and power lines.

A defined transect was walked on four occasions recording activity for all species at 25m intervals. Records from all visits were combined into a final visit map using a geographical information system to allow an estimate of territory numbers for each species. A copy of the survey report including full method is provided in the Appendix.

9.2.3 Otter and water vole survey

The very nature of a hydro project requires in river works that may affect otter holts and resting places or water vole burrows and feeding areas. It was therefore necessary to undertake surveys to establish the presence or likely absence of otter and water vole and to determine whether any features used by these species will be disturbed or lost to development.

The survey was conducted on two occasions, once during May 2017 and once during January 2018 to enable identification of new signs such as latrines, feeding laws, spraints and feeding remains. The survey method followed guidance from Chanin (2003) (otter) and Natural England (2008) (water vole). River and stream banks and edges, and land adjacent to water features were searched for field signs as detailed by Bang and Dahlstrom (1972).

9.2.4 Badger & general mammal survey

During the Extended Phase 1 Habitat survey for the Preliminary Ecological Appraisal (PEA) signs for use of the site by badgers and other mammals such as brown hare was searched for. No evidence of badgers was found throughout the site and therefore they have not been taken forward into impact assessment. Nevertheless, general measures to protect highly mobile mammals such as badgers, fox *Vulpes Vulpes*, otter and water vole are included in as required mitigation measures in the Construction Environmental Management Plan (CEMP).

9.2.5 Bats

The route of the penstock was planned to avoid the removal of sensitive habitats and trees wherever possible. However, the engineering needs of the penstock ultimately requires the removal of a number of trees. The development itself is not considered to



have operational effects on bat species as there is no above ground features (with the exception of the turbine housing which will not have external lighting) and only temporary severance of hedgerows that have recently been laid.

The Extended Phase 1 Habitat Survey included the scoping of trees present on site that have potential to support bats. In total 56 trees were surveyed with 17 identified in the tree survey to be removed. None of these 17 trees were identified during the protected species survey which included scoping bat features as having potential to support bat roosts. The scoping survey of the trees was completed by Neil Parker CEnv MCIEEM who is a NRW licensed surveyor with ten years' experience. The classification of each tree is shown in Table 3.

The location of the intake weir, syphon chamber and power house are all in open ground where there are no trees present. The trees within and in close proximity to the construction ZOI are all to be retained with no lopping or pruning to facilitate the construction of the penstock or tailrace. These trees have been set with Root Protection Areas (RPA) as required by BS5837:2012 Trees in relation to design, demolition and construction. Given that the RPA for each tree will provide a stand-off distance that will reduce disturbance to a level where any roosting bats in trees not to be removed will be unaffected it is only artificial lighting during construction that will cause an effect. The construction method does not include for night working so there will be embedded avoidance of artificial lighting, mitigating any concerns of light severance or light splay onto the trees. Given this approach to avoidance of trees with potential for bats it is considered that the potential effects are certain to be negligible and so further survey was not undertaken and not considered necessary on this occasion to take bats forward into detailed impact assessment.

9.2.6 Evaluation and Assessment Methodology

The method of evaluation and assessment utilised has been developed using guidance from the Chartered Institute of Ecology and Environmental Management. (CIEEM). The 'Guidelines for Ecological Impact Assessment in the UK and Ireland' (CIEEM, 2016) (hereafter referred to as 'the CIEEM Guidelines') provide guidance on the process of identifying the value of ecological receptors, characterising effects upon them and the magnitude of these effects, and assessing whether these effects are significant. These

guidelines form the basis of the assessment methodologies within this report. The CIEEM Guidelines are well established and provide a recognised methodology which is used widely throughout the industry. The methodology below summarises the criteria as set out in these guidelines.

A structured process has been used to determine which species/habitats need to be subject to valuation. The initial requirement of the assessment is to determine the valued ecological receptors which should be included and taken forward into the detailed assessment stage. Ecological receptors are usually sites, habitats, species assemblages/communities or populations of a species, which could be affected by a development. Other valued ecological receptors may occur on or in the vicinity of the site of the development but are not considered because there is no potential for them to be significantly affected.

9.2.6.1 Determining Value

Consideration is given to the level of nature conservation value of each ecological receptor that may be affected by the development to help determine the value of that receptor. In addition, the sensitivity of the ecological receptor is also considered to help in the decision of taking forward the receptor into characterising the potential effects. The value of a receptor is considered in terms of the population that occupies, or relies on the site, rather than at an individual or legislative level. The approach to assessing the value of ecological receptors is presented in [Table 3](#).

1. **Table 3: Definitions of nature conservation value**

Level of Value	Examples for consideration of ecological receptor value
Very High	<p>High importance and rarity, international scale and limited potential for substitution.</p> <ul style="list-style-type: none"> • An internationally designated site or candidate site SPA, SAC, Ramsar Site, Biogenetic reserve or an area which NRW has determined meets the published selection criteria for such designation, irrespective of whether or not it has yet been notified. • Internationally significant and viable areas of a habitat type listed in Annex 1 of the Habitats Directive. • Regularly occurring globally threatened species (i.e. International Union for



	<p>Conservation of Nature Red listed) or species listed on the Annex 1 of the Bern Convention.</p> <ul style="list-style-type: none"> • Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status. • A regularly occurring nationally significant population/number of any internationally important species.
High	<p>High importance and rarity, national scale and limited potential for substitution.</p> <ul style="list-style-type: none"> • A nationally designated site, e.g. SSSI, National Nature Reserve (NNR) or a discrete area which meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether it has yet to be notified. • A viable area of a UK Post-2010 Biodiversity Framework priority habitat or of smaller areas of such habitat that is essential to maintain the viability of a larger whole, this could include a network of ancient species-rich hedges or even small groups of ancient trees. • A regularly occurring significant population/number of any nationally important species i.e. listed on the Wildlife and Countryside Act 1981 (as amended). • Any regularly occurring population of a nationally important species that is threatened or rare in the county or region. • A feature identified as of critical importance in the UK Post-2010 Biodiversity Framework.
Medium	<p>High or medium importance and rarity, regional scale, limited potential for substitution.</p> <ul style="list-style-type: none"> • Regional/county significant and viable areas of key habitat identified as being of regional value. • Any regularly occurring significant population of a species listed as being nationally scarce, or in the LBAP or relevant Natural Area on account of its regional rarity or localisation. • Significant populations of a regionally/county important species. • Sites such as Sites of Importance for Nature Conservation (SINC) selected on Regional/County criteria. • Any regularly occurring significant population that is listed in a Local Red Data (RDB) or BAP on account of its rarity or localisation.
Low	<p>Low or medium importance and rarity, local scale.</p> <ul style="list-style-type: none"> • Areas identified in a LBAP or in the relevant natural area profile.



	<ul style="list-style-type: none"> • Sites/features that are scarce within the locality or which appreciably enrich the local area's habitat resource. • A diverse and/or ecologically important valuable hedgerow network. • Diverse and/or ecologically valuable grassland. • A significant population of a local important species i.e. listed on a LBAP. • Species populations of local importance.
Negligible	<p>Very low importance and rarity, local scale.</p> <ul style="list-style-type: none"> • Areas of habitat considered to appreciably enrich the habitat resource within the context of the Parish or Neighbourhood. • An occasional occurrence or small population of a locally scarce species.

9.2.6.2 Characterising potential effects

Likely effects based on the nature of the construction, operation and decommissioning of the development have been identified. The characterisation of the potential effect on the conservation status of the particular valued ecological receptor, and on the integrity of the habitats that support them as a result of the development, was determined. In characterising the potential effect an element of professional judgement is used to quantify a set of applicable criteria as described in [Table 4](#). The magnitude of an effect is independent of the value of the receptor. Effects can be positive or negative, of particular or varying timescales (e.g. short-term; <5 years, medium-term; 5-15 years, long-term; 15-25 years and permanent; >30 years), direct or indirect, reversible and can be cumulative.

2. Table 4: Criteria to describe the magnitude/character of potential effects

Magnitude of impact		Typical criteria
Major	Adverse	Loss of resource and/or quality and integrity; severe damage to key characteristic features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Intermediate	Adverse	Significant effect on the resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or



		elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes quality or vulnerability; minor loss of or alteration to, one (or maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial effect on attribute or a reduced risk of negative effect occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change		No loss or alteration of characteristics, features or elements; no observable effect in either direction

9.2.6.3 Significance of Effects

The significance of an effect is largely a product of the interaction between the value of the ecological receptor and the magnitude of the effect on it, moderated by professional judgement, to determine whether the integrity of the receptor will be affected. An ecologically significant effect can be defined as an effect (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area. Within this assessment a significant effect therefore means that the predicted effects are considered likely to affect the integrity of a receptor.

Table 5 provides the matrix for helping to determine the significance of ecological effects. The greater the environmental value or magnitude of impact the more significant the effect. In some cases, the significance is shown as being one of two alternatives. This allows for the application of professional judgement in appraising significance between individual receptors which may not have equal significance within their context.

Where there is doubt over the appropriate level of significance, for example where there is uncertainty about the full extent of the local resource (habitat area or population size),

this is stated and as a precaution the higher level of significance of the effect is applied. Within the matrix 'slight' is used to acknowledge circumstance whereby an effect may occur, albeit that it is unlikely to be significant in EIA terms. Effects defined in [Table 5](#) as moderate, large or very large are considered significant.

Table 5: Matrix for Determining Significance of Ecological Effects

Ecological value	Character/magnitude of impact				
	Major	Intermediate	Minor	Negligible	No change
Very high	Very Large	Large or Very Large	Moderate or Large	Slight	Neutral
High	Large or Very Large	Moderate or Large	Slight or Moderate	Slight	Neutral
Medium	Moderate or Large	Moderate	Slight	Neutral or Slight	Neutral
Low	Slight or Moderate	Slight	Neutral or Slight	Neutral or Slight	Neutral
Negligible	Slight	Neutral or Slight	Neutral or Slight	Neutral	Neutral

Environmental mitigation, compensation and enhancement measures proposed to avoid, reduce or remedy the significant adverse effects are then identified. These are used to review the significance of the potential effects to provide an overall, residual, effect once the measures have been implemented. This is moderated by professional judgement and includes a description of any legal and policy consequences.

An overall effect for each receptor affected by the development is provided in [Table 10](#) effects table at end of EIA.

In terms of protected species, irrespective of the ecological impact significance, measures will be required to be taken to ensure that contravention of the relevant legislation is avoided. This may include the adoption of mitigation which is acceptable to statutory authorities.

10 Baseline Conditions

This section describes the current status of the habitats and species recorded within the study area. It is based upon both the findings of the desk study and the field surveys undertaken. The nature conservation importance of each of the ecological receptors is evaluated in [Table 10](#).

10.1 Statutory Sites

The development is partly located within the Elenydd-Mallaen Special Protection Area (SPA) and Elenydd Site of Special Scientific Interest (SSSI). The Elan Valley Woods Special Area of Conservation (SAC), Elenydd SAC, Caban Lakeside Woodlands SSSI and Caeau Penglaneinon SSSI are all located within relatively close proximity to the development. The baseline descriptions of each designation are provided in [Table 6](#). There are no sites designated for bat, dormouse, or great crested newt interest within 2 km of the site boundary.

Table 6: Designated site descriptions

Elenydd-Mallaen SPA	The development is located partly within the Elenydd-Mallaen SPA as shown in Figure 1. The site covers an area of 30,022 ha and is qualified for its breeding season populations of peregrine <i>Falco peregrinus</i> (1.3% of UK population), red kite (9.4% of UK population) and merlin <i>Falco columbarius</i> (0.5% of UK population). Habitats that support these breeding raptor species are found in the Elan Valley Woods SAC and Elenydd SAC & SSSI.
Elenydd SSSI	The Elenydd SSSI covers an area of 22,770 ha, the site is of interest for its breeding raptors (species as above), blanket bog vegetation, mountain lakes supporting floating water-plantain, examples of watershed mires supporting rare plant species: such as the headwaters of the rivers Elan and Claerwen, the pool & hummock mire at Cors Lwyd and mire complex at Cors Goch. The development is partly located within the SSSI.
Elan Valley Woods SAC	The Elan Valley Woods SAC covers an area of 438.74 ha with the nearest stand of woodland situated approximately 260 m north from the pipeline route. The qualifying features for the SAC are the presence of old sessile oak woods (91A0). The habitat supports a rich invertebrate fauna, in addition to plant assemblages and fungi. Notable local species of bryophyte include <i>Bazzania trilobita</i> , <i>Plagiochila Spinulosa</i> and <i>Saccogyna</i>



	<p><i>viticulosa</i>, which are accompanied by the lichen species <i>Arthonia vinosa</i>, <i>Catillera sphaeroides</i> and <i>Thelotrema lepadinium</i>. The habitat additionally serves to facilitate breeding red kites <i>Milvus Milvus</i>. The available information from JNCC estimates the primary qualifying feature, old sessile oak woods, covers approximately 288.25 ha. European dry heaths (4030; 33.78 ha) and Tilio-Acerion forests of slopes, screes and ravines (9180; 7.02 ha) are qualifying features but not a primary reason for SAC selection.</p>
Elenydd SAC	<p>The Elenydd SAC covers approximately 8581 ha. The boundaries of the SAC are over 500m east of the development at its nearest point. Calaminarian grassland of the <i>Violetalia calaminariae</i> (6130; 25.83 ha) is present as a result of heavy metal extraction at Cwm Ystwyth, which has facilitated the colonisation of a number of scarce heavy metal-tolerant species. <i>Veizdaea cobria</i>, <i>Lecanora handelii</i>, <i>Gyalidea subscutellaris</i> and <i>Ditrichum plumbicola</i> are species of lichens and bryophytes that are responding positively to the habitat. Blanket bogs (7130; 3331.72 ha) are also a primary reason for SAC selection and Elenydd is considered to hold the largest tract of blanket mire in the uplands of central Wales. Active blanket bogs in the area are considered a priority feature. Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoeto-Nanojunctea</i> (3130; 60.26 ha) and European dry heaths (4030; 404.63 ha) habitats are present but not a primary reason for SAC selection. Floating water plantain <i>Luronium natans</i> (1831) is known to be present in the upland lakes of the Elenydd as they have been relatively unaffected by natural systems modification (e.g. abstraction etc.).</p>
Caban Lakeside Woodlands SSSI	<p>The Caban Lakeside Woodlands SSSI covers an area of 11.5 ha and supports a range of mosses and liverworts associated with humid situations with decaying wet wood. The SSSI supports a range of lichens typical of acid barks, naturally basic bark and standing dead wood and has suitable conditions for rare lichen species <i>Catillaria globosa</i> and <i>Ptychographa xylographa</i>. The proposed cable route would run through the most westerly edge of the SSSI.</p>
Caeau Penglaneinion SSSI	<p>Caeau Penglaneinion SSSI covers an area of 5.5ha, featuring species rich grasslands. Nominated as county 'Coronation Meadow' due to being an outstanding example of species-rich grassland. The proposed cable route is adjacent to the eastern edge of the SSSI.</p>



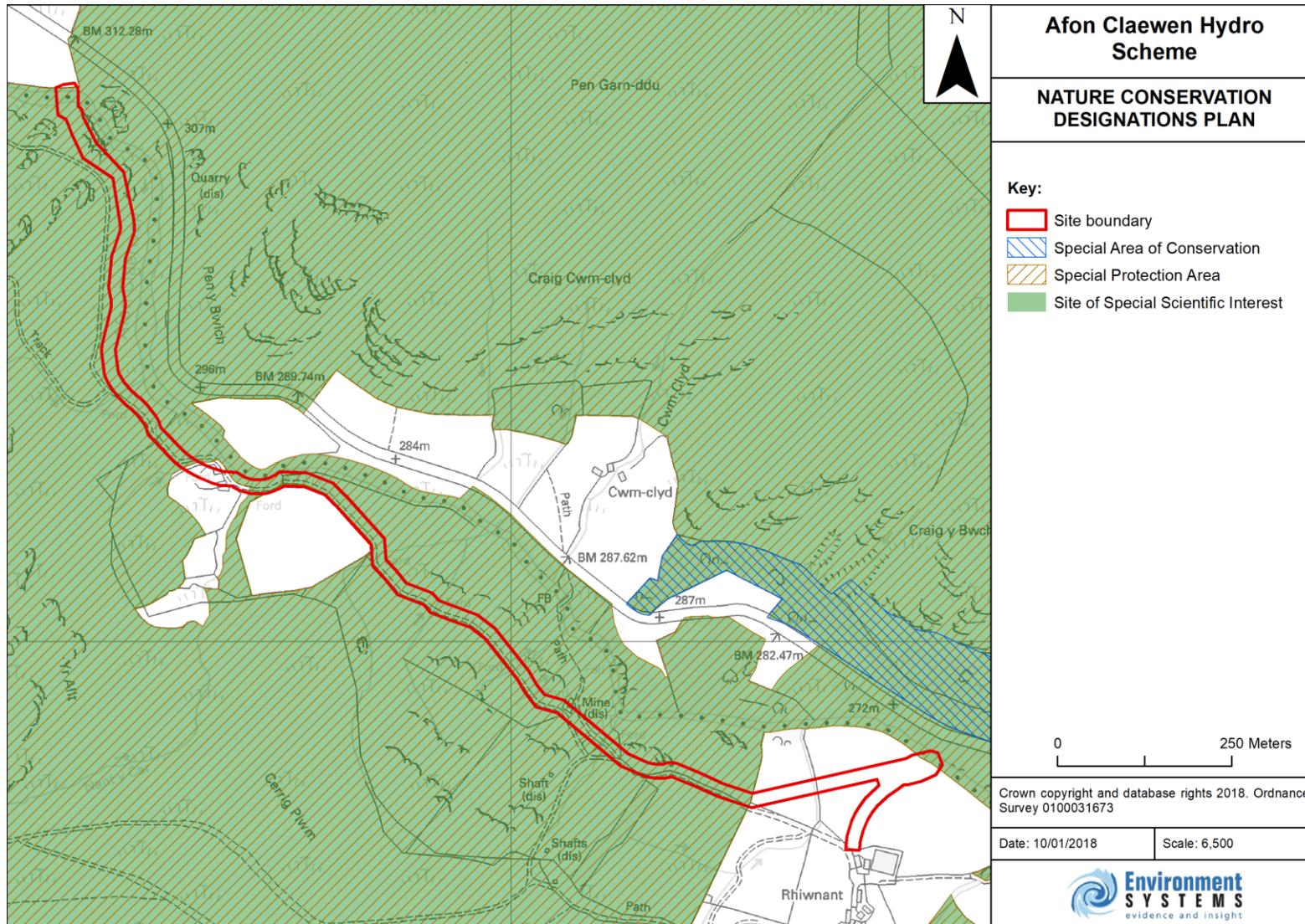


Figure 1: Nature conservation designations plan



10.2 Data search results

Table 7 provides a summary of protected and notable species recorded. Due to large amounts of data received only an indication of numbers of records provided. Records over ten years old have not been included in this assessment. Proximity of actual locations for each record was not possible as the grid reference provided was limited to just four or six numbers.

Table 7: WWBIC and NBN Gateway grouped protected and/or priority species results

Taxon Group	No. of Species	Key Species with Relation to the Development
Insect	57	Includes moths, beetles, butterfly and spiders
Lichen, liverworts, moss and clubmoss	38	Stag’s-horn clubmoss, bog pawwort, varnished hook-moss
Plant	9	Wood bitter-vetch, fragrant orchid, eyebright, cornflower, chamomile, globefflower, small-flower sticky eyebright
Fish	2	Brown trout, Atlantic salmon
Bird	55	Red kite, peregrine, skylark, curlew, hen harrier, merlin, song thrush, fieldfare, pied flycatcher, cuckoo, spotted flycatcher, tree pipit, wood warbler, yellowhammer, bullfinch
Amphibian	4	Smooth newt, palmate newt, common frog, common toad
Reptile	3	Slow worm, common lizard, adder
Mammal	24	Otter, badger, water vole, various bat species

10.3 Field Survey

10.3.1 Habitats

A description of the habitats found on the development site is provided in **Table 8**. **Figure 2** and **Figure 3** provide the Phase 1 Habitat Survey map for the site. The Appendix contains a copy of the Preliminary Ecological Appraisal which includes the field survey report for habitats.

3. Table 8: Habitat Descriptions



Habitat	Area	Description
Acid grassland	1.11 ha	<p>The majority of the pipeline lies within areas of acid grassland. The distribution of species varies throughout the site but the composition of species remains constant. More dominant grass species include sheep fescue <i>Festuca ovina</i>, sweet vernal grass and common bent. Other grasses found within the sward were red fescue <i>Festuca rubra</i> and Yorkshire fog. The sward is predominantly short as it is grazed by sheep but there are tussocks of mat grass <i>Nardus stricta</i> and tufted-hair grass in areas. Sedge species found with the grassland were common sedge <i>Carex nigra</i>, carnation sedge <i>Carex panicea</i>, green ribbed sedge <i>Carex binervis</i> and star sedge <i>Carex echinata</i>.</p> <p>In wetter areas associated with the riparian corridor rush species become more dominant these include soft rush <i>Juncus effesus</i> and sharp flowered rush <i>Juncus acutiflorus</i>. Mosses present were <i>Rhytidiadelphus squarrosus</i>, <i>Pleurozium schreberi</i>, <i>Dicranum scoparium</i> and <i>Polytrichum commune</i>. Tormentil and heath bedstraw were constant throughout the grassland. Lousewort <i>Pedicularis</i> and heath milkwort <i>Polygala serpyllifolia</i> were present in the sward along with meadow buttercup <i>Ranunculus acris</i>, common sorrel <i>Rumex acetosa</i>, sheep sorrel <i>Rumex acetosella</i> and field wood rush <i>Luzula campestris</i>.</p>
Buildings & roads	0.46 ha	<p>The pipeline route largely follows the course of an existing stone track that is a Byway Open to All Traffic (BOAT). It was noted during the survey that this is recreationally used by off-road vehicles and as an equestrian route.</p> <p>The remains of a mine adit are present at SN 89087 61908 and ruins of a former farm are present at SN 88585 62225. Both now have become overgrown with mature trees present. No other buildings are present on site.</p>
Dry heath	0 ha within construction zone	<p>The dry heath habitat is related to the cable route only. There was no dry heath recorded along the pipeline route.</p> <p>The proposed cable route runs along the public footpath within areas of dry heath. Common heather <i>Calluna vulgaris</i> is the dominant shrub with bilberry being a constant and very conspicuous but the abundance varied across the site. Other common species within this community included tormentil, bell heather <i>Erica cinerea</i>, deergrass <i>Muhlenbergia rigens</i>, heath</p>



		<p>bedstraw and purple moor-grass <i>Molinia caerulea</i>. Other forbs present included ribwort plantain and heath milkwort. There were occasional patches of male-fern <i>Dryopteris filix-mas</i>. The ground layer was abundant with moss species such as red-stem <i>Pleurozium schreberi</i>, <i>Hylocomium splendens</i> and common haircap moss <i>Polytrium commune</i>. There were occasional small rowan seedlings present up to about 50 cm tall. Tormentil occurs frequently along with heath bedstraw. Grass species that were recorded are sheep's fescue, red fescue, common bentgrass and sweet vernal grass, however these are less dominant than the <i>Erica</i> species. Rarely occurring species were barren strawberry <i>Ranunculus sterilis</i>, common sorrel and foxglove. The lichen <i>Cladonia sp.</i> was occasional throughout the habitat. At the very start of this habitat from the main road, bracken is abundant.</p>
Flush	0.02 ha	<p>A flush was located within the acid grassland. This is sphagnum sp. rich with an abundance of small sedges. Sedge species include the two species of cotton grass, carnation sedge, star sedge and common sedge. In the wetter areas species such as common butterwort <i>Pinguicula vulgaris</i>, bog asphodel <i>Narthecium ossifragum</i> and round-leaved sundew <i>Drosera rotundifolia</i> were recorded. Other species observed were marsh violet, greater bird's foot trefoil and heath-spotted orchid <i>Dactylorhiza maculata</i>.</p>
Improved & poor semi-improved grassland	0.91 ha	<p>An area of improved grassland is located where the proposed power house and length of pressure pipeline is to be positioned. The grass is heavily grazed by sheep and cattle and has an abundance of perennial ryegrass and frequented by white clover. Other species found within the grassland are Yorkshire fog, ribwort plantain <i>Plantago lanceolata</i>, creeping thistle <i>Cirsium arvense</i> and common mouse-ear <i>Cerastium fontanum</i>. Areas adjacent to the river are frequented with soft rush.</p>
Marshy grassland	0.22 ha	<p>Large dense tussocks of purple moor grass <i>Molinia caerulea</i> dominate the areas. Other grass species present are sweet vernal grass <i>Anthoxanthum odoratum</i>, tufted hairgrass <i>Deschampsia cespitosa</i> occasionally and Yorkshire fog <i>Holcus lanatus</i> rarely. Rush species present within the grassland are soft rush <i>Juncus effesus</i> and articulated rush <i>Juncus articulatus</i>. Herbaceous plants recorded within the marshy grassland were tormentil <i>Potentilla erecta</i>, greater bird's-foot-trefoil <i>Lotus pedunculatus</i> frequently, marsh thistle</p>



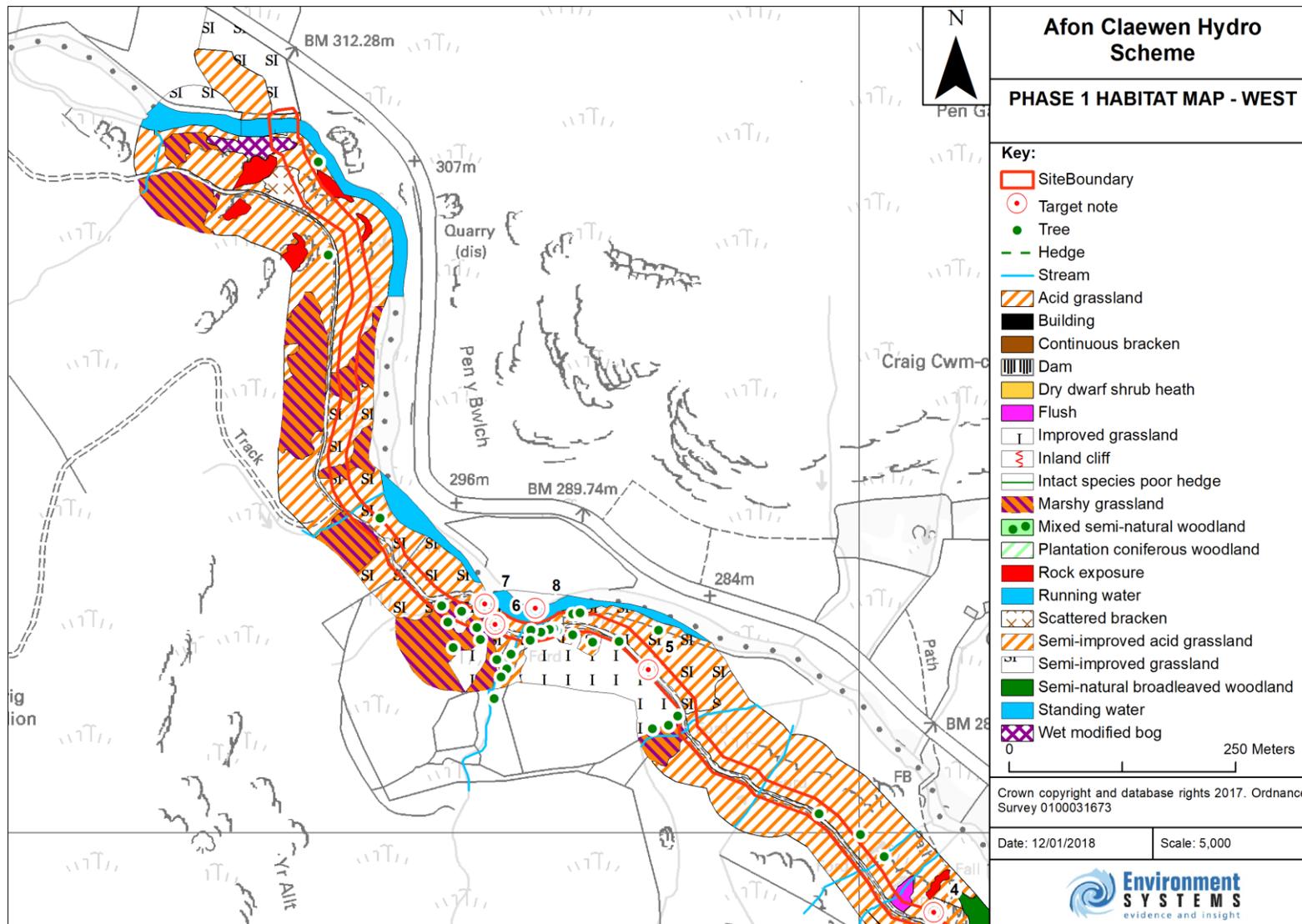
		<p><i>Cirsium palustre</i>, marsh violet <i>Viola palustris</i> and marsh bedstraw <i>gallium palustre</i> were all recorded occasionally within the area. Common sorrel <i>Rumex acetosa</i>, marsh pennywort <i>Hydrocotyle vulgaris</i>, sneezewort <i>Achillea ptarmica</i>, and marsh willowherb <i>Epilobium palustre</i> were found rarely within the marshy grassland. The area is grazed by sheep with limited fencing and access to many of the small watercourses.</p>
Plantation coniferous woodland	0 ha within main construction zone.	<p>A stand of coniferous woodland is located to the south of the pipeline route. The understory is devoid of plant growth and the canopy is dominated by spruce species.</p> <p>The cable route runs along a path that is adjacent to a large plantation of coniferous woodland. As before there is no understory and the canopy are a mixture of Norway spruce <i>Picea abies</i>, sitka spruce <i>Picea sitchensis</i>, Douglas fir <i>Pseudotsuga menziesii</i> and Scot's pine <i>Pinus sylvestris</i> with some European larch <i>Larix decidua</i>.</p>
Rivers & streams	0.05 ha / 191 m	<p>The Afon Claerwen runs from west to east to the north of the site. The river was fast flowing with many large boulders.</p> <p>Small streams are present throughout the development Zol. Target notes 3 and 4 show the location of small streams that are associated with the species poor hedgerows. The stream at the time was slow flowing and is flanked by shallow banks that are have the frequent presence of soft rush and bramble <i>Rubus fruticosus</i>.</p>
Rock exposure with scattered bracken over acid grassland	0.03 ha	<p>Areas of exposed bedrock are present in several places. The exposed rock is typically adjacent to acid grassland with small areas of scattered bracken beginning to dominate along the edge of the rock into the acid grassland</p>
Semi-improved acid grassland	1.24 ha	<p>Areas of semi-improved grassland are located within the development area. These areas are grazed and in places and enclosed by fences. The diversity of species is less than that of the unenclosed acid grassland and is frequented by species more associated with improved grasslands such as perennial ryegrass <i>Lolium perrene</i> and white clover <i>Trifolium repens</i>. However, there is still a diversity of herbaceous plants in parts of the sward and can therefore be classed as good semi-improved acid grassland.</p> <p>An area of clear-fell coniferous woodland was located adjacent to the cable route. The timing of this was at least five years ago giving the habitat time to rejuvenate and is best described as acid</p>



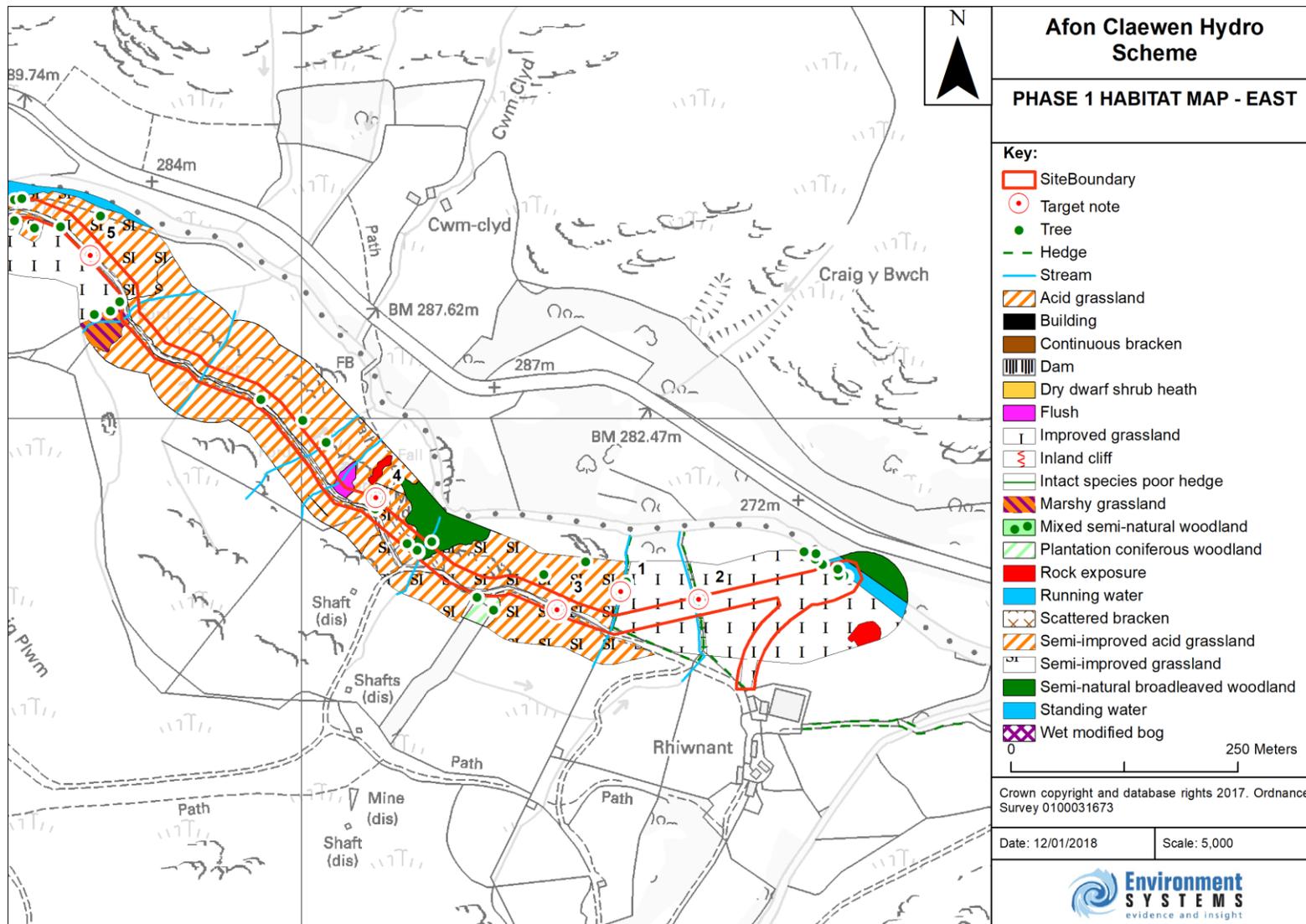
		grassland. The sward height is at least 50cm with the dominant species being red fescue, other grass species are sweet vernal grass and common bent grass. Tormentil is occasional with fox glove <i>Digitalis purpurea</i> .
Semi-natural broadleaved woodland	0.06 ha	A small area of semi-natural broadleaved woodland associated with the steep riparian corridor was located within the 25m (north) of the pipeline (SN 89139 61884). The canopy is open and consists primarily of downy birch <i>Betula pubescens</i> with occasional sessile oak <i>Quercus petraea</i> , goat willow <i>Salix caprea</i> , rowan <i>Sorbus aucuparia</i> and ash <i>Fraxinus excelsior</i> . The ground layer is grazed by sheep and is consistent with the surrounding semi-improved acid grassland. Bluebells <i>Hyacinthoides non-scripta</i> and bracken <i>Pteridium aquilinum</i> were occasional within the ground flora. The cable route runs along a public footpath with stands of semi-natural broadleaved woodland either side of the track. The stands of woodland are situated on a steep slope leading down to the road. The composition of species within the canopy layer is constant and dominated by sessile oak with occasional ash and downy birch. The shrub layer contains occasional rowan. The ground flora is dominated by bilberry <i>Vaccinium myrtillus</i> abundant with common bent <i>Agrostis capillaris</i> and frequented with moss species such as lawn moss <i>Rhytidiadelphus squarrosus</i> , wood hair moss <i>Polytrichum formosum</i> and red stem moss. Other grass species found within the woodland was sweet vernal grass <i>Anthoxanthum odoratum</i> .
Species-poor intact hedge	60 m	There are two traditionally laid hedgerows that separate the improved grassland fields. They are species poor with willow, hazel <i>Corylus avellana</i> , rowan and beech <i>Fagus sylvatica</i> . The ground flora is consistent with that of the surrounding improved grassland.
Wet modified bog	0.04 ha	The vegetation resembles that of a drying degraded blanket bog. In the wetter areas, there are Sphagnum sp. that appear to be drying out. Among the bryophyte species recorded are <i>Pleurozium schreberi</i> , <i>Rhytidiadelphus sp.</i> and <i>Polytrichum commune</i> in places these species dominate giving an indication of the degradation of the bog as it has become too dry. Other species present are sedges such as the cotton grass <i>Eriophorum angustifolium</i> and <i>Eriophorum vaginatum</i> . Grass species recorded were tufted hairgrass, sweet vernal grass, common bent. Herbaceous plants consisted of creeping cinquefoil <i>Potentilla reptans</i> . Bracken is encroaching into



		the drier areas of the bog vegetation.
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4. Figure 2: Phase 1 Habitat Map - West Area



5. Figure 3: Phase 1 Habitat Map - East Area



10.3.2 Birds

Breeding Bird Surveys (BBS) confirmed the presence of 49 species throughout the study area with 20 species either listed on the RSPB’s Birds of Conservation Concern (BoCC) red or amber lists, or protected by the Environment (Wales) Act, WACA or the Birds Directive.

The BBS was conducted on the whole pipeline route including a wide survey area to account for later evolution of the layout design. Therefore, of those territories recorded in the full BBS report (provided in the Appendix), two species holding territories were recorded within the development. Ten species holding 16 territories were recorded in the 50m area surrounding the development. No raptor nests or flights were recorded in this area. **Table 9** and Figure 4 present the species, number of territories and location of each territory.

6. Table 9: Breeding bird territories within the development and within 50m of the development (colours denote the corresponding BoCC list for which the species appears)

Species	Scientific name	No. of Territories recorded within the development	No. of territories recorded within 50m of the development
Grey wagtail	<i>Motacilla cinerea</i>	1	1
House martin	<i>Delichon urbica</i>		2
Lesser redpoll*	<i>Carduelis cabaret</i>		1
Linnet*	<i>Carduelis cannabina</i>		1
Meadow pipit	<i>Anthus pratensis</i>		4
Redstart	<i>Phoenicurus phoenicurus</i>		3
Song thrush*	<i>Turdus philomelos</i>	1	1
Tree pipit*	<i>Anthus trivialis</i>		1
Whinchat	<i>Saxicola rubetra</i>		1
Willow warbler	<i>Phylloscopus trochilus</i>		7

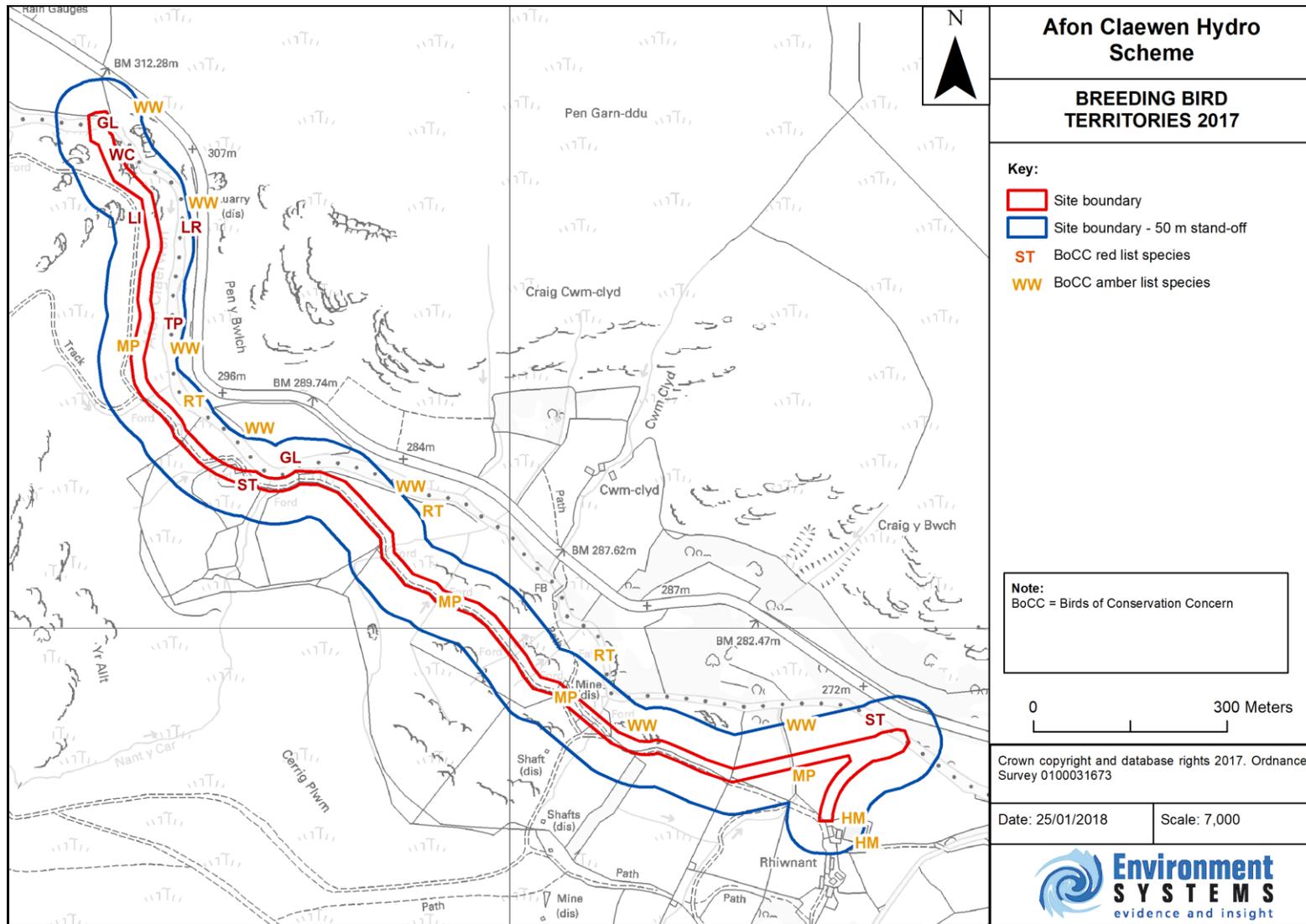
Colours denote the corresponding BoCC list for which the species appears.

Species marked with * are protected under Section 7 of the Environment (Wales) Act 2016.



From the species accounts in the full BBS report (included in the Appendix) there were 12 species which may be affected by the laying of the connection cable to the grid. This includes bullfinch *Pyrrhula pyrrhula* (one territory), dunnock *Prunella modularis* (two territories), linnet (one territory), mistle thrush *Turdus viscivorus* (one territory), pied flycatcher *Ficedula hypoleuca* (three territories), redstart (eight territories), skylark (one territory), song thrush (four territories), tree pipit (three territories), whinchat (one territory), wood warbler *Phylloscopus sibilatrix* (two territories).

Red kite *Milvus milvus* was recorded using the land around the development and cable route but no nests were found within the BBS study area. Peregrine *Falco peregrinus* was observed 'yikking' above the crags along Coed y Foel and Graig y Foel and may be using the crags for nesting although this could not be fully confirmed.



7. Figure 4: Breeding bird territories 2017

10.3.3 Water Vole

Many of the watercourses that cross the development have either recently been worked alongside, damaging and disturbing and presence of water vole, or the watercourses themselves no longer exist above ground and have become silted up and covered with rushes as shown in Figure 5.

In the more suitable watercourses no specific water vole activity such as burrows, latrines, feeding lawns and pathways was found. A number of the watercourses were considered suitable to support water vole however and following consultation with Ken Perry of NRW confirmed a record (14/04/2015) of droppings approximately 130m west of the intake weir on a small watercourse that joins the river.

10.3.4 Otter

A number of features were identified during the survey which were considered suitable to be used by otters. An otter scat was found at the western end of pipeline route on the existing byway track. A number of features on the Afon Claerwen were found to be suitable to support otter. A slide over protruding base rock on the north bank of the river approximately 92m north of the development boundary was recorded, and suitable holt location was found approximately 120m from the development boundary. The holt/couch was not confirmed as in use but appears to be suitable for occupation. In addition to these specific field signs a number of boulders in the river showed limited signs of regular use for sprainting (although no specific spraints or markings could be found) where the lichen and moss is absent at the highest point of the rock. The vegetation alongside the riverbank is largely fenced off from livestock but no distinct signs of access into the water could be found. At some locations where the river is not fenced the riverbanks were shingle and mud directly to improved grassland fields (i.e. around the tailrace and power house).

Review of the gathered during the desk study confirms that otter is present in the area. The last result in the dataset from the LERC data search was in 2014. The nearest record is approximately 460m to the east near Llanerch y Cawr taken during the Otter Survey of Wales 2009-2010 (Strachen, 2015). There are no details associated with the record as to the field sign or whether there is a potential or active couch or holt present. Many of the other desk study results for otter are located in the Caban-coch Reservoir with no such records on the Claerwen Reservoir. The only upstream record of the development is from 2010. This record is approximately 880m to the west and has no information on the field sign present or whether there is a potential or active couch or holt present. The record does state that there are dangerous rocks present and it is on the Afon Claerwen.



It is clear from the survey results that otter is present in the area and it is expected that otter is actively using the stretch of the Afon Claerwen identified for the development. No breeding or natal sites were identified during the survey and so otters are considered as passage and foraging for the purposes of the EclA.

10.3.5 Badger

No specific evidence of badger was found during the habitat surveys, bird surveys or the actual protected species walkover surveys. Within the development site itself (i.e. the pipeline, intake weir and power house etc.) there is no defined woodland habitat which all but removes the presence of badger setts being present. Woodlands within close proximity of the development (i.e. within 100m) are limited to a small coniferous plantation and deciduous woodland on steep slope above the river with bedrock close to the surface. Neither of these woodlands provided positive field signs for badgers.

Within the habitat along the cable route, there were specific field signs such as setts (used or disused), latrines or snuffle holes within 30m of the mixed and coniferous woodlands of badgers using the area. Although a number of mammal tracks (e.g. parting in round level vegetation was noted) these cannot be solely associated with badgers.

Review of the desk study data confirms that the nearest record to the development itself is on the opposite side of the river approximately 419m to the north. Another record approximately 1.2km to the south east is present. Further records are predominantly centred around the woodlands along the Garreg-ddu Reservoir as well as the Elan Visitor Centre. This demonstrates that badgers are active in the area and should be fully accepted as using the land identified for development at least commuting between different areas of suitable foraging habitat.



8. **Figure 5: Example of watercourses that cross the development site that have become silted and rush dominant with little space for water vole burrows etc.**

10.3.6 Assessment of Nature Conservation Value

Table 10 evaluates the nature conservation of the ecological features present within or in the immediate vicinity of the development. Each ecological receptor has been assigned an ecological value according to the geographical scale at which it is important and following guidance from the CIEEM Guidelines (**Table 3**). Where conservation status or species have designations at different levels (international, national and region/county/local) the highest value is assigned. The value is assigned based on the identified population or extent, rather than the scarcity or legal protection of the species or habitat as a whole, and for example, individual occurrences within the development of a nationally scarce species are not necessarily valued at the national level.



9. Table 10: Evaluation of ecological receptors

Ecological receptor	Evaluation rationale	Value	Taken forward into impact assessment
Designated sites			
Elenydd-Mallaen SPA	Internationally important site designated due to supporting populations of breeding red kite, peregrine and merlin.	Very high	Yes
Elenydd SSSI	Nationally important for breeding raptors as qualifying features for the Elenydd-Mallaen SPA as well as blanket bog vegetation. Other SSSI features of interest not present within the development Zol.	High	Yes
Elan Valley Woods SAC	Old sessile oak woodland that support breeding red kite and notable for bryophyte, fungi and invertebrate diversity.	Very high	Yes
Elenydd SAC	Large SAC with several qualifying and supporting features including heavy-metal tolerant lichens and bryophytes found on mine spoil; blanket bog and mire and European dry heaths present. Other features not present of close by include floating water-plantain in upland lakes and calaminarian grassland of the <i>Violetalia calaminariae</i> (at Cwmystwyth)	Very high	Yes
Caban Lakeside Woodlands SSSI	An area of woodland supporting mosses and liverworts associated with humid condition. Rare lichen and standing deadwood present.	High	Yes
Caeau Penglaineinon SSSI	Outstanding example of species-rich grassland	High	Yes
Habitat within the development			
Acid grassland	Majority of the pipeline falls within acid grassland with a diverse sward and composition across the site including sedges, grasses, rushes, mosses and forbs	Low	Yes



Buildings and roads	Rough track and tarmacadam road used to facilitate access. Former mine adit used for fly-tipping and inaccessible with no planned works over or in the adit.	Negligible	No
Dry heath	Footpath identified for laying cable alongside is located in dry heath. Heath is dominated by common heather with bilberry. Other common heath species were also found along this stretch of footpath	High	Yes
Flush	Located within the acid grassland and will be directly affected by the construction of the pipeline. Contains wet areas with bog asphodel, common butterwort, round-leaved sundew and heath-spotted orchid.	Medium-high	Yes
Improved & poor semi-improved grassland	Fields (0.91 ha) intensively used for rearing livestock are typical of the locality and region. These are of limited value for the ecosystem.	Negligible	No
Marshy grassland	Areas of dense purple moor-grass with variety of rush, grass and herb species. Area is grazed by sheep but offers good water retention and botanical diversity that supports wildlife.	Medium	Yes
Plantation coniferous woodland	Not a valuable ecological feature in itself being a planted non-native coniferous woodland. Outside of the development and did not contain evidence of supporting protected or priority species such as badger, red kite, otter etc.	Negligible	No
Rivers and streams	Approximately 191m of streams will be crossed by the pipeline. In river-works will take place in the Afon Claerwen at the intake and tailrace. Rivers and streams are BAP habitat but the actual area to be affected is very limited. The lower end of the conservation spectrum is therefore applied.	Low-medium	Yes
Rock exposure with scattered bracken over acid grassland	Small area of rock and bracken over acid grassland. Not of interest botanically or serving a significant ecosystem purpose. Wildlife supported by the habitat type assessed individually.	Negligible	No
Semi-improved acid grassland	Within the development there is greater diversity of herbaceous plants compared to the improved grassland present but less diversity than the more unimproved acid grassland	Low-medium	Yes



	and marshy grassland. Alongside the cable route there are patches of clear-fell plantation which has		
Semi-natural broadleaved woodland/ scattered trees	A small area of woodland is present north of the pipeline route. Some tree loss of individual scattered trees closer to the pipeline but distinctly separated from the woodland itself.	Medium	Yes
Species-poor intact hedge	Two hedgerows that have recently been traditionally laid alongside streams. Target is clearly to restore the hedgerows to make them more diverse and improve connectivity locally.	Medium	Yes
Wet modified bog	Area of modified bog which is becoming dominated by bracken as it is rapidly drying out with bracken encroaching. Poor quality example of wet bog in the area.	Medium-high	Yes
Species within the development site			
Birds (General)	Bird surveys recorded 49 species, ten of which are conservation concern and showed evidence of occupying a breeding territory within the development. These include four UK BAP species. No raptors or Schedule 1 WACA species were observed as holding territory.	Low	Yes
Birds (UK BAP/ conservation concern)		High	Yes
Reptiles	All UK reptiles are listed on Schedule 5 of WACA and listed on Section 7 of the Environmental (Wales) Act 2016. Reptile species known to be present locally include common lizard, grass snake and slow worm. Populations of these species are widespread within suitable habitat.	High	Yes
Badger	Site provides suitable badger habitat. No badger setts were recorded and little evidence throughout the development or in close proximity. Badgers are widespread and common in the UK.	Low	Yes
Water vole	Evidence of water vole was restricted to a record upstream of the intake weir location and there are suitable streams that cross the pipeline route which will be disturbed. Water vole are protected under the Schedule 5 of WACA and are a UK BAP Priority	High	Yes



	Species with a long-term decline.		
Otter	No otter holts were recorded within the development site itself or within 100m of the boundary. Evidence of otters is present and there are records locally but more associated further downstream and towards the Caban-coch Reservoir. Otter is a European Protected Species (Habitats Directive) and a UK BAP Priority Species. Otter is well represented in Wales and the Afon Claerwen as a tributary of the Wye is likely to be at carrying capacity with poor fish stocks (as a result of acidification) a likely constraint on more otter activity in this upper catchment area (Strachan, 2015).	High	Yes
Bats	No roosts features were identified within the development boundary and trees to be removed had no Potential Roost Features (PRF). The upland habitat is generally of low quality for bats with the exception of the river corridor itself. All bats in the UK are protected under the WACA and Habitats Regulations 2017.	High	No

11 Identification and Prediction of Impact

In this section, potential effects on valued ecological receptors are described and assessed to determine whether they are potentially significant in the absence of any mitigating environmental measures being undertaken. The character of potential effects is discussed as per criteria in [Table 4](#). Habitat or species of negligible conservation value/ sensitivity are only considered where they are legally protected (and therefore may require environmental measures even if effects are not ecologically significant). Effects are assessed against the significance matrix in [Table 5](#) and only effects of moderate significance or above are judged to result in "significant" effect.

The ecological receptors considered to be valued and at risk from the development and therefore taken forward into impact assessment are:

- Elenydd Mallaean SPA
- Elenydd SAC
- Elenydd SSSI
- Elan Valley Woods SAC
- Caban Lakeside Woodlands SSSI
- Caeau Penglaneinon SSSI
- Acid grassland incorporating Semi-improved acid grassland
- Wetland habitats incorporating marshy grassland, flush and wet modified bog
- Rivers and streams
- Dry heath
- Semi-natural broadleaved woodland
- Species-poor intact hedge
- Birds (UK BAP species/ conservation concern)
- Badger
- Water vole
- Otter

11.1 Potential effects during construction

During the construction phase there will be direct loss of a linear strip approximately 2.5 km of land spanning approximately 20m wide plus associated construction compounds. The total land take required for construction is 6.22 ha. Construction details are described in Chapter 4.

In summary the main construction elements are:

- Creation of a 2 km pipeline with up to a 3m excavation.

- Pipeline will only be built in 200m sections with temporary French drains and silt traps installed. Soils will be stockpiled along the pipeline before reinstating and landscaping once each section is complete
- Installation of Coanda screens and concrete conveyance channel into intake chamber. Intake chamber will be finished with stone facing.
- Bench to be cut in to valley side to create level platform for access and construction at the intake weir where there will be a semi-buried reinforced concrete chamber connected to the intake weir. The chamber will provide the link to the start of the 1.8m penstock.
- Syphon chamber to be located at end of cut level for pressured pipe system.
- Additional access tracks to facilitate construction alongside the penstock
- The route of the buried pipe will have top soil removed and stored prior to replacement and seeded with local species to aid recovery.
- Mining are and historical stone ruins to remain undisturbed
- Trees to be removed adjacent to mining area and at tailrace
- Creation of a concrete tailrace
- Powerhouse (17m x 14m) block built with timber cladding
- Permanent access track from Rhiwnant farm to powerhouse for materials deliveries.
- Upper construction compound adjacent to intake weir & lower construction compound at powerhouse. Both will have turf removed and filled with gravel. Soils to be stockpiled and reinstated at end of construction phase. Lower compound will contain welfare unit, porta cabins, machinery set down etc. Upper compound will have machinery set-down and materials.
- Pressure pipeline to be buried beneath stream crossings and stream reinstated above the pipe to maintain the current flow path. In river works for stream crossings will include:
 - The removal of fluming/ access arrangement followed by temporary diversion of the tributary to enable burial of the penstock below the tributary bed
 - The reinstatement of the natural tributary bed and restoration of normal flow.
 - Each watercourse crossing will take up to 3 weeks and will take place between June and September.
 - Construction to last between 9-12 months. Some works must be completed during spring/ summer due to abstraction license conditions
- Laying of the grid connection cable to Elan sub-station and the Elan Dam. This will include burying the cable with 450mm of cover and to include sand surround (bedding) and marker tape (HV cable safety tape). The final cover will be back fill from the material excavated for the trench. The trench will be approx. 300mm wide. A mini-excavator (7 ton or similar with

rubber tracks) will be used to excavate the trench at 30m lengths and work along the route from the powerhouse to the substation ensuring that there is no tracking over the reinstated route.

Each aspect of construction identified will result in the following predicted effects:

- Direct civil engineering works within the Elenydd Mallaean SPA and Elenydd SSSI. Cable route to be laid in very edge of the Caban Lakeside Woodlands SSSI. There is no direct take/effect on qualifying or supporting features. The exception to this is the degraded bog adjacent to the intake weir.
- Loss of upland acid grassland, scattered bracken over acid grassland; marshy grassland; flush, wet modified bog, improved and poor semi-improved grassland; species-poor intact hedge; and dry heath. Other habitats will not be directly affected (i.e. outside of construction zone) but may incur indirect effects.
- Potential mortality, disturbance and displacement of protected and sensitive fauna.

Descriptions of predicted effects during construction without mitigation are given in the following paragraphs with a summary of character of potential effect and significance effect for each ecological receptor provided in Table 12.

11.1.1 Effects on designated sites

Species and habitats of conservation status is considered in relation to their inclusion on the EC Habitats Directive (94/43/EEC) and Conservation of Habitats and Species Regulations 2017. For wild birds, species of conservation status is considered in relation to their inclusion on the EC Birds Directive (79/409/EEC). In practice, these features are identified as designated sites including SACs (habitats and species exc. Wild birds) and SPAs (wild birds). The development is in close proximity and at times within three SAC and SPA. These are the Elenydd SAC, the Elan Valley Woods SAC and the Elenydd-Mallaen SPA.

Article 6(3) and (4) of the EC Habitats Directive (94/43/EEC) requires an Appropriate Assessment for “Any plan or project not directly connected to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects”. It is therefore considered that a methodological approach using European Commission Environment DG’s ‘Assessment of plans and projects significantly affecting Natura 2000 sites’ (2001). This approach will use the following four stage process to assess the need and scope of Appropriate Assessment:

- Stage One Screening - identification of likely impacts alone or in combination;

- Stage Two Appropriate Assessment - Consideration of the impact upon the identified features of the Natura 2000 site alone and in combination with other plans and projects with respect to that sites conservation objectives;
- Stage Three Assessment of Alternatives - Where adverse impacts are identified, this stage assesses the alternative mechanisms of delivering the desired result without having adverse impacts;
- Stage Four - An assessment of compensatory measures required where no alternatives exist and the scheme is adjudged to need to proceed on the grounds of Imperative Reasons of Overriding Public Interest (IROPI).

At any point in the process depending upon the results of that part the process may be able to cease. A copy of the flow chart for Article 6(3) and (4) procedure in relation to the aforementioned stages of the guidance is provide in [Figure 6](#).

To facilitate discussion with the Local Planning Authority, Powys County Council, and the Statutory Nature Conservation Organisation, Natural Resources Wales, a matrix of impacts that includes direct and indirect effects; short and long-term effects; construction, operational and decommissioning effects; and, in-combination and cumulative effects has been prepared. The methods used to predict these effects will be based on the direct measurements of habitat loss using GIS software and will display the area lost and proposals for in-situ mitigation. Compensation measures are not being included in the assessment.

11.1.1.1 Elenydd-Mallaen SPA and the Elenydd SSSI

The species for which the Elenydd-Mallaen SPA is designated for is breeding populations of red kite, merlin and peregrine which are listed on Annex I of the EU birds Directive (79/409/EEC). Although the development is located within the SPA geography the habitats that support these species for nesting and roosting are largely absent from the construction site. The breeding bird survey results confirm absence of heavy use of the development site by these species and during other field surveys limited notes on incidental raptor movements were noted. The direct effects on the qualifying species during construction are therefore in relation to disturbance.

Disturbance is considered for the purposes of the assessment to be noise emitted from the machinery used to dig trenches and install the weir, pipeline and tailrace; and general movement of plant, vehicles and presence of construction staff. The construction phase of the project is planned to be short-term (i.e. between 9-12 months) and the amount of land take is very small

with less than 0.02% of the total 30,007³ ha habitat available elsewhere in the SPA. During the construction phase there will be localised working typically at the construction compounds, at the intake weir and powerhouse and then in circa. 200m sections of the penstock. This will focus the noise and increased activity level disturbance effects but will not be close enough to a nest to cause displacement during the breeding season. The effects on the qualifying bird species of the SPA are considered as largely reversible as the work is temporary in nature and will result virtually no permanent built features as only the intake weir, syphon chamber and very end of the tailrace will be above ground features in the SPA; and the penstock will be reseeded with suitable grassland diversity mixed seed once completed. When these characteristics of the construction phase are considered alongside the conservation objectives of the SPA it is clear that the integrity of the habitats that support the qualifying bird species will not be adversely affected by the project. Given that the SPA and species of value are of very high value and the effect is certain to be negligible adverse then the resulting impact on the SPA will be slight adverse.

Managed in line with the needs of the SPA and set out in the SSSI vision documents available on the NRW website⁴. The SSSI prime habitats such as valley mires, blanket bog and pool and hummock mire are absent from the construction site. Drier elements of acid grassland are the dominant habitat type present with some botanically diverse flush and hummocks of mat grass and tufted hair-grass sporadically present. This acid grassland is representative of the management by sheep grazing across the construction area. Upland acid grassland both locally and regionally is extensive with an estimated 33,607 ha in Powys (Powys Nature Recovery Action Plan, 2017). The grassland ecosystem in this area is widespread and structurally well connected. Diversity and condition varies between the various grassland habitat patches and their existing intensity of grazing. The temporary land-take and required reseeded (in the absence of mitigation) on the acid grassland will be minor as the surrounding habitat is also largely acid grassland and will allow for natural migration of plants into the resurfaced land. The result will be a small area of land take that will take approximately 10 years to fully recover and so is considered a minor adverse effect

The marshy grassland, flush and wet modified bog is extensive locally and throughout Powys with an estimated 12,654 ha of marshy grassland (inclusive of rhos pasture), 2,074 ha of flush and spring, and 41 ha of bog habitat (Powys Nature Recovery Action Plan, 2017). Wet and marshy

³ Total area for the SPA taken from the available SPA GIS Dataset available on the Lle Portal - <http://lle.gov.wales/catalogue/item/ProtectedSitesSpecialProtectionAreas/?lang=en>

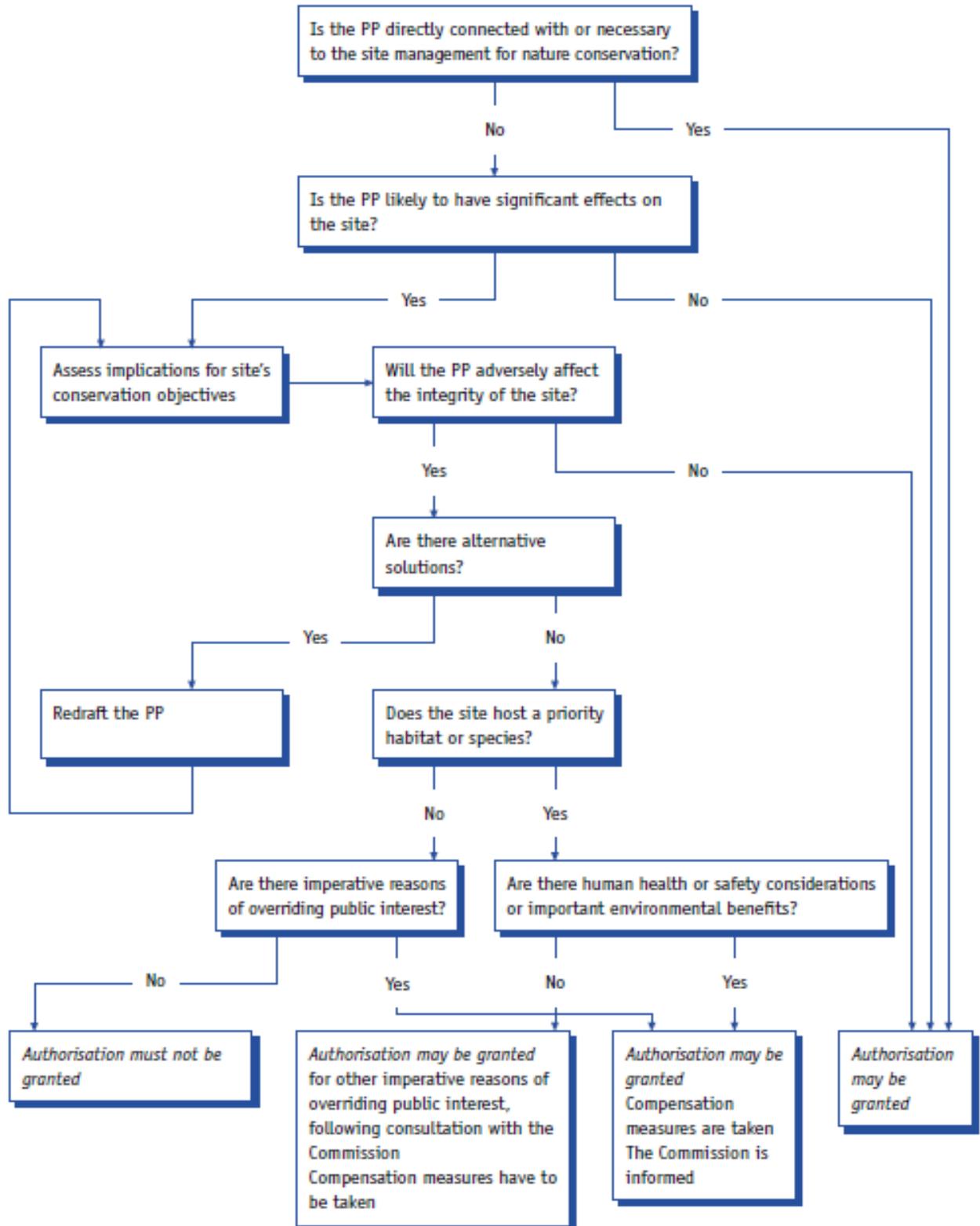
⁴ NRW designated sites data available online at: <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/designated-sites/?lang=en>

grassland habitats which are the second most extensive habitat type after acid grassland on the construction site is frequent throughout Wales and southwest England and drainage has resulted in the development of this type of poor marshy grassland vegetation community (Elkington et al, 2001). In the absence of mitigation, a direct irreversible effect could occur. Even though construction is temporary the habitat has specific soil drainage and flush characteristics which require aerated soils for water to move downslope towards the river. Compaction of the soils is likely therefore to reduce the amount of available water retention space in the soil resulting in potential change of botanical diversity. The marshy grassland and wet modified bog habitats account for 0.19 of land take required yet are quite degraded on site due to the grazing present and existing drying out. Given the ability of the development to reinstate the features (i.e. in the absence of mitigation) it is considered that there will be a minor effect on a high valued (SSSI) ecological receptor resulting in a slight impact.



Flow chart of the Article 6(3) and (4) procedure (from MN2000) in relation to the stages of the guidance

CONSIDERATION OF A PLAN OR PROJECT (PP) AFFECTING A NATURA 2000 SITE



10. Figure 6: Flow chart for consideration of effects on a Natura 2000 site (European Commission, 2001)



At Craig y Mynach the cable route will pass through an area of dry dwarf shrub heath. The route follows an existing footpath from the road to the plantation woodland at Coed Lan-fraith. The cable is to be buried with 450mm of cover and to include sand surround (bedding). The final cover will be back fill from the material excavated for the trench. The trench will be approx. 300mm wide. The installation over this area is expected to be carried out within one week from start to finish. The aim being to not leave the ground excavated for any prolonged period, enabling the set aside top soil to be not left aside for any extended periods. The cable will be laid in 30m sections working up the route ending with the mini-excavator entering the track in the plantation woodland to prevent disturbance of the already reinstated route. It is estimated that approx. 0.52 ha of dry dwarf shrub heath is likely to be affected using a 5m width either side of the trench as a zone of influence. The work is to be carried out at the very edge of the heath which spreads north and west up the hill towards the more valuable mire and bog habitats of the SSSI. The temporary loss of the strip of heath will not result in isolation of the heath habitat post-construction and will have reversible effects as the topsoil will be replaced facilitating re-establishment of the heath vegetation. The effects are therefore considered as minor adverse as there will at least a short-term lapse in condition and diversity along the route but this will recover in time and so the resulting impacting will be slight adverse.

In summary the effects on the SPA and SSSI will be minor adverse as there will be some changes to the attributes of the habitat but the upland grassland ecosystem will be largely maintained in its current state. In the long term there will be no change to the integrity of the SSSI as there is likely to be full recovery of the habitat extents which will maintain the available hunting, scavenging and roosting ground for the SPA bird species.

11.1.1.2 Elan Valley Woods SAC

Two patches are directly affected digging and trenching work to bury the cable connecting the powerhouse to the sub-station at the Elan dam. The cable route follows an existing forest track and footpath which passes through these two patches of the SAC. As described above the cable will be laid directly into the track and there will be no tracking over woodland soils and ground flora. Compaction of the ground flora and roots of the trees will therefore result in no change to the SSSI and have a neutral impact.

In digging a trench for the cable there is likely to be some dust created which has potential to cause asphyxiation to the woodland ground flora including lower plants (bryophytes, liverworts and lichens) and fungi growing from the leaf litter and dead wood. The laying of the cable will be a short-term aspect lasting a matter of days through these sections of the SAC and in close

proximity to the SAC meaning the arising of dust will be limited and unlikely to be greater than day-to-day maintenance works and vehicles passing along the track. The effect is therefore considered as negligible adverse resulting in a slight adverse impact on the SAC features. It is therefore considered unlikely that the extent of the qualifying SAC habitats will be changed and that the integrity of the woodland ecosystem will not be significantly adversely affected by the laying of the connection cable.

Effects such as disturbance to other valued ecological receptors known to be supported by the Elan Valley Woods SAC are discussed in their respective section of this EclA.

11.1.1.3 Elenydd SAC

The Elenydd SAC is located over 500m from the cable route at its nearest point and over 900m from the development at its nearest point. This means that there will be no direct land take or working within the SAC itself. Calimarianian grassland of the *Violetalia calaminarie* which is reliant on heavy metals from former mining works is one of the qualifying features of the SAC. Given the absence of these habitat types and environmental factors that need to come together to form this type of habitat, it is certain that this habitat will be unaffected by the development or cable route works.

Blanket bogs and mire is another primary reason for designation of this SAC. This habitat has potential to also be present outside of the SAC itself and may be designated under SSSI status elsewhere (i.e. in the Elenydd SSSI as discussed above). Within the likely zone of influence there is one small area of wet modified bog and one area of flush. These are surrounded by marshy and acid grassland which is generally in poor condition due to extensive sheep grazing. Given the extent of these two habitat patches outside of the SAC and its qualifying features it is unlikely that the temporary and partial loss of these habitats will affect the integrity of the SAC itself. This is largely due to the isolation of the habitat patches in relation to the SAC itself.

European dry heaths are a feature of the SAC but not a primary qualifying feature. Although the SAC itself is isolated from the development and cable route there is a short stretch of the cable that needs to be laid in dry dwarf shrub heath at Craig y Mynach. This area of dry heath is more associated with the Elenydd SSSI and has been assessed in the above sections.

Other features such as oligotrophic and mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojunctea* and floating water pennywort are unlikely

to be affected by the works both temporarily and permanently due to their absence and distance from the working zone of influence.

In summary, the Elenydd SAC is isolated from the development in both the major works to the intake weir, penstock and powerhouse as well as the cable route. The nature of the works being limited in their zone of influence will not give rise to extensive dust pollution and will not alter hydrological pathways associated with the SAC features themselves. The effects from the development on the SAC are therefore considered as no change resulting in neutral impact.

11.1.1.4 Caban Lakeside Woodlands SSSI

The only aspect of construction that will affect the Caban Lakeside Woodlands SSSI is the laying of the cable. At this location the cable follows the route of the existing forest track. As described above the construction method for the cable route is restricted to a mini-excavator working in approx. 30m sections along the track digging a trench up to lay the cable at 450mm deep and 300mm wide. The full working width of the installation of the cable is therefore limited to the track itself with only low volumes of dust generated from the digging. The installation of the cable is therefore replicative of regular maintenance works to the track and passing regular passing of vehicles. The effects on the mosses and liverworts is therefore negligible adverse due to the short time frame (i.e. less than one week), is temporary and reversible (i.e. the dust will only be present during this works) and will not affect the extent of the SSSI habitats itself. The resulting impact of a negligible adverse effect on a high value receptor is considered as a slight impact.

11.1.1.5 Caeau Penglaneinon SSSI

The cable route will pass along the track to the east boundary of the Caeau Penglaneinon SSSI. At no point will the cable route enter the SSSI. The only likely effect is therefore of increased dust arising from the digging works carried on wind to the grasslands. The method of installing the cable (described above) is considered replicative of regular maintenance works to the track and passing regular passing of vehicles. The effects on the grassland diversity and condition is therefore negligible adverse due to the short time frame (i.e. less than one week), is temporary and reversible (i.e. the dust will only be present during this works) and will not affect the extent of the SSSI habitats itself. The resulting impact of a negligible adverse effect on a high value receptor is considered as a slight impact.

11.1.2 Effects on Habitats

The proposed development will require the temporary removal of all habitats within the development area. The total area within the site boundary is 4.12 ha. This will amount to 2.69 ha of

temporary habitat loss and approximately 0.13 ha of permanent habitat loss to the powerhouse, tailrace, intake chamber. In addition, there will be temporary loss of 0.52ha of dry dwarf shrub heath to lay the connection cable. There will be no permanent loss to the laying of the connection cable. **Table 11** presents the habitat extent figures within the development area for each habitat type.

11. Table 11: Habitat extent in the development area

Habitat taken forward into impact assessment	Temporary Habitat Loss	Permanent Habitat Loss
Acid grassland	1.11 ha	0.03 ha
Dry dwarf shrub heath	0.52 ha	0 ha
Flush	0.02 ha	0 ha
Intact species-poor hedge	16.5 m	16.5 m
Marshy grassland	0.22 ha	0 ha
Semi-improved acid grassland	1.24 ha	0 ha
Semi-natural broadleaved woodland	0.06 ha	0.06 ha
Wet modified bog	0.04 ha	0.04 ha
Rivers and streams	143 m	0 ha
Remaining habitats not included in impact assessment		
Improved grassland	0.9 ha	0.02 ha
Scattered bracken	0.06 ha	0 ha
Semi-improved grassland	0.01 ha	0 ha
Track & road	0.46 ha	0 ha

The acid grassland and semi-improved acid grassland accounts for 57% of the total land take within the development. As described for the Elenydd SSSI, the habitat is extensive throughout Powys and is structurally connected to further extensive areas of the upland grassland ecosystem. The diversity and condition of the grassland can be considered representative of the mid-Wales region with dominance of common grass species that are associated with sheep grazing. The short-term temporary land-take that will be re-seeded (in the absence of mitigation) will have a minor adverse effect as it will take approximately 10 years for the sward diversity to fully recover in an

upland area. The result of the effect of stripping the turf and excavating the soils will result in a neutral/slight adverse impact.

The wetland habitats on site include flush, marshy grassland and wet modified bog, in addition to the freshwater habitats of the Afon Claerwen itself and the streams that flow through the site into the river. Many of the streams that cross the grassland has become blocked as sediment has gathered and rush species grown along the narrow riparian zones. These streams are now visible only in small pockets where the water reaches the surface before flowing through the topsoil itself. This gives rise to areas of marshy grassland and flush in between the acid grassland. It helps to form a mosaic of wet grassland and marshy habitats which has relatively low species diversity but the flush in particular is in relatively good condition with some iconic species of flush and wetland such as common butterwort, bog asphodel, round-leaved sundew, marsh violet and heath-spotted orchid. The habitat is therefore of some value locally of medium value. Only the penstock will pass through these habitats and so tracking of vehicles and excavation will be kept to a minimum with sections of pipe installed at 200m lengths. The wet ground will provide some natural damping down of any dust arisings and there is a low risk of sediment dispersing through the streams and now defunct streams. In the absence of mitigation, the effect of excavations and tracking before replacing the topsoil and reseeding will be an intermediate adverse effect resulting in a moderate impact.

The wet modified bog is located at the intake weir and will for lost to the development. The total habitat patch size of this wet modified bog is 0.16 ha and the total land take will be 0.04 ha which is 25% of the total patch size. The area identified for land take is a drier part of the bog and is becoming encroached with bracken and acid grassland with common bent, tufted hair grass and sweet vernal grass all present along this section. The bog is heavily degraded with these species representing the drying out of the habitat. There are no open pools or wet features throughout the bog area. The installation of the intake weir and associated intake chamber will require the removal of this patch. Bog habitat is widespread locally and regionally but not on a national basis with mid-Wales being a strong-hold of bog habitat. Digging the foundations for the intake weir and chamber will create a natural retention of water which may help to increase the water table immediately adjacent to the structures but this may also slightly affect the pH level of the soils and subsequently the vegetation. However, this is considered inconsequential in comparison to the availability of higher water table. Taking these effects of construction into account, without considering mitigation, there are negatives (habitat loss) and positives (water retention due to wall

of intake chamber). On balance it is considered that these will be an intermediate negative effect on a high value habitat asset resulting in a moderate impact.

The small area of dry heath is to be temporarily affected during the laying of the cable. This is discussed in detail in the Elenydd SSSI section above. The temporary loss is near-certain not to affect the integrity, connectivity, condition or diversity of the heathland as a whole and will not affect the hydrological cycle in this area. The effects to the dry dwarf shrub heath are therefore considered to be time limited and reversible resulting in a minor adverse effect and slight adverse impact.

The loss of a small section of broadleaved semi-natural woodland is unlikely to affect the integrity or conservation status of the habitat and only represents a small proportion of such habitat within the local area. This area of small woodland is more akin to scattered trees as it is surrounded by marshy and acid grassland before a fence line over a steep ravine which is dominated by sessile oak and downy birch. The three trees to be removed at this location are sycamore and ash. The Tree Survey (Environment Systems, 2017) confirms that 17 trees are to be removed to facilitate construction and severance of up to 16.5m of species-poor intact hedgerow will happen. None of these trees are exemplar of their species and the hedgerow is currently in poor condition due to recently being laid (although it will recover in time). In the absence of mitigation there will be a loss of this woody habitat which forms a mosaic with the grassland and marshy habitats retaining diversity and helping to provide localised water regulation. The effect of removing these trees, in absence of mitigation, on the local ecosystem will therefore be intermediate adverse with a moderate impact.

11.1.3 Effects on Reptiles

There are records of two reptile species within the area and it is considered that reptile species such as slow worm *Anguis fragilis*, grass snake *Natrix natrix* and common lizard *Zootoca vivipara* are widespread and under recorded. No hibernacula or features that could provide a shelter were found along the cable route.

It is likely that these more common reptiles will use the footpath and sparser vegetated areas close to the footpath for basking. The cable laying in the heath is a short-term construction aspect (estimate one week) and will be working to a narrow (no more than 5m width) corridor along an existing footpath. The noise and disturbance from increased activity during this period will displace reptiles that are present. There is also possibility of mortality from tracking and digging. Once the cable is laid the topsoil will be backfilled and reseeded with the mini-excavator tracking away from

the completed work which will reduce the compaction of the soil and displacement of reptiles. This means that at any point there will be a 30m trenching length directly affected with noise and vibration in close proximity causing the displacement. The extent of the heath habitat spreading north and west of the footpath and available wooded and bracken habitats that are structurally connected to the footpath it is likely that individual animals will disperse as the min-excavator approaches. In the absence of mitigation there will remain a risk of absolute harm but effects on the local populations will be minimal and considered as minor adverse effect resulting in a slight adverse impact.

11.1.4 Effects on Birds

The site supports a range of birds typical of habitats within the area, including some of conservation interest. Elenydd-Mallaen SPA supports red kite, peregrine and merlin which the breeding bird survey results show occasionally forage across agricultural land in the area. The effects on these species is discussed above on the impacts on the Elenydd-Mallaen SPA.

The impact on the breeding territories for passerine species include one seasons displacement of one grey wagtail territory and one song thrush territory. Both of these species are of high value being included on the BoCC Red list.

The grey wagtail territory accounts for one of four identified throughout the entire survey which includes the main development site and the cable route. It is likely that there is a greater number of grey wagtail territories along the riparian corridor of the Afon Claerwen and Afon Elan. The intake weir where the territory was recorded is in open ground, i.e. the river banks are not covered with woody vegetation and there are limited rock overhangs which provide shelter for nesting sites, which means direct loss of a nest is highly unlikely but temporary loss of the territory by displacement is near-certain. At a regional and national level, the loss of one territory will not affect the overall conservation status of the species (estimated of 35 thousand breeding pairs in Britain⁵ BTO Birdfacts). The effect of loss of one territory for one season will therefore only affect the local population and it is expected that this territory will be readily repopulated post-construction. The effects for territory loss are considered as minor adverse resulting in a slight/moderate impact on the local population.

The song thrush territory is located adjacent to the powerhouse and tailrace. As above the construction has the potential to result in loss of a nest and/or displacement resulting in loss of

⁵ BTO Birdfacts. Accessible via <https://blx1.bto.org/birdfacts/results/bob10190.htm>

the territory. Given the short-term timescale of construction the displacement will last for one breeding season. Song thrush are known nest and raise young predominantly in woodland and scrub but also present in urban areas such as villages and occasionally found in pastoral farmland and larger towns. Disturbance to this territory is therefore likely to be reflect the responsiveness of the individual birds themselves and although there is a potential loss there is likely to be many more territories locally which will recover within a short period (i.e. 1-5 years post-construction). The effect is therefore considered as minor adverse resulting in a slight-moderate impact on the local population. The BTO Birdfacts website suggest a British population of an estimated 1.1m territories. It is therefore not considered that there will be an impact on the wider population and conservation status of the species.

The remaining territories recorded represent a small population of birds typical of the region and habitat types surrounding the development. Habitat clearance to facilitate construction will impact on bird species found on site using those habitat types to be lost. As the population is small and suitable habitat for re-colonisation is present around the site boundary, the magnitude is assessed as minor negative. This is because the loss of the habitat will not affect breeding bird assemblage in the locality or region and construction activities are temporary. This will therefore result in a slight adverse impact.

There is risk of mortality or injury to breeding birds on site during construction and operation. This is due to increased traffic on the site or by removal of habitat. This magnitude of impact is assessed as minor negative and the significance is slight adverse.

11.1.5 Effects on Water Vole

The location of known water vole activity is 130m upstream of the intake weir on a small watercourse that joins the river. This will not be directly or indirectly affected by the construction works and as such will result in no change. Surveys on the water courses that cross the penstock route within 50m upstream and downstream of the tailrace have potential to support water vole but no field signs were found. Based on these field survey results the impacts as a result of construction are therefore no change.

Taking into consideration the proximity of the know present of water vole to the development there is potential for future presence along each of the more open watercourses. In this case it is most likely to be an indirect effect, i.e. as a result of increased turbidity affecting water quality. The flow of the watercourses is unlikely to change so distinctively that it will affect the ability of water

vole to continue create burrows and forage as normal. The character of the effect therefore is considered as minor adverse resulting in a slight adverse impact.

11.1.6 Effects on Otter

A number of field signs were recorded that demonstrate otter is present along this stretch of the Afon Claerwen. It is likely that otter also hunt and move along the tributaries that flow through the development. No specific holt or couches were found during field surveys within 100m of the development. Loss of features that provide shelter for otter will not occur and only disturbance is considered as a potential effect.

Disturbance is considered largely limited due to the short time frame (i.e.1-2 months of construction at the intake weir and tailrace) and only working in daylight hours. As otter are predominantly nocturnal animals the working in daylight hours only means that artificial lights will not be used during their most active daily periods. Given that this disturbance is temporary and reversible (i.e. the watercourses will remain the same post-construction) the effect is negligible adverse resulting in a slight adverse impact in the absence of mitigation.

11.1.7 Effects on Badger

Surveys to date recorded low badger activity throughout the site, although they are considered to be present throughout.

Habitat loss will lead to a small decrease in food availability where areas of grassland are removed in place of construction compounds and pipeline route. However, the total area of construction land on site is minimal compared to the habitat available in the local landscape.

Disturbance to foraging areas and badger movements may occur through noise, construction traffic movement, construction activities such as site clearance and digging. These may affect the natural behaviour of badgers within the local area during the extent of the construction works.

During the excavation of the pipeline trench there is a small risk that badgers may fall and become trapped in open holes in the ground.

11.2 Potential effects during Operation

During operation there will be no ongoing physical or direct works to the built hydro development. Activities will be limited to monitoring and maintenance. The coanda screens that will be installed are self-cleaning with the exception of large build-up such as branches, leaves and general river material. This will be cleaned out by hand, as will the intake channel, intake/syphon chamber and tailrace.

The powerhouse will require ongoing access and maintenance. This will be via a van or standard road going 4-wheel drive vehicle. Maintenance to the powerhouse is largely restricted to the internal workings such as the turbine and control panels etc. The building fabric will be maintained as required with it being possible to use the access track across the existing improved grassland adjacent to the farm to temporarily store material (i.e spare slates, scaffolding for re-roofing after approximately 60-100 years).

Each aspect of operation identified will result in the following predicted effects:

- Potential mortality, disturbance and displacement of protected and sensitive fauna.
- Increase in ponded area behind intake weir.

Descriptions of predicted effects during construction without mitigation are given in the following paragraphs with a summary of character of potential effect and significance effect for each ecological receptor provided in Table 12.

11.2.1 Effects on designated sites

11.2.1.1 Elenydd Mallaean SPA

The qualifying features for the SPA are peregrine, red kite and merlin. No nests or specific areas of breeding territories such as displaying was recorded during surveys. The area of land used for the development within the SPA is very small with no specific habitats that are suitable for actual nest locations. Given that the hydro development will not result in noise and vibration, is not lit during day or night and has no moving above ground parts, effects are absent apart from human disturbance during routine maintenance (similar to that of general farming activities). The effect is therefore considered as no change with neutral impact.

11.2.1.2 Elenydd SSSI

Although the development is located within the boundary of the SSSI once the construction period is completed there will be no ongoing activities that will directly or indirectly affect the habitats or species of interest. Maintenance of the physical built features will be completed ad-hoc with access via the existing track and byway. Clearing of the screens is to be completed by hand and not considered to affect the conservation objectives of the SSSI. The character of the effects is therefore negligible resulting in a slight impact.

The ponded area created behind the intake weir will stretch upstream. The location of the intake weir means that this will not directly affect habitat (acid grassland) of any significance along the banks. This is a permanent effect but neither adverse nor positive as the acid grassland are of

lower overall value and the river habitat is of high value. The effect is therefore considered as minor adverse as there is a slight change in habitat extents but it does not affect the key features or integrity of the SSSI. The impact is therefore as slight.

11.2.1.3 Elan Valley Woods SAC, Elenydd SAC, Caban Lakeside Woodlands SSS and Caeau Penglaneinon SSSI

Once the cable is laid there will be no requirement for regular ongoing maintenance of the connection to the substation. The cable is designed to be reinforced so that it is laid and then remains in-situ for the lifetime of the hydro scheme which is usually greater than 100 years. On update of the hydro scheme in the future, any effects will be related to the construction period to upgrade. However, this is not considered part of this scheme and would be assessed under future environmental regulations as part of the specific construction and operation activities of that project. As there are no operational effects associated with the cable connection the impacts on these designated sites is no change/neutral.

11.2.2 Effects on habitats

No additional long-term impacts to those described above for the construction phase are predicted for the operational phase. There may be some risk of pollution of soils and habitats through spillage of fuel, oils and lubricants to ground from vehicles and potential accidents during normal operation. There is a low likelihood of this occurrence and it is considered that any spillage would be on a small scale. The habitats range from low to high nature conservation value and it is considered that the character of the effects would be negligible-minor adverse, depending on the scale or spillage and the type of soils/vegetation affected. This would result in a slight-moderate adverse effect.

11.2.3 Effects on fauna (reptiles, birds, water vole, otter, badgers)

On completion of the construction stage there will be no direct or indirect changes that will directly affect the populations of these species. It is largely anticipated that the lost bird territories will re-establish as this is likely only disturbance and displacement during the construction phase. Similarly badgers and otter will still be able to commute and forage throughout the development site. There will therefore be no change during operation and sub-sequentially neutral impact.

Water vole and otter presence was only detected outside of the development site and once the construction phase is complete the water flow and turbidity (in absence of mitigation) is predicted to be maintained. There will therefore be no change during operation and sub-sequentially neutral impact.



12.

13. Table 12: Potential construction and operation impacts with no mitigation

Receptor	Value	Effect	Character of Effect	Significance of Impact
Construction				
Elenydd-Mallaen SPA	Very high	Temporary land take of area of predominantly acid grassland within the SPA. No specific nest locations within close proximity and territories unlikely to be affected by construction works.	Negligible adverse	Slight adverse
Elenydd SSSI	High	Temporary land take of area of predominantly acid grassland with some marshy grassland, flush, wet modified bog and dry dwarf shrub heath within the SSSI. Limited displacement on breeding birds including those qualifying features of the SPA.	Minor adverse	Slight adverse
Elan Valley Woods SAC	Very high	Connection cable to be laid in the existing forest track within the two patches of the plantation woodland area of the SAC. Effects limited to low levels of dust caused by trenching and general vehicle movement.	Negligible adverse	Slight adverse
Elenydd SAC	Very high	SAC is isolated from the development and cable route. The hydrological connectivity is also isolated from the SAC as the development is lower in altitude. Features of the SAC absent from the project.	No change	Neutral
Caban Lakeside Woodlands SSSI	High	Connection cable to be laid in the existing forest track within the two patches of the plantation woodland area of the SAC. Effects limited to low levels of dust caused by trenching and general vehicle movement.	Negligible adverse	Slight adverse
Caeau	High	Connection cable to be laid in the existing forest track within the	Negligible adverse	Slight adverse



Penglaneinion SSSI		two patches of the plantation woodland area of the SAC. Effects limited to low levels of dust caused by trenching and general vehicle movement.		
Habitat general	Low-high	Temporary risk of pollutants (primarily dust) during construction	Minor adverse	Slight adverse
Acid grassland incorporating Semi-improved acid grassland	Low	Acid grassland demonstrable example of diversity and condition found locally. Extensive acid grassland throughout the area which is well connected to further grassland and wetland habitats. Resurfaced and reseeded post-construction.	Minor adverse	Slight adverse
Wetland habitats including Marshy grassland, flush and wet modified bog	Medium-high	Direct temporary loss of marshy grassland, flush and wet modified bog. Uncertainty over quality of reinstated grassland post-construction. Part of SSSI so assessed of high value for purposes of assessment.	Intermediate adverse	Moderate adverse
Rivers and streams	High	The habitat and ability of species using/reliant on the river and watercourses where crossings are required is unlikely to be affected beyond disturbance and temporary displacement. Pollution risk through increased suspended solids and turbidity will be temporary during construction of the intake and installing the pipeline beneath stream bed. The in-river works including the stream crossings will be constrained by other permitting requirements and so has a temporary period of disturbance to the habitat and associated riparian species. Watercourse morphology will largely remain the same with gravel beds to streams and boulders and gravel in the Afon Claerwen. The only exception is the intake weir and tailrace itself which are limited in effects to the river habitat (i.e. restricted to effects on flows).	Minor adverse	Moderate adverse



Dry dwarf shrub heath	High	Effects and impacts on dry heath assessed as part of Elenydd SSSI. Temporary land take during laying of the cable and reinstate afterwards.	Minor adverse	Slight adverse
Semi-natural broadleaved woodland/ Scattered trees	Medium	Areas of scattered trees to be felled but trees not exemplar specimens. Sycamore and two ash trees slightly separated from birch and oak woodland to be removed. A number of trees close to the woodland and adjacent to the disused mine will be removed but will not affect the integrity of the woodland it	Intermediate adverse	Moderate adverse
Species-poor intact hedgerow	Medium	The two hedgerows will be severed by the penstock. However, they have recently been traditionally layed and currently provide a limited resource. The width of the severance will be approx. 5m and as a will remove all woody vegetation. The retained length of the hedgerows will be reduced to 50m	Intermediate adverse	Moderate adverse
Reptiles	High	Reptiles will be affected mainly in the dry dwarf shrub heath during the cable laying. This is short term and does not sever the habitat retaining integrity and allowance for movement of reptiles in the area	Minor adverse	Slight adverse
Birds	High	Disturbance and displacement through construction phase.	Minor adverse	Slight adverse
Water vole	High	Disturbance through potential increase in turbidity (sediment) during short period of construction along tributaries and in slower part of the Afon Claerwen below the tailrace. Temporary risk of pollutants (fuel spillages) during construction.	Minor adverse	Slight adverse
Otter	Very high	No direct impact on shelter. Some temporary displacement during construction of the intake weir and tailrace. Temporary risk of pollutants (fuel spillages) during construction. Potential for	Negligible adverse	Slight adverse



		getting trapped in open excavations.		
Badger	High	No known setts within development or within 50m of development. Limited field's signs but anticipated to be present throughout the area. Disturbance therefore unlikely but potential for badgers to have to adapt commuting routes around the 200m sections of pipeline.	Negligible	Slight adverse
Operation				
Elenydd-Mallaen SPA	Very high	No direct or indirect activities with the exception of routine maintenance will occur. Maintenance is by hand to clear coanda screens.	Negligible adverse	Slight adverse
Elenydd SSSI	High	No long-term loss of the SSSI interest features and ongoing land management will continue as prior to construction and operation.	Negligible adverse	Slight adverse
Elan Valley Woods SAC	Very high	No ongoing management requirements along the cable route.	No change	Neutral
Elenydd SAC	Very high	No ongoing management requirements in close proximity to the SAC.	No change	Neutral
Caban Lakeside Woodlands SSSI	High	No ongoing management requirements along the cable route.	No change	Neutral
Caeau Penglaneinon SSSI	High	No ongoing management requirements along the cable route.	No change	Neutral
Acid grassland incorporating Semi-improved	Low	Botanical diversity changes in marshy grassland, flush and wet modified bog habitat due to ongoing changes in soil quality and	Minor adverse	Slight adverse



acid grassland		hydrology. Limited to area of wet ground. Potential pollution spillage events but highly unlikely and will be localised to small vehicular oil, fuel and turbine lubricant spills. Effects will be temporary. Effects to rivers and streams are not anticipated as river flows will be maintained largely as they are at present and riparian zone vegetation will recover.		
Wetland habitats including Marshy grassland, flush and wet modified bog	Medium-high			
Rivers and streams	High			
Dry dwarf shrub heath	High			
Semi-natural broadleaved woodland	High			
Species-poor intact hedgerow	Medium			
Reptiles	High	No direct or indirect activities with the exception of routine maintenance will occur and is not perceived to be greater than the current vehicular traffic using the existing Byway Open to All Traffic (BOAT).	No change	Neutral
Birds	High			
Water vole	High			
Otter	Very high			
Badger	High			

12 Mitigation Measures

The most effective mitigation against ecological impacts is avoidance by design and development of the location of infrastructure. This has been carried out throughout the assessment phase using available field survey and desk-based information to relocate the intake weir and use a syphon pump to pressurise the first part of pipeline. The original design was to locate a construction compound closer to the intake weir but this would have had further land take on the wet modified bog, so this was rationalised. The tree survey has been used to help refine the pipeline route reducing the total amount of tree loss necessary. Construction and materials compounds have purposely been located on improved grassland which is of negligible nature conservation value. These are considered as embedded mitigation measures designed to avoid as far as practically possible significant ecological effects.

The development is designed with some minimum 100-year life span so decommissioning aspects are not applicable at this time. Should the hydro scheme fall into disuse following the minimum life span it is more appropriate to leave the infrastructure in-situ rather than cause further adverse effects once species and habitats have recovered post-construction.

Best practice guidance such as Pollution Prevention Guidelines and IAQM guidance on dust from construction sites (IAQM, 2014) will be carried out at all times when working on site, via implementation of a Construction Environmental Management Plan or similar.

All site compounds and access tracks will be of the minimum size required for safe working. These will be fenced to prevent encroachment of machinery and materials onto adjacent vegetation.

Stockpiling of materials will be restricted to specific sites such as the construction compound and temporary storage areas within the working widths of the pipeline. Waste materials will be removed from the site and disposed of at the earliest opportunity and will not be stockpiled.

12.1 Mitigation for designated sites

The construction of the hydro scheme will affect habitats and species assemblages which are not directly linked to the qualifying features of the designated sites. Within the boundaries of the designated sites areas of bracken removed can be treated as per a normal habitat removal and storage task.

12.1.1 *Flush, modified wet bog, and marshy grassland Removal and Reinstatement*

Marshy grassland is reliant on the hydrological properties of the underlying soils. Therefore, a methodology for extracting the existing marshy grassland turf and subsoils is described:

- Cut or mow grassland collecting arising (this is needed so that the vegetation is short when turves are cut which gives them a better success rate and makes them easier to transport).
- Erect stock proof fencing around the working width.
- Erect silt fencing along each side of the strip area (10m width) and internal drifts at 50m intervals to arrest suspended silts from the stripped area being washed into the surrounding areas of retained or yet to be lifted turf areas – the internal drifts will be removed as the turf lifting reaches them.
- A conventional 13t tracked excavator will work in conjunction with a SPIDER excavator or similar to lift and place the turves from the strip area into the wet storage cell. The storage cell will be made from rigid plastic driven/dug into the ground to form a bunded environment to place turves. The cell will be maintained as wet by installing a trickling water pump to maintain water volume supporting the vegetation. Soils will be stored either side of the corridor or in the materials compound. Both machines are to be fitted with Engcon Tiltrotator and specialist turve cutting attachments.
- Following turf removal any topsoil remaining on the ground will be scraped off to one side of the strip area for storage.
- Excavate trench, store excavated subsoil to one side of the working width in wet cell.
- Install pipeline and intake chambers.
- Backfill with subsoil with no or light compacting to replicate pre-excavation state
- Replace topsoil and turf

Once the subsoil and topsoil is replaced the reinstatement of the turf can begin without having to wait for the remainder of the trench section to be completed. Replacement of the turf will be completed within three days of subsoil re-fill. A team of ground workers will work behind the turf replacement machines back filling by hand any voids around the turf joints.

Practical benefits of the methodology include

- A linear working progression over the corridor minimises machinery traffic and all work will be conducted from the stripped surfaces so removing the risk of compaction.
- Only two parallel cut lines required that should become indistinct within weeks of completion.
- Use of water fed detainment cell(s) to maintain water volume in vegetation dependant soil.

12.1.2 Dust Suppression

A Dust Management Plan (DMP) will be developed and implemented. The specific receptor is the oak woodland including the bryophyte, liverwort and lichen species present along the cable route.

Primarily damping down techniques will be used in the woodland sections using a tractor and bowser as necessary. This is likely to only be needed during hot, dry weather when the dust particulates are able to spread. During wet and damp weather, dust for the scale of the mini-excavator is likely to be very limited and unnecessary to apply damping down. Nevertheless, a DMP needs to be in place with an Ecological Clerk of Works (ECoW) to determine when damping down is required.

All vehicles will switch off engines when stationary to prevent idling vehicles. Diesel and powered generators will be avoided with mains electricity or battery powered equipment used as far as practically possible. A signpost system imposing a maximum speed limit of 10 mph will be employed throughout the construction zone (regardless of designated sites) to reduce dust and emissions to adjoining habitats.

Cutting, grinding and sawing equipment will be fitted or used in conjunction with suitable dust suppression techniques such as water sprays or local extraction (e.g. suitable local exhaust ventilation systems). An adequate water supply not affecting the existing Afon Claerwen will be installed for effective dust suppression and mitigation, using non-potable water supplies where possible. Any skips on site will be fitted with covers. Drop heights from loading shovels, hoppers and excavators will be minimised and use of fine water spray implemented. Clean-up equipment will be located within the working width to deal with dry spillages using wet cleaning methods.

Excavations and temporary earthworks are to be stabilised using hessian or trackifiers where ground is exposed. Small working areas approach will be taken to reduce exposure of soils to air where possible.

Sand, aggregates and bulk cement are to be delivered in enclosed tankers and stored in soils with suitable emission control to prevent escape of material and overflowing during delivery. Or where bags are used, ensure they are maintained in sealed bags and stored in the materials/construction compound.

Where trackways and trackouts are located these are to be maintained using water assisted dust sweeper(s) or similar. This will also apply to access road and local roads, to remove, as necessary, any material tracked out of the site. This may require a sweeper being in constant use. No dry sweeping of large areas will be permitted. Vehicles entering and leaving site carrying materials will be fitted with covers to prevent escape. A wheel washing system will be implemented with rumble

grids to dislodge accumulated dust and mud prior to entering or leaving the designated site area as well as the development site itself.

12.2 Mitigation for habitats

Mitigation for specific habitats within the SAC and SSSI for the marshy grassland and indirect effects of dust on woodland are discussed in the section above. This section focusses on general measures to those habitats affected outside of the designated sites.

Topsoil and retained vegetation which may be subject to disturbance (for example movement of vehicles, machinery and site staff) will be protected from damage by fencing to prevent accidental encroachment onto adjacent habitat.

Removal of soils and vegetation will be done, where possible, by turf stripping to a depth of 300mm (where substrate allows). Turfs will be stripped and stored in a manner that maintains the viability of the seed bank so that both the speed and success of re-establishment of vegetation are maximised on completion of construction. This will also minimise the risk of invasive species becoming established.

The grassland areas to be temporarily lost are planned to be resurfaced using the retained topsoil and reseeded. No information was available for the seed mix. The existing species diversity in these is quite poor and opportunity will arise through the construction to enhance the habitat. The acid grassland can be wet and in places form part of the marshy grassland in wetter seasons, so a species seed mix and seed dispersal from adjacent areas will be used. The seed mix can be used to enhance the species diversity in order to restore the habitat to a more semi-natural state and will include species such as tufted hair grass, meadow buttercup, Yorkshire fog, heath bedstraw, common sedge.

Dry dwarf shrub heath will be temporarily lost along the cable connection. Soils here are very thin and on a steep slope so stockpiling is unlikely to be possible. However, heather seeds and plants can be taken from this area using a soft strip approach to retain the vegetation. Seeds will be stored and used to germinate new plants. Where it is possible to dig up and store existing plants these will be healed-in to a storage area within the construction compounds until it is possible to replace along the working width. Along the centre and edge of the access track heather and bilberry will be planted. The resulting loss will largely be mitigated as there are patches of loose rock and substrate at the surface. The track with vegetation is likely to mimic this habitat post-construction and throughout the operational phase.

Seventeen trees will be removed to facilitate construction. Three trees will be along the edge of a small piece of downy bird and sessile oak woodland over a ravine above the river. The trees in the woodland themselves will not be affected (i.e. will be outside of a root protection area) but they do form a functional link. Further up the slope of the trees to be removed is open upland habitat. At the central area of the penstock where several trees are to be removed, these consist of larch, hawthorn, beech, horse chestnut, crab apple, ash and downy birch. Only hawthorn, downy birch and perhaps crab apple really reflect the nature of the upland ecosystem with the remainder appearing to be planted when the disused cottage/farm was still in use. Targeted tree planting at a rate of 3:1 will be implemented to a minimum of 51 trees. Species will include sessile oak, hawthorn, rowan goat willow and downy birch. Trees will be planted at irregular spacing of approximately 3m gaps requiring a minimum of 0.04 ha of space. Using the result of the habitat survey and site knowledge the locations identified in [Figure 7](#) will be suitable for planting small copses of trees to provide stepping stone connectivity throughout the development and local area without detracting from the open nature of the remainder of the site.

The remainder of habitat loss is improved grassland. This will be replaced upon completion of each section by restoring the grassland sowing from a local seed source or from an approved supplier. The composition will reflect the region and should include species such as yarrow, common knapweed, lady's bedstraw, oxeye daisy, salad burnet, selfheal, meadow buttercup, common sorrel, red campion, common bent, crested dogstail, red fescue and small cats tail.

12.3 Mitigation for water vole and watercourses

The streams to be crossed via the penstock pass through acid grassland, marshy grassland and improved grassland skirting the edge of the flush habitat. All streams are currently grazed up to the edges of the streams.

In order to avoid potential pollution impacts to soils, vegetation and watercourses from machinery used during construction, all refuelling and servicing of vehicles will be carried out within a designated area with an impermeable base away from any watercourses. To prevent spillages, refuelling will be carried out by pumping through a trigger delivery nozzle. Fuel, oil and other potential contaminants will be stored within bunded tanks to 110% of the volume stored and only the minimum quantity required will be stored on site. The designated area will be maintained in a secure and clean manner. An adequate quantity of oil absorbent material will be stored on site and spillages cleared up immediately. All construction equipment will be maintained in good working order and checked regularly for spillages/leaks.

For each under-stream crossing point a Reasonable Avoidance Measures (RAMs) approach will be taken. This will include:

12.3.1 Avoidance and protection

- All retained streams will be protected from construction activity, vehicle movements and storage of materials through the installation of fencing at a minimum distance of 5m from the top of each stream and bank to prevent encroachment into potential water vole habitats. The 5m stream stand-off distance will be adhered to where practical. Where an existing well-used track has streams either side in the 5m zone, the track will still be used for access.
- Access tracks to working areas, laydown areas and general construction activities will maintain the 5m buffer from each stream where possible.
- Where maintenance of a 5m buffer cannot be achieved due to the nature of the works, such as under-stream sections and creation of access road crossings, further measures will be implemented as described below.
- Silt traps will be installed in streams and watercourses which are affected by works to prevent materials being transported into adjacent habitats.
- Spill trays will be used to ensure that any spillages are unable to enter streams.
- Bunds will be created where working areas are adjacent to retained streams to prevent sediments and pollution being washed into the streams through surface run off.
- If any streams require to be emptied, prior to works (e.g. prior to loss of stream or during works within stream) settlement tanks and controlled outflows will be used.
- Wherever possible existing crossing points of streams will be used for use with temporary access routes. However, it may not be possible to avoid water vole habitats in every instance and mitigation is therefore required.

12.4 Pre-commencement water vole survey

- A pre-commencement water vole survey will be carried out between April and October in the year prior to commencement of works in each area. The survey will include all streams which will be directly impacted by works, or where a minimum 5m buffer cannot be maintained.
- The purpose of the survey will be to update the existing survey information and confirm presence and absence of water voles. It is possible that water voles may have colonised previously unused streams prior to the start of works.
- Where no water vole burrows are identified during the pre-commencement survey, vegetation control will be undertaken to dissuade water voles from colonising the working

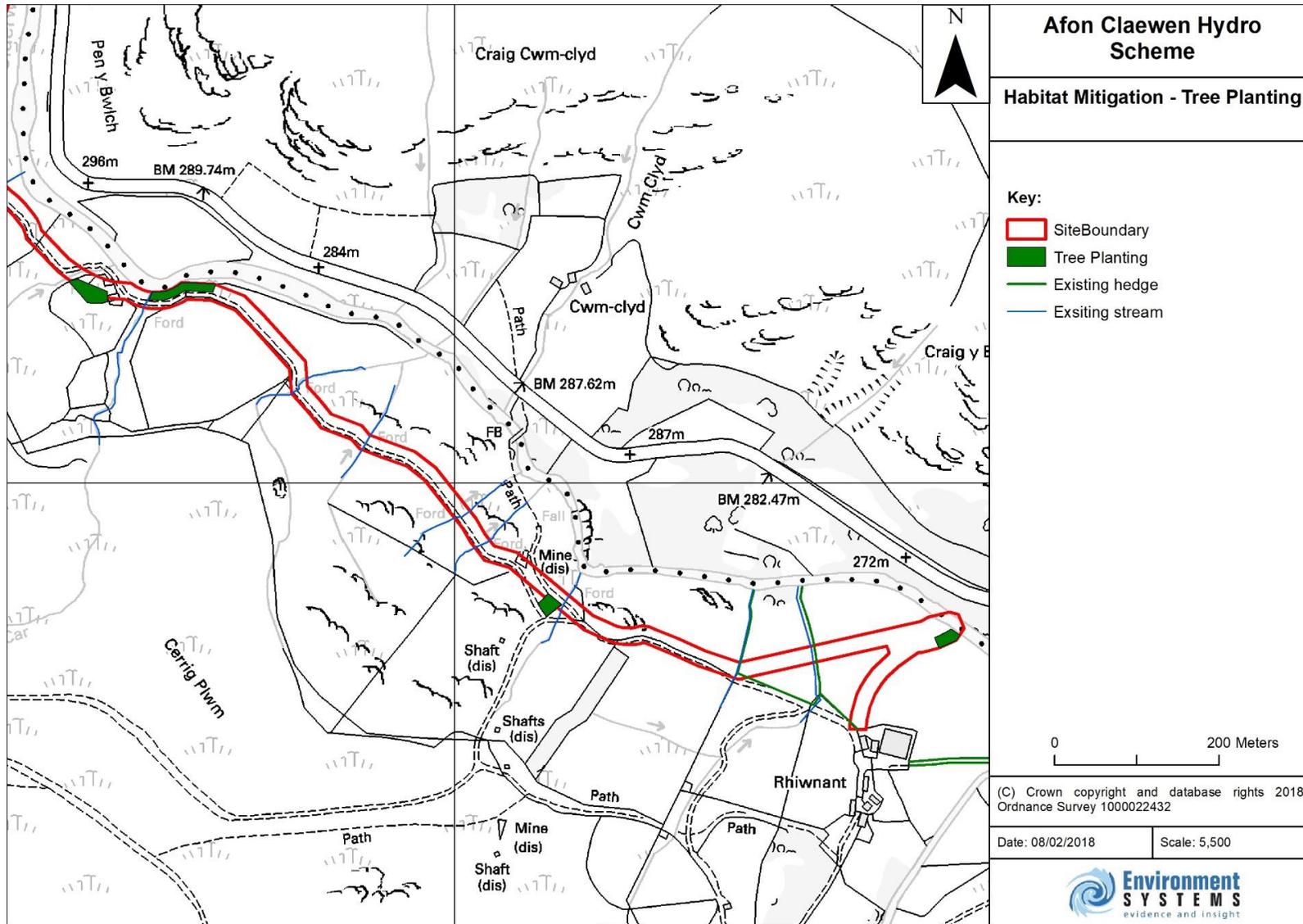
area prior to commencement. Vegetation in the stream and on both banks will be strimmed to bare ground to at least to the top of the bank. Where tall vegetation extends beyond the top of the bank, it will be strimmed to bare ground to 5m from the top of the bank.

Vegetation strimming in the stream will extend 5m up and downstream from the working area. Arisings will be removed from the cleared area and stored further than 5m from the top of the stream banks.

- Vegetation in the working area will be strimmed regularly to ensure that water voles are dissuaded from colonising the working area.
- Where water voles are identified in the stream or watercourse measures will be taken to ensure water voles are moved out of the area using either:
 - displacement methods; and
 - trapping and exclusion under NRW licence.

12.5 Displacement of water voles

- Water voles show high fidelity to their territories and only small areas sections of habitat are suitable for displacement of water voles. The Water Vole Conservation Handbook (WVCH) 3rd Edition 2011, (Strachan et. al) considers that displacement and vegetation management is appropriate for distances of up to 50m. Beyond this distance, passive displacement techniques are less successful, and sometimes there is a requirement to trap and translocate voles to a place of refuge, under a licence from NRW.
- No sections of ditch or water course longer than 50m will be affected therefore no licensed trapping is proposed.
- Prior to any displacement being undertaken, an assessment of adjoining habitat will be undertaken in order to ensure the suitability of adjacent habitat to support water vole. This will include consideration of water quality, existing water vole population and presence of predatory species. Capacity of adjacent ditch sections is unlikely to be an issue due to the short duration of the exclusion (3 weeks), because of pre-displacement vegetation control to stop water vole establishing territories or using the habitat as foraging ground and because of the relatively short length of ditch excluded.
- In order to be effective displacement methods must be implemented between late February and early April to ensure that animals are moved prior to young being born, after which moving animals using this method is unlikely to be effective



14. Figure 7: Proposed woodland planting areas

12.6 Mitigation for birds

The majority of the construction phase will occur during one year and is expected to last between nine and twelve months. The in-river works and works along the edge of the habitat prone to flooding will need to be completed in accordance with permitting. Therefore, works are likely to occur in the breeding season. There is potential therefore to contravene WACA by disturbing established nests of any bird species. Therefore, any works carried out during the breeding season must comply with WACA and an ECoW must be present to assist in managing the disturbance to breeding birds.

The ECoW will be present on site to check ahead of construction the working area and surrounds for nesting birds. Only where an area has been confirmed as absent of nests or significant parts of a breeding territory will construction be allowed to progress. Works to the river or along the banks will therefore need to be timed to start before breeding season begins to de-value the habitat or mid-July onwards (subject to yearly variations) once the majority of breeding has been completed. Where a nest is identified then a stand-off distance will be employed based on the species and movement within territory, where possible using industry standards (e.g. Ruddock and Whitfield, 2007). If it is not possible to do this, consideration will be given to screening working areas to make them less obtrusive to breeding birds or, as a last resort, adapting the work programme so that certain activities and working areas are avoided while breeding is taking place.

12.7 General mitigation measures for small mammals, amphibians and reptiles

The location of the works adjacent to the river and in the heath is considered to support small mammals i.e. mice, voles etc, amphibians and reptiles. However, surveys were considered likely to only return small numbers due to the small area of land take required in suitable habitats. In other words, the survey effort is likely to provide unrealistic results and mitigation measures would be as described below.

To ensure no harm comes to individual animals the most appropriate mitigation would involve a scheme of phased degradation of the vegetation within the development footprint. The purpose being to make these areas unfavourable for these species prior to the commencement of works. Vegetation would be removed by means of hand cutting and removal, under the supervision of a suitably qualified and experienced ecologist and following a detailed method statement including hand searches of habitat suitable for each species. There is plenty of suitable alternative habitat surrounding the working areas for these species to use, and the majority of the site will continue to be managed as present and therefore will be unaffected by the development. This approach will

also fit with the need to sensitively handle vegetation in these areas for restoration post-construction.

12.8 Mitigation for Mammals (including badger and otter)

Badgers and otters are known to be present in the area however no setts or holts were found within disturbance distance of the site. Commuting and foraging animals are therefore the only likely activities on the development site itself.

To ensure no take up of setts or holts between the submission of planning and the start of works an ECoW will undertake a pre-commencement survey within 100m of each development feature, for example ahead of the erection of the construction compound near to Rhiwnant Farm, before the access tracks are upgraded near wooded areas and streams and before the start of works on the intake weir. Where sett and holt features are found measures will be put in place to undertake further survey and define use and where necessary complete a derogation license to help facilitate the works.

Trenches or excavations will not be left open overnight and will be either boarded, fenced off at the end of each day or egress ramps will be provided.

Materials such as buckets, barrels of liquids and pipes will not be left uncovered and heavy objects will not be propped against built features or banks as otters and badgers are inquisitive mammals that are strong enough to push over these materials.

Any temporarily exposed pipe system to be capped when contractors are off site to prevent badger from gaining access.

12.9 Management and Enhancement

During the operational phase disturbance or damage to vegetation will be avoided during any maintenance works through inclusion in the HMP. The HMP will be prepared and will include the following actions:

- Management of the habitats and tasks to maintain these (i.e. replacement of dead saplings);
- Monitoring of heath and grasslands and appropriate revisions to management prescriptions;
- Management and eradication of invasive species through appropriate and legal techniques.

13 Residual Effects and Cumulative Effects

15. Residual effects after the environmental and compensatory measures referred to above have been taken into account are shown in

Table 13. This table refers to the construction and operational phases of the development only; the effects which will arise from the decommissioning (if required) of the development are considered to be the same as those which will arise during construction. Implementation of the mitigation measures outlined will avoid or minimise the potential impacts to the majority of the ecological receptors.

There are no known or informed development within proximity to the hydro scheme which will build cumulative effects. There will be a slight change in location (wooded habitats only) of habitats but composition and extent will be largely retained through development and implementing a HMP. Any forthcoming projects in the area, such as road improvements, can work in coordination with the HMP to be produced for the development to enhance semi-natural habitats.



16.

17. Table 13: Residual effects with mitigation

Receptor	Value	Effect	Character of Effect	Significance of Impact without Mitigation	Mitigation Measures	Residual Character of Effect	Significance of impact with Mitigation
Construction							
Elenydd-Mallaen SPA	Very high	Temporary land take of area of predominantly acid grassland within the SPA. No specific nest locations within close proximity and territories unlikely to be affected by construction works.	Negligible adverse	Slight adverse	Habitat retained and restored as detailed above post construction. Breeding bird ECoW to monitor surrounding habitats for presence of qualifying species and implementation of any specific measures at that time.	Negligible adverse	Slight adverse
Elenydd SSSI	High	Temporary land take of area of predominantly acid grassland with some marshy grassland, flush, wet modified bog and dry dwarf shrub heath within the SSSI. Limited displacement on breeding birds including those qualifying features of the SPA.	Minor adverse	Slight adverse	Implementation of best practice guidance from IAQM through CEMP to prevent smothering from dust. Breeding bird ECoW to monitor surrounding habitats for presence of qualifying species and implementation of any specific measures at that time.	Negligible adverse	Slight adverse



Elan Valley Woods SAC	Very high	Connection cable to be laid in the existing forest track within the two patches of the plantation woodland area of the SAC. Effects limited to low levels of dust caused by trenching and general vehicle movement.	Negligible adverse	Slight adverse	Implementation of best practice guidance from IAQM through CEMP to prevent smothering from dust.	Negligible adverse	Slight adverse
Elenydd SAC	Very high	SAC is isolated from the development and cable route. The hydrological connectivity is also isolated from the SAC as the development is lower in altitude. Features of the SAC absent from the project.	No change	Neutral	No specific mitigation necessary however, implementation of best practice guidance from IAQM through CEMP to prevent smothering from dust at the development site will remove any potential wind drifting dust.	No change	Neutral
Caban Lakeside Woodlands SSSI	High	Connection cable to be laid in the existing forest track within the two patches of the plantation woodland area of the SAC. Effects limited to low levels of dust caused by trenching and general vehicle movement.	Negligible adverse	Slight adverse	Implementation of best practice guidance from IAQM through CEMP to prevent smothering from dust.	Negligible adverse	Slight adverse
Caeau	High	Connection cable to be laid	Negligible	Slight adverse	Implementation of best practice	Negligible	Slight adverse



Penglaneinion SSSI		in the existing forest track within the two patches of the plantation woodland area of the SAC. Effects limited to low levels of dust caused by trenching and general vehicle movement.	adverse		guidance from IAQM through CEMP to prevent smothering from dust.	adverse	
Habitat general	Low-high	Temporary risk of pollutants (primarily dust) during construction	Minor adverse	Slight adverse	Habitats such as improved grassland, and bracken will be replaced like for like. Areas of meadow will be re-seeded with a more species diverse sward mix.	Negligible adverse	Slight adverse
Acid grassland incorporating Semi-improved acid grassland	Low	Acid grassland demonstrable example of diversity and condition found locally. Extensive acid grassland throughout the area which is well connected to further grassland and wetland habitats. Resurfaced and reseeded post-construction.	Minor adverse	Slight adverse	Grassland to be reseeded with suitable seed mix over retained topsoil. Species diversity to reflect existing acid grassland and to add species similar to local area to enhance further. No loss of long-term condition, diversity, connectivity or extent post-construction.	Negligible adverse	Slight adverse
Wetland habitats including Marshy	Medium-high	Direct temporary loss of marshy grassland, flush and wet modified bog. Uncertainty over quality of	Intermediate adverse	Moderate adverse	Turf removal and soil removal by specialist equipment. Storage in wet cell fixed with trickle water pump and gauzes/sheets to	Minor adverse	Slight adverse



grassland, flush and wet modified bog		reinstated grassland post-construction. Part of SSSI so assessed of high value for purposes of assessment.			prevent particulate loss. Turf/tussock marked and replaced like for like across marshy grassland area.		
Rivers and streams	High	The habitat and ability of species using/reliant on the river and watercourses where crossings are required is unlikely to be affected beyond disturbance and temporary displacement. Pollution risk through increased suspended solids and turbidity will be temporary during construction of the intake and installing the pipeline beneath stream bed. The in-river works including the stream crossings will be constrained by other permitting requirements and so has a temporary period of disturbance to the habitat and associated riparian species.	Minor adverse	Moderate adverse	Implementation of best practice guidance through a CEMP to prevent risk of spillages and increase in turbidity. Any effects will be temporary.	No change	Neutral



Dry dwarf shrub heath	High	Effects and impacts on dry heath assessed as part of Elenydd SSSI. Temporary land take during laying of the cable and reinstate afterwards.	Minor adverse	Slight adverse	Retained vegetation and seed stock used from existing vegetation (i.e. seed collection and retaining of plants). Track will mimic existing surface rocky habitat on steep slope. till a measurable change remains for a short-time frame.	Negligible adverse	Slight adverse
Semi-natural broadleaved woodland/ Scattered trees	Medium	Areas of scatted trees to be felled but trees not exemplar specimens. Sycamore and two ash trees slightly separated from birch and oak woodland to be removed. A number of trees close to the woodland and adjacent to the disused mine will be removed but will not affect the integrity of the woodland it	Intermediate adverse	Moderate adverse	Removed trees will be replaced with ratio of 3:1 trees located to provide stepping stone woodland patches. At least 20 years before similar habitat structure resumed so remains as some measurable change, i.e. minor adverse.	Negligible adverse	Slight adverse
Species-poor intact hedgerow	Medium	The two hedgerows will be severed by the penstock. However, they have recently been traditionally layed and currently provide a limited resource. The width of the	Intermediate adverse	Moderate adverse	Up to 16.5m of hedgerow to be lost. The gaps will be approx. 8m each meaning functional connectivity is retained. Each of the hedgerows is fenced either side meaning grass and shrub	Minor adverse	Slight adverse



		severance will be approx. 5m and as a will remove all woody vegetation. The retained length of the hedgerows will be reduced to 50m			layer can form. Deep rooting woody plants (i.e. trees) need to remain absent to protect pipe from damage. Functional feature of hedgerow will be maintained.		
Reptiles	High	Reptiles will be affected mainly in the dry dwarf shrub heath during the cable laying. This is short term and does not sever the habitat retaining integrity and allowance for movement of reptiles in the area	Minor adverse	Slight adverse	ECoW to supervise RAMs approach including habitat degradation to displace reptiles along this short section of cable route. Will be able to re-colonise post-construction.	Negligible adverse	Slight adverse
Birds	High	Disturbance and displacement through construction phase.	Minor adverse	Slight adverse	Measures to avoid breeding bird season outside of the in-river works areas will be implemented. ECoW to provide breeding bird survey to in-river works area and implement satisfactory barrier/exclusion measures. Breeding territories will almost certainly re-establish post-construction.	Negligible adverse	Slight adverse



Water vole	High	Disturbance through potential increase in turbidity (sediment) during short period of construction along tributaries and in slower part of the Afon Claerwen below the tailrace. Temporary risk of pollutants (fuel spillages) during construction.	Minor adverse	Slight adverse	Disturbance and pollution spillages remain but can be controlled by installing silt traps and spill kits. Implementation of RAMs to prevent disturbance, reckless displacement and mortality of water vole.	Negligible adverse	Slight adverse
Otter	Very high	No direct impact on shelter. Some temporary displacement during construction of the intake weir and tailrace. Temporary risk of pollutants (fuel spillages) during construction. Potential for getting trapped in open excavations.	Negligible adverse	Slight adverse	Disturbance during construction along pipeline route. Fencing and working hours will restrict noise and vibration at dusk/dawn and during the night. No lighting will be installed. Pathways to be retained during construction and general measures to prevent sheltering in compounds and excavations implemented through CEMP/ECOW.	Negligible adverse	Slight adverse
Badger	High	No known setts within development or within 50m of development. Limited field's signs but anticipated to be present throughout	Negligible	Slight adverse	Disturbance during construction along pipeline route. Fencing and working hours will restrict noise and vibration at dusk/dawn and during the night. No lighting will	Negligible adverse	Slight adverse



		the area. Disturbance therefore unlikely but potential for badgers to have to adapt commuting routes around the 200m sections of pipeline.			be installed. Pathways to be retained during construction and general measures to prevent sheltering in compounds and excavations implemented through CEMP/ECOW.		
Operation							
Elenydd-Mallaen SPA	Very high	No direct or indirect activities with the exception of routine maintenance will occur. Maintenance is by hand to clear coanda screens.	Negligible adverse	Slight adverse	None applicable	Negligible adverse	Slight adverse
Elenydd SSSI	High	No long-term loss of the SSSI interest features and ongoing land management will continue as prior to construction and operation.	Negligible adverse	Slight adverse	Habitat management and monitoring scheme to be implemented. Ongoing active management of wet modified bog, marshy grassland and flush to encourage species diversity and improving condition.	Negligible adverse	Slight adverse
Elan Valley Woods SAC	Very high	No ongoing management requirements along the cable route.	No change	Neutral	None applicable	No change	Neutral
Elenydd SAC	Very high	No ongoing management requirements in close proximity to the SAC.	No change	Neutral	None applicable	No change	Neutral



Caban Lakeside Woodlands SSSI	High	No ongoing management requirements along the cable route.	No change	Neutral	None applicable	No change	Neutral
Caeau Penglaneinon SSSI	High	No ongoing management requirements along the cable route.	No change	Neutral	None applicable	No change	Neutral
Acid grassland incorporating Semi-improved acid grassland	Low	Botanical diversity changes in marshy grassland, flush and wet modified bog habitat due to ongoing changes in soil quality and hydrology. Limited to area of wet ground.	Minor adverse	Slight adverse	Habitats will be restored and where possible enhancements have been sought. Ongoing maintenance through a HMP will be implemented to improve condition and diversity of SSSI features within the scheme boundary.	Negligible adverse	Slight adverse
Wetland habitats including Marshy grassland, flush and wet modified bog	Medium-high	Potential pollution spillage events but highly unlikely and will be localised to small vehicular oil, fuel and turbine lubricant spills. Effects will be temporary. Effects to rivers and streams are not anticipated as river flows will be maintained largely as they are at present and riparian zone					
Acid grassland	Low						
Rivers and	High						



streams		vegetation will recover.					
Dry dwarf shrub heath	High						
Semi-natural broadleaved woodland	High						
Species-poor intact hedgerow	Medium						
Reptiles	High	No direct or indirect activities with the exception of routine maintenance will occur and is not perceived to be greater than the current vehicular traffic using the existing Byway Open to All Traffic (BOAT).	No change	Neutral	Habitats largely restored with the exception of a small section of hedgerow. No loss of long-term breeding territories and species diversity. No barriers or foraging resource changes will be notable for badger or bats. Therefore, no change remains.	No change	Neutral
Birds	High						
Water vole	High						
Otter	Very high						
Badger	High						



14 Summary and Conclusions

The development with appropriate mitigation is deemed not to have a significant effect on any ecological receptor. Without mitigation it is possible that effects could result in distinct changes to habitat composition and condition and protected wildlife could be directly harmed. A specific section within the construction management plan or a CEMP is required and an ECoW will be employed to manage the ecological issues during construction.

There will be a minor impact to wet modified bog, marshy grassland and scattered trees with streams that cross the penstock temporarily adapted to facilitate construction which is located in the SPA and SSSI, however none are outstanding examples of these habitat types. Measures have been recommended in this chapter to retain the wet grassland vegetation and soils by keeping them wet during temporary storage. Once the construction is complete in this area, the soils and vegetation will be replaced without heavy compaction in order to replicate the movement and storage of water. The long-term effect is unlikely to result in distinctive botanical change.

The overall long term residual effect of the hydro development on the identified ecological receptors, based upon the full adoption of all mitigation measures proposed herein is assessed as slight adverse which is not significant in EIA terms.



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16 Fish

The presence of the Caban Coch dam downstream and the Claerwen Dam upstream of the proposed development have had a marked impact on the fish populations in the Afon Claerwen since their construction over 100 and 50 years ago, respectively. The presence of the Caban Coch dam means that the river is not accessible to fish migrating from the sea and, therefore, there is no possibility of a population of salmon and/or sea trout. The fish population is further impacted by releases of water from the Claerwen Dam, which discharges at its full 3.7 m³/s rate for approximately 50% of the time and has no discharge for the rest of the time and creates an artificially flow regime in the river. As would be expected under such upstream and downstream influences, the fish population is impoverished, compared to that observed in less modified but otherwise similar streams, and only low densities of brown trout (*Salmo trutta*), bullhead (*Cottus Gobie*) and minnow (*Phoxinus phoxinus*) have been reported as present by NRW and its predecessor, the Environment Agency.

The abstraction of a flow equivalent to that released from the Claerwen Dam will have the effect of naturalising the flow regime in the depleted reach, potential improving conditions for fish and the general ecology of this section of river, although any such improvement is unlikely to constitute a significant (positive) impact.

Considering the impoverished fish population, discussions with NRW and its predecessor confirmed that a formal fish pass is not appropriate. In order to allow fish to move upstream past the hydro intake a rocky-ramp fish easement will be constructed. The easement, in accordance with NRW's good practice guide for such structures, will have each "pooled step" no more than 100m high and will allow residual flow to pass through the pools.

Fish will be prevented from entering both the intake and outfall by suitable physical screens complying with NRW good practice guidance and subject to their formal approval.

Results from a fish survey carried out by NRW (formally EA)

Catchment	River Name	Site Name	10 Digit NGR	Site Code	Date Fished	Survey Type	Reason for Survey	0+ Salmon	0+lev1 Salmon Classification	>0+ Salmon	>0+ lev1 Salmon Classification	lev2 Salmon Classification	0+ Trout	0+ lev1 Trout Classification	>0+ Trout	>0+ lev1 Trout Classification	lev2 Trout Classification	Other species
Wye	claerwen	nt, U/S Nant y Wern	SN87683 62925	w065b	10-Aug-86	SQ	RJSMP	0	F	0	F	F	0	F	0	F	F	
Wye	claerwen	nt, U/S Nant y Wern	SN87683 62925	w065b	19-Aug-03	ME	RJSMP	0		0			1		0			
Wye	claerwen	nt, U/S Nant y Wern	SN87683 62925	W065b	08-Aug-08	ME	SAP	0		0			2		2			M

The Fisheries Classification System (FCS) used by the Environment Agency, classifies fisheries from A - Excellent through to F - Fishless

The system classifies fish both within the 2 age categories (0+ and >0+) - LEV1, and as a combined classification for salmon or trout - LEV2.

Please note that there are no classifications for the ME (5 min) surveys as they are in no way quantitative.

Q is catch depletion population estimate (Carle and Strub population density model)

SQ is the first run of a Q site (without the nets)

ME is a timed riffle survey (minimum estimate) presence absence

0+ or fry are those salmon and brown trout which were hatched in that year, i.e. not yet seen a winter.



>0+ or **parr** are those which have seen at least one winter. This usually includes 1+ and 2+ salmon but only includes 1 year old brown trout.

Adult brown trout are those fish older than 1 year old.

+ denotes that the fish was caught in the summer, i.e. still growing

Numbers are given as numbers per 100m² for both Q and SQ surveys. For ME surveys, actual numbers are given.

Reason for survey abbreviations:

SAP	Salmon Action Plan (part of the National Fisheries Monitoring Programme)
RJSMP	Regional Juvenile Salmonid Monitoring Programme (now called the National Fisheries Monitoring Programme)

For other species abbreviations:

BH	Bullhead	M	Minnow
BA	Barbel	MU	Mullet
BL	Bleak	RT	Rainbow Trout
C	Charr	RO	Roach
CB	Common Bream	RU	Rudd
CC	Common Carp	S	Stickleback
CH	Chub	SB	Silver Bream
CR	Crayfish	SH	Shad
DA	Dace	SM	Smelt
EE	Eel	ST	Sea Trout
FL	Flatfish	STL	Stone Loach
GU	Gudgeon	TE	Tench
GR	Grayling	L	Lamprey
PI	Pike	LB	Brook Lamprey
PE	Perch	LR	River Lamprey
		LS	Sea Lamprey

From these results in table the survey in 1986 found no fish at all, in 2003 1 non migratory trout and in 2008 only 2 non-migratory trout and 1 minnow where recorded as present in the Claerwen watercourse.



17 Noise

17.1 Areas and measures

Sources of noise emission from the scheme are as follows:

- Water discharge within turbine scroll case and to outfall
- Generator rotation
- Forced ventilation
- Electronics

Noise Level Data for the scheme is not readily available as, unlike other RE technologies such as wind turbines, each hydro power turbine and generator set up is bespoke and unique to the watercourse it utilises, with manufacturers not providing decibel data for the components. Additionally the significantly low noise outputs of modern turbines is such that manufacturers have not needed to establish noise data.

Noise caused by water movement and fall can be considered as identical to natural background noise of the watercourse. This has no detrimental influence on the surroundings and can therefore be discounted.

17.1.1 Generator

The generator is a high efficiency 3 phase model, with a likely peak efficiency of 95%, resulting in less energy losses to sound and heat. Three phase generators are also more compact than single phase models leading to smaller components which emit less noise. The moving parts of the generator are incased in a cast iron shell, and again is partially attenuated within the powerhouse.

17.1.2 Turbine

The turbine is incased in fabricated carbon steel scroll case which is then directly concreted and grouted into the concrete floor, meaning vibration is limited. The turbine is entirely sealed from the outside environment, barring necessary ventilation which remains within the powerhouse interior. Hence noise is already somewhat attenuated within the powerhouse.

The turbine type for this scheme will be high efficiency Francis, a reaction type turbine. Francis turbines rely on multiple guide vanes placed within a scroll case to alter the discharge volume of water. As they do not use spear valves then there will be no high pressure high velocity water noise as there is with turgo models (albeit to no great extent). Furthermore Francis turbines, being reaction type turbines, are not open to air in the sump. The draft tube exits the turbine and is submerged within the sump as it discharges water. Resulting in much less internal noise from the turbine being emitted to air and resounding down the outfall.

17.1.3 Walls

The wall construction is to be a 300mm cavity block wall with a further 50-100mm of larch cladding. The resulting wall thickness will measure approximately 350-400mm. This, and the mass of the wall, will serve to dampen vibration considerably and hence no additional measure of sound insulation is required.



17.1.4 Doors

Doors specified for the powerhouse will be custom made due to the necessity of requiring the correct aesthetics as well as the necessary level of noise attenuation. The doors will have an inner and outer skin and between this will be a centre of standard insulation to act as a sound attenuator as well as thermal insulation. All edges will be appropriately sealed as standard, creating a tight fitting door when closed, resulting in minimal noise emission. The measure above has been utilised on many of our schemes and has proven to be effective. A similar powerhouse is shown below from a 500kW scheme recently commissioned in Cumbria.



17.1.5 Ventilation Louvers

The Claerwen powerhouse contains 2 ventilation louvers. The pair of ventilation louvers are located in the main turbine room and are responsible for the attenuation of the majority of noise exiting the powerhouse as both vents are large to ensure adequate air flow to the scheme components.

The louvers will both have professionally made baffles specified and fabricated by ventilation and acoustic specialists. The louver at ground level will be baffled but passive, as shown in the image below:



The second louver, placed in the roof space, will be baffled but will also house a low RPM low noise fan linked to a thermostat, to force ventilate the powerhouse if temperatures rise above a certain figure. This can be site specific however the figure tends to be in the region of 25-30°C in order to protect electrical equipment. Such an arrangement is shown below:



The exterior aesthetic of the louvers can be seen in the image in section 2.4

17.1.6 Roof

The roof will comprise steel profile sheet, waterproof membrane, and an internal insulation layer, covered by a ceiling of plywood. The roof make up is such that attenuation of sound is high.

17.2 Rationale

Noise levels measured within a powerhouse in Scotland, on a 1MW Francis scheme with an air cooled generator, and electric fan ventilation system gave the following spread of octave band sound power levels:

Freq.	63	125	250	500	1k	2k	4k	8k	Hz
SWL	70	75	80	87	90	85	75	70	dB



The peak sound occurs at 1kHz and this is 90dB.

Attenuation modelling on previous schemes using measures as described above estimated that a noise reduction of 32dB(A) was possible. Implemented on the Claerwen scheme which would have a similar sound curve to the one above, would reduce the noise emission from the powerhouse to around 58dB(A), similar to the level of normal conversation at 1m.

Given the above mitigation measures to limit noise being emitted from the powerhouse, the noise level immediately outside the powerhouse is likely to already be at a low level. Further attenuation of noise emission will be achieved by the distance between the source and the recipient. This corresponds to a decrease of 6dB for every doubling of the distance between the source and the recipient, within open space. The close proximity to the watercourse and topography also have a beneficial effect on noise emissions the site having trees next to the watercourse, the noise of the watercourse itself and the upward slope to the South West all help reduce noise emissions travelling out from the powerhouse.

The nearest property is the tenanted farm cottage that is 210m up the hill above the powerhouse location. The distance of 1m from the powerhouse will double 7.5 times before reaching the properties, corresponding to a sound reduction of 45dB. Applying this reduction to the estimated attenuated noise of 59dB results in a residual noise level at the properties of 14dB. Background noise levels in a rural area are generally considered to be in the region of 30-40dB. The farm cottage has some large barns in front of it and this additionally shields any noise travelling from the powerhouse so the 14dB (which is already a nearly inaudible sound categorised as a quiet whisper/rustling of leaves) will be reduced into inaudible sound levels from this location.

Other residential properties are more than three quarters of a kilometre away, well beyond any noise emission capability even without the noise attenuation measures that will be employed.

17.3 Conclusion

Noise will be effectively attenuated at the powerhouse through the measures outlined above. Nearby dwellings will not experience any sound level close to or greater than those at background noise level.

18 Historic Environment

An Archaeology walkover survey was requested by CPAT and CADW during the scoping exercise, more was initially required by CPAT but withdrawn after further correspondence with CADW.

The walkover report is provided in the planning application, it led to the understanding the positioning of the items of historic interest and the pipe route was able to be updated subsequently as details in the walkover report addendum to minimise and avoid impact.

19 Cumulative & Residual Effects

This chapter assesses the cumulative effects arising should the scheme be developed.



15.1 Visual

The proposed hydroelectric scheme on the Afon Claerwen is located within the Elan Valley. The Elan Valley has seen significant development over the years in the form of water reservoir and other hydroelectric schemes. The proposed scheme itself is located between two reservoirs, the Claerwen reservoir is located upstream and Dolymynach reservoir is located downstream of the proposed hydro scheme. Along with the two reservoirs that the proposed hydroelectric scheme is amid the Elan valley has a larger network of reservoirs and dams. Within the Elan valley there are a total of six reservoirs, the Claerwen, Dolymynach, Caban-coch, Garreg-ddu, Penygareg and Craig Goch (see figure). Both reservoirs were constructed as water reservoirs for Birmingham built in the 19th and 20th century. The reservoirs have also been used to generate hydroelectric power since the late 1990's with the Claerwen rated at 1680kW, Caban coch rated at 950kW, Craig Goch at 480kW, Pen y Garreg at 810kW and Foel Tower 300kW.

The Claerwen Dam that is located roughly 2km upstream of the of the proposed hydroelectric scheme intake. The Claerwen dam stands 56m high and 355m wide which holds back a total of 48,300,300m³. The dam itself is constructed from concrete but its face is clad with stone.

The area has had previous industrial development in the form of the Claerwen dam which was a significant variation to the natural landscape and is now a major landscape feature. However, run of river hydropower is favored for its low key visual impact, post construction, compared to other renewable energy technologies. Most run of rivers scheme can only be seen in their immediate vicinity (unlike the dams with are not run of river).

The proposed development is far more modest in scale in terms of the weir crossing the Afon Claerwen than the Claerwen reservoir dam and will not be visible from the vast majority of the landscape as its low profile is obscured by vegetation and topography. Given the dissimilarity between the Afon Claerwen dam and this form of intake, as well as the general small scale form of the intake and its remote location, we cannot consider the two as having a combined significant cumulative visual effect on the area.

The powerhouse will be more prominent structure and will be located in agricultural land that can be seen from the other side of the valley on an unclassified road. Vegetation will help obscure the powerhouse structure to some degree but the structure would will not be completely hidden. However, the power house structure will be located below a farm that has a number of agricultural buildings. An additional to this there are a number of buildings located all along the Elan valley and along the unclassified road mentioned before. Given that the power house would be clad with locally sourced timber to give an authentic look it is unlikely that the powerhouse would be prominent in the environment.

Previous chapters note that the grid connection will not require any overhead lines to be installed and therefore no cumulative effects will be caused by the grid connection.



15.2 Ecological

Cumulative effects on the ecology of the area are likely to be negligible and in some cases introduction of a hydroelectric scheme may be beneficial. The proposed hydroelectric scheme will be placed downstream of the Dolmynach and Caban-coch dam. These two dams provide an already serious preventative for fish migration up the watercourse. Along with the two dams that are located downstream of the proposed hydroelectric scheme there are two waterfall located within the derogated reach which would add to the fish migration difficulty as they are total barriers to fish passage. Operation of the proposed hydroelectric scheme will also be governed by the release of water from the Afon Claerwen. Release of water from the base of a large reservoir like the Claerwen holds two problems to the ecology.

The first problem is the lack of oxygen with in the water that is released. Still water from the base of any reservoir hold less oxygen that turbulent surface water. The reason for this is that turbulent water can dissolve oxygen from the atmosphere which can have the beneficial effect of increasing biodiversity. Having the low oxygenated water pass over the intake and pass through the turbine would increase the turbulence of the water course and in turn increasing the oxygen levels.

The second problem is the temperature of the water released from the Claerwen reservoir. The greater the reservoir of water is the more constant the temperature becomes all year round. Because of this the water released from a reservoir may have differ from the natural seasonal temperature of the watercourse. This can have a significant effect on the biodiversity affecting the insects and aquatic breeding and migration patterns. The addition of a hydroelectric scheme will slightly reduce the volume of non-ambient temperature water through its derogated reach providing some small benefits to ecology.

15.3 Hydrological

Water that is discharged from large reservoirs such as the Claerwen have reduced temperatures, and lower levels of oxygenation due to water being discharged from deep still areas of the waterbody.

To avoid cumulative impacts the proposed scheme must improve the hydrological conditions of the watercourse arising from Claerwen reservoir or have no further degrading effect.

The proposed development abstracts surface water which then flows through approximately 2km of buried pipeline. Temperatures below ground are still affected by seasonal air temperature variations down to ~3m deep, but remain more stable than surface temperatures. In a warm season the ground surrounding the pipeline is likely to be warmer than the water in the river recently discharged from Claerwen reservoir. Theoretically the pipe itself will transfer the heat from the surrounding ground to the abstracted water and will hence help to marginally raise the water temperature before being discharged back into Afon Claerwen at the outfall.

High levels of dissolved oxygen in water is beneficial for the biodiversity of the watercourse. Oxygenation occurs through aeration of water. The proposed scheme oxygenates the water at several points; at the intake weir, at the turbine, and the outfall.

At the intake weir water either drops into the residual flow chamber, through the screen, or over the screen entirely when the river is in high flows. In all cases the water undergoes significant turbulence and aeration which adds dissolved oxygen. Evidence of this can be seen at many operational hydropower sites using the similar screens with the weir creating a 'waterfall'. Abstracted water is aerated again as it cascades down the riprapped trapezoidal channel of the outfall before being discharged to the river.



The residual volumetric flow in the river becomes less due to the abstraction to the turbine. This creates numerous channels and thin sheets of falling white water over boulders and gravels, rather than larger more solid columns of laminar flow which pass over boulders without causing aeration. Resulting in the derogated reach also improving in oxygenation ability.

The cumulative effect on hydrology is therefore likely to be positive. Mitigating the effect of Claerwen reservoir dam by very slightly improving temperature, whilst also improving oxygenation.



20 Appendix

Appendix 1 - Craig Y Mynach Cable Installation Method Statement



ELLERGREEN

hydro

**Afon Claerwen Hydro
Scheme**

**Cable Install Craig Y
Mynach Method
Statement**

**Hydropower Consultancy &
Development**



Document Control

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21 General Description of Works

This method statement covers a section of the installation of HV electrical cable from the hydro scheme powerhouse to the connection point. The section is between sd3559950 and sd2934089r as shown on fig 1 below.

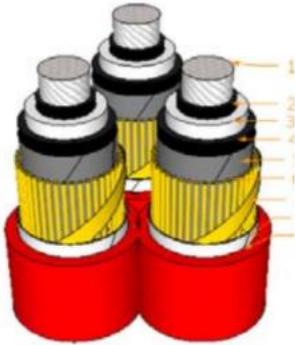


Fig 1 cable route shown in red, the area this method statement applied to is within the red ellipse.



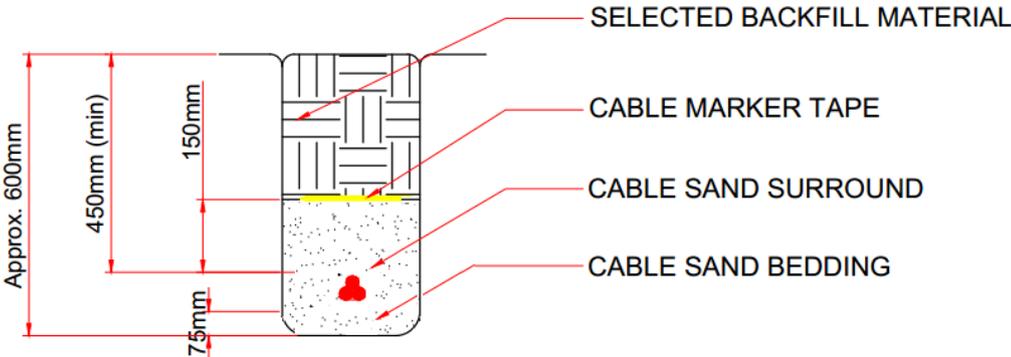
Fig 2 route of cable shown in red, cable to be fully buried

The cable is XLPE armoured electrical cable, the is a Triplex Cable with Aluminum Conductors , XLPE Insulated , Copper Wire Screened and PE Sheathed 6.35/11 kV. The cable is made up for 3 assembled cables and the overall external diameter will be approx 60mm



The cable is designed for direct buried with no duct.

Trench Profile



The cable is to be buried with 450mm of cover and to include sand surround (bedding) and marker tape (HV cable safety tape). The final cover will be backfill from the material excavated for the trench. The trench will be approx. 300mm wide.

The installation over this area is expected to be carried out within 1 week from start to finish. The aim being to not leave the heath excavated for any prolonged period, enabling the set aside top soil to be no left aside for any extended periods.

22 Method Statement

1	Site Preparation
1.1	Peg out and mark cable route
1.3	Cable to be housed in large reel on stand, positioned in the layby adjacent to the location where this route starts.



1.4	Lay out cable adjacent to the route (on the uphill side) placed on the ground
2	Excavation/ Cable laying
2.1	Work along route with mini excavator (7 ton or similar with rubber tracks), strip top soil and set aside ready for reinstatement. Excavate out approx. 30m long section. 
2.2	All loose material removed from dug trench to be set aside adjacent to the trench.
2.3	Place cable into length of trench, add sand bedding as necessary
2.4	Back fill with excavated material
2.5	Reinstate top soil
2.6	Move onto next 30m section working up route. Finally end with machine at top entrance to planted woodland. Machine to leave heath travelling into woodland rather than disturbing the reinstated route



Appendix 2 - Afon Claerwen Hydro pipeline and public byway track



Afon Claerwen Hydro Pipeline and Public Byway Track

The hydro project at Afon Claerwen consists of an intake, buried pipeline, powerhouse and outfall. The pipeline transports the water from the intake down the hillside to the powerhouse. The power is produced from the potential energy in the water created from the elevation difference between the intake and the turbine in the powerhouse. The pipeline is therefore a pressure pipeline full of water when the scheme is operational. The pipeline route follows the track which is a public byway. The diameter of the pipeline is 1.8 meters and it will be buried with a minimum of 1m cover from the crown of the pipe to the ground surface. Therefore minimum excavation depth will be 3m. In areas the pipe will be deeper to smooth the gradient where the ground level is undulating. Installation of the pipeline involves an open cut trench excavated with large machinery, the route will have a soil strip which includes set aside of surface soil for reinstatement, access for the machinery alongside the trench. In general terms the pipeline will be located to the side of the existing track and the existing track will be the access for the machinery alongside. A quite significant amount of works will occur to the track during construction, it will be widened, in areas benched into the hillside to be flatter and filled with gravel where necessary. In some areas the track dips and is often below the water table in these locations, the track gradient will be made more consistent with infill (using site won material) and surface gravel. In areas like this and other areas the surface water conditions will be managed using suitably sized culverts to enable water to pass across the track without eroding the track surface. In certain areas the culverts will need to extend or meet cut trenches to enable water to flow downwards away from the track surface.

Once the pipeline is installed the track will remain an access route for any intake works not completed ahead of the pipeline install itself.

Post construction of the hydro scheme infrastructure, reinstatement and restoration works will take place. The track will be a long term maintenance route for the intake and pipeline which both require zero planned maintenance but both may require adhoc (albeit rare) machinery access for repair work in the long term. Therefore it is beneficial to the project to reinstate the track in a condition that it appropriate for the long term condition of the track to remain usable by 4x4 and tracked excavator. The track currently is maintained by the council and requires quite significant maintenance due to erosion and waterlogging at various locations. The works are to be engineered to overcome and reduce the factors that cause damage and erosion over the course of time, a lot of the works for installation of the pipeline already make significant improvements and the improvements that are suitable to retain will be retained and further improvements made during the restoration phase at the end of the construction works.

The restoration works are to keep in mind that range of users of the track, which include mountain bikes, quod bikes, motocross bikes, walkers and 4x4 off road vehicles. The track is important access for the tenant farm as well. Some users of the track will desire a really uneven and broken up surface, this has to be balanced with other users looking for ease of access. In summary the surface of the track will be similar to how it is now with a mixture of bedrock and stone and gravel. The main difference will be a smoother overall gradient and no longer significant areas of pooling water. The improved drainage will mean less potholes on the tracks surface than are currently present.