Results of Desk-based Assessment & Walkover Survey at

Afon Cwm Mynach, Near Dolgellau





C.R Archaeology Compiled by M. Jones & C. Rees on Behalf of NB Hydro Services

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Archaeolok

Walkover Survey Conducted by Matthew Jones Historical Research Conducted by Matthew Jones Report Written by Matthew Jones & Catherine Rees

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1.0 Introduction

C.R Archaeology have been instructed by NB Hydro Services to conduct preliminary archaeological works at Afon Cwm Mynach, near Dolgellau. The river is proposed for the development of a run of a micro hydro scheme for the generation of electricity. There is an existing hydro scheme at the site which has fallen into disrepair and the proposed project intends to re-use elements of the existing infrastructure. Details of the project are included as Appendix A.

This document has been prepared to outline works which will supply the Snowdonia National Park Authority Archaeologist with information as to the potential archaeological impact of the scheme.

A specification (CR42-2013) was written following a discussion with Snowdonia National Park Authority Archaeologist John Roberts (4th July 2013) as a methodology for an initial programme of works. It was intended that the results of the works outlined in this proposal inform decisions as to the necessity and/or nature of any further archaeological mitigation strategies which may be required.

The development area (figure 1) is situated in a small north-south orientated river valley and terminates at Borthwnog Farm. It runs along the old parish boundaries of Llanaber and Llanelltyd, within the county of Gwynedd and is located within the Snowdonia National Park and RSPB Nature Reserve. Figure 2 details the route of the proposed works.

Archival research identified substantial Post-Medieval mining activity within the valley, although little evidence was uncovered as to earlier land use. This was confirmed during the walk over survey where the remains of a number of substantial industrial structures were recorded.

The route of this scheme has been designed so as to minimise the breaking of virgin ground and to avoid standing structures. The topography, wooded nature and limited soil depths in this area have all contributed to it being assigned a low potential for archaeological activity pre-dating the use of the valley by extraction industries.



Figure 1. Site of Afon Cwm Mynach, Near Dolgellau. Location Map (Source: OS Open Data Mapping. Contains Ordnance Survey data © Crown copyright and database right [2013])

Figure 2. Route & Details of Proposed Scheme



2.0 Project Aims & Objectives

The programme of works proposed for Afon Cwm Mynach aimed to undertake a desk-based assessment and walkover survey.

The first aim of this scheme of works was to undertake desk based historical research exploring the history of the site. This information included a map progression and archival research and this has been utilised to compile a coherent narrative history of the site.

The Gwynedd Historic Environment Record (HER), the Royal Commission of Ancient and Historical Monuments Wales (RCAHMW) database, Dolgellau Archives, Bangor University Archives, Caernarfon Archives and publications were all consulted to compile a record of known archaeological sites in the vicinity.

The second aim of this archaeological investigation was to undertake a walkover survey of the site and to assess the survival of any above ground archaeological remains (i.e. earthworks and standing structures).

It is intended that this document be utilised to inform further archaeological planning decisions and conditions at the site.

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3.0 Scheme of Works - Methodology

The Afon Cwm Mynach works were conducted in two sections and each is detailed separately below.

3.1 Desk Based Research

A complete and coherent history of the site was compiled utilising material sourced from local archives. Due to the diverse range of material available – in particular with relation to mining activities – Dolgellau, Bangor and Caernarfon Archives were all consulted. This allowed as comprehensive a history as possible to be compiled. A full map progression of the area was undertaken and where appropriate the archive information was supplemented with information from local libraries and specialist interest websites & journals.

In order to identify the character of archaeological remains in the vicinity of the site a search of the Gwynedd HER was conducted examining an area within a 500m radius of the proposed route. As this covers a linear area a corridor of 500m around the central line was investigated rather than an area within a 500m radius of a central grid reference.

The RCAHMW database and the commission's survey of the area was also consulted. The information collected is discussed within the main report text.

The works were carried out accordance with the IfA Standards and Guidance for historic environment desk-based assessment (www.archaeologists.net).

This material forms the historical background for this archaeological report. This report also includes the results of the walkover survey.

3.2 Walkover Survey

A walkover survey of the proposed route of the works was undertaken by Matthew Jones of C.R Archaeology on the 8th July 2013. This work consisted of:

- 1) The route of the proposed works was walked and an examination made of any visible archaeological remains, in particular standing structures and surviving earthworks
- 2) A photographic record of the route was created showing the general character of the area and detailed photographs with an appropriate scale were taken of features of archaeological

interest. The locations of photographs taken were noted on the site plan. The measurements and location of any features were recorded on an annotated site plan and in notebook form.

The works were carried out accordance with the IFA Standards and Guidance for historic environment desk-based assessment (www.archaeologists.net).

3.2.1 Equipment

The photographic record compiled during the walkover survey was undertaken using a 14.2 megapixel Sony A350 digital camera with a variety of standard and other lenses. Images were captured in RAW format for later processing into high resolution JPG and TIF files.

3.3 Health and Safety

A risk assessment was conducted prior to the commencement of works and site staff were familiarised with its contents. A first aid kit was located in the site vehicle.

3.4 The Report

This report clearly and accurately incorporates information gained from the programme of archaeological works. It presents the documentary evidence gathered in such a way as to create a clear and coherent record. The report contains a site plan showing the locations of photographs taken.

It is intended that this report will inform decisions as to the necessity and/or nature of any further archaeological mitigation strategies which may be required.

A copy of the report in Adobe PDF format will be sent to the appropriate monitoring archaeologist for approval before formal submission. A bound paper copy and PDF digital copy of the report will be submitted to the Snowdonia National Parks Authority Archaeologist as part of the formal submission. A digital Adobe PDF version and a bound paper copy of the final report will be lodged with the Gwynedd Historic Environment Record within six months of completion of fieldwork. PDF versions of the report will also be lodged with Dolgellau Archives and the RCAHMW.

3.4.1 Copyright

C.R Archaeology and sub-contractors shall retain full copyright of any commissioned reports, tender documents or other project documents, under the Copyright, Designs and Patents Act 1988 with all rights reserved; excepting that it hereby provides a licence to the client and the local authority for the use of the report by the client and the local authority in all matters directly relating to the project as described in the Project. copyright c.R.Archaeology

4.0 Geographic and Geological Context

4.1 Topography

The site is located on the Afon Cwm Mynach, a tributary of the Mawddach, which flows into the north side of the estuary approximately 3km to the west of Dolgellau. The site is located along the boundaries of the old parishes of Llanaber and Llanelltyd in the county of Gwynedd and lies within the Snowdonia National Park. It is situated within a steep sided, wooded valley with areas of bedrock visible at surface level in several places.

The starting point of the scheme is approximatively 850m (Grid Ref SH 68862 19640) north of the A496 and terminates in the yard of Borthwnog Farm (Grid Ref SH 68946 19143),

4.2 Geology

The bedrock geology of the site (at a scale of 1:50 000) is described as "Maentwrog Formation -Mudstone, Siltstone And Sandstone. Sedimentary Bedrock formed approximately 495 to 518 million years ago in the Cambrian Period. Local environment previously dominated by open seas with pelagite deposits. These rocks were formed on a deep ocean floor beyond the influence of land. They often consist of fine material from microscopic pelagic organisms" (www.bgs.ac.uk).

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5.0 Archaeological and Historical Background

Research was conducted at the Dolgellau Archives, Bangor University Archives and Caernarfon Archives. The records held for the parishes of Llanaber and Llanelltyd were searched along with the Borthwnog Estate and mining records for the area. Relevant information from these searches is included below. Where the exact location of findspots/sites are unknown this information is included only if it is felt relevant to provide an indication of the archaeology of the area.

A search of the Gwynedd Historic Environment Record was conducted on the 11 July 2013. An area covering a radius of 500m from three points along the proposed development was examined.

5.1 Prehistoric

No archaeological findspots or sites of a Prehistoric date were recorded on the GAT HER within the study area. A Historic Landscape Characterisation was carried out by the Gwynedd Archaeological Trust (GAT Report 537: 59). This report identified no prehistoric activity within the area which was recorded as Parcel 08 Forestry, Cym yr Whin (PRN 19187).

5.2 Romano-British

No archaeological findspots or sites of a Romano-British date were recorded on the GAT HER within the study area. A Historic Landscape Characterisation was carried out by the Gwynedd Archaeological Trust (GAT Report 537: 59). This report makes no mention of Romano British activity within this area which was recorded as Parcel 08 Forestry, Cym yr Whin (PRN 19187).

5.3 Medieval

The name of valley and river Cwm Mynach is stated as meaning 'Monks Valley' and is thought to have come from the ownership of the valley by the Cistercian monks of Cymmer Abbey (RCAHMW 1921: 50). It is not know when the name came into common usage but it appears on the first edition Ordnance Survey Map of 1886.

The GAT Historic Landscape Characterisation (GAT Report 537: 59) records this in a little more detail stating that the land was owned and farmed by the monks following the granting of a charter by Llywelyn in 1209 as part of the demesne attached to the abbey itself.

5.4 Post-Medieval

The majority of the archaeological evidence for the study area dates from this period and the Post -Medieval township of Tai-Cynhauaf (NPRN 413951) has been identified within the valley. This township was developed in association with the mining and industrial activity in the area.

The 1843 Tithe Map for the area records limited settlement and the field boundaries shown are considered very unlikely to pre-date the Post-Medieval enclosure of the Ffrîdd. Many of these field boundaries are masked by the current tree cover (GAT 537: 59). The lack of information contained on the Tithe does not allow the exact location of the proposed works to be identified and therefore these maps have not been included in this document.

The area to the north-west of Dolgellau is famous for its copper and gold mines, although other minerals such as lead, zinc and manganese were also extracted. The remains of these industries including sounding tunnels and shafts are found throughout the valley. The focus of this activity was predominantly situated in the Vigra and Clogau mountains (Williams 1980).

Although a number of sources indicate a possible earlier origin to many sites, mining records for the area survive from the 1860's and chart the continuation of industry throughout the nineteenth century, detailing the rise and fall of the different mining companies (GAT Report 291: 140).

Major periods of investment were evident throughout this time and usually followed the formation of a new company. In 1880 The Clogau Mining Company was formed with an investment of £30,000 and in 1888 Clogau Gold Mines Ltd was formed following a further investment of £50,000. At this time the mine employed around 25 men. The company was re-invented as the St David's Gold Mine in 1903 with an investment of £60,000. (Williams 1986:43-46).

Between 1919- 1920 the Clouge Mine was being worked by the Garth Gell Exploration Company which was later bought out by the Hillide Mining company. The period after the second world war saw the mineral rights for the area being passed through a succession of different companies and owners. Eventually the mines were taken over by an Australian company who floated the Clogau Gold Mines P.L.C on the stock market (Williams 1986:43-46).

This rich industrial history has left a legacy of standing buildings and associated structures including mines and exploration soundings along with numerous culverts and drains. A search of

the GAT HER resulted in the identification of the remains of a number of separate mines within a 500m corridor of the proposed development. These were: Maes Tryfer Mine (PRN 20593), Hendreforion Mine (PRN 20632), Cesailgwm Mine (PRN 20637), Tynycoed Mine (PRN 21908) and Cambrian Taicynhaeaf Mine (PRN 20592). Details of these features are included in Appendix B.

Of particular significance to this scheme is the Garthgell mine (NPRN 34127, PRN 21804) and associated structures, some of which lie along the path of the proposed works. Garthgell was a small and unsuccessful mine. It was worked for several years in the 1860s, and was reopened at the start of the 20th century on the strike of various lodes on the west bank of the Cwm Mynach river. Several short adits were driven, including two on the eastward extension of the Clogau St David's lode. Mineralisation was poor and the only recorded output, dated 1900, was 5 ounces of gold being produced from 26 tons of ore. Other associated ore minerals include chalcopyrite, pyrite, sphalerite and galena (www.mindat.org).

A description of the site is given in the Gwynedd Metal Mines Survey (GAT Report 291). The site is currently overgrown and some of the elements detailed in the survey could not be identified during the Walk-over Survey section of the works. "*The underground workings for this mine were accessed by adits and shafts. Adits were noted by the side of the pathway at SH68791939 and SH68822001. Some lodes were worked near the confluence of the Afon Cwm Mynach with the Nant Cesailgwm, and there is a possible shaft in the back garden of the dwelling Llwyntryfer at SH68941992. A further shaft is marked at SH69071991. An adit at SH68901990 may have been purely for drainage as it does not seem to have fed the transport system to the mill" (GAT Report 291: 140).*

The Coed Garthgell Dressing Mill (also recorded under NPRN 34127, PRN 21804) lay along the western side of the river and the access trackway runs between the mill levels. This mine processing site is described as "the site of a mill believed to date from the 1860's. It is bisected by the pathway, partly overgrown and partly made into a picnic area. Nevertheless, it is possible to see that it operated on five floors. A rock-breaker fed a battery of stamps; base metals were dressed on five round buddles on the lowest floor, which survive, and measure 4m in diameter, and Mosheimer Pans were also used" (ibid). These buildings appear as un-named structures on the 1901 Ordnance survey map (see Figure 4).

Also associated with the dressing mill were a steam engine and water-wheel. These were offered for sale in 1873. GAT records water-wheel pits to the north and south of the mill area. Also surviving are the pipe and leat which form part of a feed system which abstracted water from the Afon Cwm Mynach. A further pipeline is also recorded as carrying water south from the mill on a shelf-like formation built up with stones where the pipeline passes under the path (GAT Report 291: 140).

The aforementioned trackway which it is intended will be used as an access route possibly has historic origins and it is recorded that the current pathway may have represented the main haulage route of the mine (ibid).

A further small, possibly domestic, structure is also noted as part of this building complex. It may have served as a barracks or in an ancillary function. It was a one-roomed structure which was accessed by a ramp from the road (ibid).

The final ancillary structure noted in association with the Garthgell Mine is a substantial smithy located at SH68852004 (PRN 12186). This is to the north of the previously discussed building range and although it falls just within the HER search radius it is not located along the route of the proposed scheme and lies outside the development area. It is described as "*a substantial and attractive smithy. It has a central doorway in both longitudinal walls and flanking windows. The hearth is situated at the eastern end. An unusual feature is the apron roof over the doorways, supported on two pillars in each case. The roof timbers mostly survive and some slates remain"* (ibid).

In addition to the mines and associated industrial buildings were two further Post-Medieval sites – both of which were standing buildings. Soar Chapel (NPRN 8463) is a Calvinist Methodist Chapel and survives as a modern home to east of the starting point of the development. It was built in 1846 and was altered and re-roofed in 1886 both these periods of building corresponded with major periods of mine investment and the chapel was likely erected to serve the spiritual needs of the mining community (www.coflein.gov.uk).

The final structure is a small Hydroelectric pumping station used to supply the country house of Nant y Garreg (NPRN 403003). The entry for the structure is as follows - "Hydroelectric pumping station to supply country house of Nant y Garreg, comprising single concrete pipeline surviving alongside east side of river, drawing water from further up stream, and delivering to small flat-

roofed pumping station with controls and dials intact in the late 1970s. Pumping station survives alongside old gold mine adit" (www.coflein.gov.uk). This feature is discussed in the following section.

The cartographic evidence for this area is limited and the above ground workings could not be located on estate maps or sources in addition to the Ordnance Survey. Dolgellau Archives held only a limited selection of Ordnance Survey Maps of this area and did not hold all pages of the First Edition (dated 1886). Only the section covering the lower (southern) portion of the proposed work could be found and is included as Figure 3. This map shows the river and woodland much as it appears today. It also shows Borthwnog Farm and the route of the trackway. The mine buildings although standing at this time would have been shown on the sheet to the north of that provided as figure 3.

The same section of the Second Edition Ordnance Survey Map dated 1901 (Figure 4) showed little change from the 1886 Edition. The upper sheet (included in Figure 4) does however show a number of the Garthgell buildings discussed in the text above including the mill and smithy.

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6.0 Results of Walkover Survey

The scheme begins approximately 850m to the north of Borthwnog Farm. The proposed route runs on an approximate north-south axis along the western side of the river valley ending the yard of the aforementioned farm. The route has been photographed and the results are included as Plates 1-XX. Appendix C shows the location and directions of the photographs discussed in the text.

The proposed route begins at the site of an existing weir. This structure was formed of two stone elements which are located at a river confluence where a tributary joins the Afon Cwm Mynach (see sketch plan included as Figure 5).

The first structural element was a dry stone wall which had been constructed using large blocks of local stone up to 1.5m in length (Plates 1-5). One segment of the wall was built at a right angle to the water flow (east-west axis) and was located between the two streams. There was a gap in the east-west element but this was thought to be due to erosion by the river rather than being a deliberate characteristic. This section of the weir has been damaged by trees and is covered in moss but is in good condition. There was a return which was orientated north-south and ran upstream. Due to the dense vegetation it was not possible to determine the length of this wall beyond approximately 9m.

Approximately 0.5m downstream from the east-west wall was a second stone structure (Plates 6-7) orientated on a north-east – south-west axis. This is probably best described as akin to a series of closely spaced stepping stones rather than a wall as such as it was a single course in height.

The date of these features is unclear and although they are not marked as a weir or stepping stones on the 1901 Ordnance Survey Map there does appear to be a structure at this juncture of the river. It is not know whether the reason for this is that it had fallen out of use by this time or that it did not yet take its current form. It is therefore not possible to ascertain whether the feature is associated with mining activity or the previous hydroelectric scheme.

The original proposal states that this feature will be rebuilt in reinforced concrete and this course of action would involve damage to much of the original structure. This has however been revised – see section 8.

The pipe then runs along the western edge of the river and joins an existing disused open leat (Plate 8). At the point where the leat starts a small stone built wall was identified (Plate 9). This structure was approximately 1m in height, 0.75m in width and ran for a distance of 1.4m. It was orientated on a south-west - north-east axis. The feature was of rough construction with irregular coursing and a large moss covered stone had been used as capping. It is unclear what the function of this feature was but it is believed to be of a Post-Medieval date and associated with the leat.

The first section of this open leat is approximatively 2.5m in length and was filled with degraded leaves and soil. This short section stops at a small sluice gate with two cast concrete posts (see Plate 8). The remains of a wooden door with iron fittings can be seen in the closed position under the organic fill.

A roughly constructed dry-stone wall leads from the point of the sluice gate and forms the eastern edge of the leat. A ceramic pipe was laid from this point (Plate 10). This section uses a system of split pipes which contain an above ground element which is thought to have been used to prevent blockages. The pipe joins the open leat and continues for a distance of c.50m and passes an old mine entrance (Plates 11 & 12).

This tunnel is more than likely associated with the Gold Mine level marked on the 1901 Ordnance Survey Map. There was rough stone walling leading from the entrance of this tunnel which was thought have been utilised to direct water from the mine into the leat. The open leat is channelled into a pipe bridge which is used to span a gap (Plate 13). This pipe is made from strengthened fibres and is clearly damaged.

The pipe rejoins the open leat which runs along the eastern side of the public footpath parallel with the river for a distance of approximately 100m. At this point the leat crosses the public footpath and is raised to run along the hillside. The remains of a number of structures associated with the mining/processing activities (NPRN 34127) are located to the east of the pipe line and are on either side of the public footpath. The footpath/trackway which is to be used for access has been noted in GAT Report 291 (Page 140) as possibly representing the main haulage route of the mine.

These remains are stepped over four levels with the footpath running between the upper and second tier. The upper tier is a stone revetment obscured by vegetation which runs parallel to the path (Plate 14). The second tier is the remains of a stone sluice with a cast iron stand, possibly to support an

overhead element which leads down to the third level (Plates 15 & 16). This structure is believed to have been a crushing/dressing mill and wheel stand (Plate 17 & 18). None of the machinery remains although there were substantial wall elements surviving. Also at this level was what appeared to be the remains of a small cottage or workshop (Plate 19 - 22). In front of these buildings was an open yard with four concrete circular buddles which drain into the river (Plates 23 - 25). The lowest level is a stone built platform with associated drains on the river edge (Plate 26).

The existing leat runs above the stone revetting wall and the access trackway runs between the revetting wall and the second tier of structures. The nature and extent of the structure associated with the stone revetting could not be ascertained on the ground although it is shown on the 1901 Ordnance Survey Map as a square enclosure/area.

The existing pipe line continues along the western side of the track for a distance of 350m and it is proposed that a new section of pipe be laid along this route either above or below ground depending on the results of further consultation. No standing archaeological remains were identified along this section and the current path is almost at bedrock level. It is believed that this area is of no archaeological potential.

A hydroelectric pumping station (NPRN 403003) recorded by Royal Commission was identified to the east of the trackway down a steep slope. It was a flat roofed building constructed of corrugated iron sheeting and was cut into the edge of the river cliff. It was reached via a cast iron ladder. The broken remains of pipes can be seen in the river. Photographs of this structure are included as Plates 27 - 29).

No date for this structure is given and the record merely states "*Hydroelectric pumping station to supply country house of Nant y Garreg, comprising single concrete pipeline surviving alongside east side of river, drawing water from further up stream, and delivering to small flat-roofed pumping station with controls and dials intact in the late 1970s. Pumping station survives alongside old gold mine adit*" (www.coflein.gov.uk). The construction appeared to almost certainly be of mid twentieth century date although it may be of a slightly earlier origin as the use of water turbines to produce electricity for private schemes was operational from the 1890's onwards (Palmer et al 2012: 297). This structure will be unaffected by the proposed works.

The pipeline will follow along the western side of the public path and, where possible, will use benching levels that have been used for a earlier pipes (Plates 30 & 31). It is, however, possible that it may be necessary to extend the existing trackway by up to 2m in places to facilitate construction access. As with much of the pipeline the path is at or almost at bedrock level and there is limited soil cover in adjacent areas. As there are no standing remains noted it is unlikely that this limited extension will have any archaeological impact.

At the junction between Sections B and C (marked in cyan and blue on the map) was a substantial dry stone field boundary wall (Plates 32 & 33). This wall is assumed to be of Post-Medieval date and, as it has already been previously breeched by the existing trackway, the remains will not be affected by the proposed scheme.

An unsafe existing access route will necessitate the construction of a new trackway c.100m in length through a previously undisturbed area marked as Area C in the proposed development plans. It is unclear as to whether the new pipe will be above or below ground in this area but groundworks will be necessary to construct the aforementioned trackway. As with other areas there is root disturbance and shallow soil depths but unlike other areas this area is not known to have been previously disturbed. Although still considered to be of low archaeological potential it is considered that there is a slightly elevated risk of damage to any buried remains in this area.

The final section of the pipeline drops down towards Borthwnog Farm (Plate 34). Although there is to be some stripping in this area to bury the pipeline it is not considered necessary to monitor works. The bedrock was observed near the surface and the angle of slope is considered to be indicative of earlier landscaping. The pipe will run close to an existing field boundary wall (Plates 35 & 36) which has many holes in it and appears to be unstable in places. It has been noted that the scheme may cause some limited disturbance to this wall but any damaged areas will be rebuilt using traditional techniques and materials. This wall appears on the 1st and 2nd edition Ordnance survey maps.

The site of the turbine and generator house is within the yard of Borthwnog Farm (Plate 37) bounded to the east by a slight bend in the river. This area is laid with tarmac and has been generally been used for storage. The outflow pipe will leave this building and rejoin the river and will cut through modern flood defences constructed using rubble and boulders which will be reinstated after the completion of works.



Plate 1. Dry Stone Weir at Beginning Of Route. See Figure 5 for Location



Plate 2. Dry Stone Weir at Beginning Of Route. See Figure 5 for Location





Plate 3. Dry Stone Weir at Beginning Of Route. See Figure 5 for Location

Plate 4. Dry Stone Weir at Beginning Of Route. See Figure 5 for Location





Plates 5 & 6. Dry Stone Weir at Beginning Of Route. See Figure 5 for Location



Plate 7. Dry Stone Weir at Beginning Of Route. See Figure 5 for Location





Plate 26. Stone Built Platform and Associated Drain	Plate 29. Hydroelectric Pumping Station
cular Device) Plate 25. Circular Buddles	Plate 28. Hydroelectric Pumping Station
Plate 24. Detailed Shot of C Buddle (Used as a Separation	vdroelectric Pumping Station
Plate 23. Circular Buddles	Plate 27. Hy



7.0 Discussion of Archaeological Potential

The following section discusses the potential for archaeological remains from different time periods. It considers the results of the Archaeological and Historical Background research and integrates this with the results of the walkover survey. The potential for archaeological remains is discussed chronologically.

7.1 Potential for Prehistoric Remains

No archaeological findspots or sites of a Prehistoric date were recorded on the GAT HER within the study area. A Historic Landscape Characterisation was carried out by the Gwynedd Archaeological Trust (GAT Report 537: 59). This report identified no prehistoric archaeology within the area and did not highlight it as being of potential for exploitation during this period. Prehistoric activity is recorded on the more open upland mountain and moorland areas overlooking the proposed development area.

The only slight indication of Prehistoric exploitation of this area is a recent Stuart Needham article discussing the Mold Cape. In this article he suggests that the Mawddach Gold Field around Dolgellau could be a potential source for the gold used to make the cape. He comments that *"Dolgellau can be accessed directly from the head of the Dee Valley via Bala Pass; hence the possibility of a regular and fairly direct link to Mold"* and that gold could possibly have been panned for in the area. Micro-chemical analysis of the gold from the cape and from the Dolgellau area, whilst by no means conclusive, has shown a wide range of silver contents and that the gold could have come from the area. Needham has however acknowledged that these ore deposits are taken from recent mining activity and may not reflect the what was available to prehistoric peoples. (Needham 2012: 228). This is obviously a tenuous link as even if the gold came from this area it did not necessarily come from this valley. If the gold ore was exploited during the prehistoric period then is likely that the more modern mining activities will have removed all traces of it.

The location of the proposed scheme within a steep-sided river valley makes settlement evidence unlikely and due to the limited soil depths observed coupled with the likelihood of serious root damage only features cut into the bedrock are likely to have survived. Any remains recovered are therefore most likely to be stray finds resulting from transient land use which will be difficult to place in context. Based on the available evidence the potential for remains from this period within this area is considered to be low and the significance of such remains is considered to be low-moderate.

7.2 Potential for Romano-British Remains

No archaeological findspots or sites of a Romano-British date were recorded on the GAT HER within the study area. A Historic Landscape Characterisation was carried out by the Gwynedd Archaeological Trust (GAT Report 537: 59). This report makes no mention of there being a high potential for Romano British activity within this area.

As discussed in the Prehistoric section above there is the possibility that there was Roman exploitation of the gold mines in the area but there is no evidence to support this. In their comprehensive study of Roman Wales, Arnold & Davies make no mention of gold extraction in this area (Arnold & Davies 2000: 96-100). Once more if the gold ore was exploited during this period then is likely that the more modern mining activities will have removed all traces of it.

The location of the proposed scheme within a steep-sided river valley makes settlement evidence unlikely and due to the limited soil depths observed coupled with the likelihood of serious root damage only features cut into the bedrock are likely to have survived. Any remains recovered are therefore most likely to be stray finds resulting from transient land use which will be difficult to place in context.

Based on the available evidence the potential for remains from this period within this area is considered to be low and the significance of such remains is considered to be low-moderate.

7.3 Potential for Medieval Remains

The name of valley and river Cwm Mynach is stated as meaning 'Monks Valley' and is thought to have come from the owner ship of the valley by the Cistercian monks of Cymmer Abbey following the granting of a charter by Llywelyn in 1209 as part of the demesne attached to the abbey itself.

It is suggested that the land was used for livestock and this transient usage is unlikely to have left any archaeological traces as the steepness of the valley is not conducive to building. Any remains recovered are therefore most likely to be stray finds which will be difficult to place in context. The potential for remains from this period is therefore low and the significance of such remains is considered to be moderate.

7.4 Potential for Post-Medieval Remains

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As is demonstrated in Section 5.4 there are significant Post-Medieval industrial remains within the 500m search radius, some of which will be reused as part of the proposed scheme of works. Gold mining is only recorded at a handful of sites in Wales and it is an important development in the history of the Dolgellau area. Some of the structures have already been damaged by previous schemes such as the addition of picnic areas.

In addition to the industrial features there are also Post-Medieval field boundaries within the area and some were noted during the walk-over survey.

The potential for remains from this period is high and the significance of such remains is considered to be high.

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8.0 Development Areas and Potential Negative Archaeological Impact

Although the project intends to re-use elements of the existing infrastructure that do not require the breaking of any new ground or the destruction of standing remains there are certain sections of the proposed works which *may* have a potentially negative impact on archaeological remains. The following areas have been highlighted as possibly requiring further mitigation or consideration:

For details of section areas please refer to Figure 2.

Section A – The weir at the northern extent of the proposed development is marked for replacement with a concrete structure of the same dimensions. It is a strong possibility that this weir was associated with the gold mining activities in the area and therefore its removal/replacement as noted in the project proposal would be directly at odds with the "*Conservation Priorities and Management*" laid out in GAT Report 537 which states "*retention of mining remains*" as one of its three priorities.

The exact nature of this work has however been clarified and it is proposed that the existing stonework will be retained and the top section modified to provide a controlled level – probably capped with concrete. The breeched eastern side of the feature will be closed with a stone faced reinforced concrete structure.

The existing leat is to be cleared of debris and reused and it is not considered necessary to watch the majority of this process. There is however one small area of interest which was noted during the walk-over survey. The leat intersects with a drainage channel from the gold mine and it would be of interest to record what happens at this intersection. There is the possibility of being able to record a section through the older drainage channel and a representative section through the more modern leat would also be recorded.

During the walkover survey two structures were noted which were very close to the proposed route including one which would be located between the access trackway and the leat. These structures are part of the Garthgell Mill (see Section 5.4) and care must be taken when moving plant along the trackway. Although during the walkover survey it was unclear as to the dimensions of the upper mill elements, and therefore whether it may be damaged by the proposed works, the structure has been located on the 1901 Ordnance Survey Map and measurements can be taken from this. It is possible that there is a relationship between the existing leat and the mill. As part of the

management recommendations for the site GAT Report 291 has noted "*photographic record, measured survey of the mill site*" and it will need to be confirmed as to whether this work has been carried out as there is no mention of the results in the HER.

Section B – It is considered necessary to extend the existing trackway by up to 2m in places to facilitate construction access. Monitoring may be an option although given the low archaeological potential and limited area to be stripped this may not be required.

Section C – An unsafe existing access route has necessitated the construction of a new trackway c.100m in length through a previously undisturbed area. Monitoring may be an option although the area is believed to be of low archaeological potential.

Section D – There is to be some stripping in this area to bury the pipeline but it is not considered necessary to monitor works in this area. The bedrock was observed near the surface and the angle of slope is considered to be indicative of earlier landscaping.

Turbine House – The construction methods for the turbine house are as yet unconfirmed but the level of disturbance below the tarmac/hardcore level is unknown.

Tailrace – This is a limited area to install a twin wall culvert of 600mm diameter and the scale of the works is considered too small to have a significant impact and does not require monitoring.

Outfall – This element is considered to have no archaeological impact. The existing floodwall is constructed using modern material and debris.

Access – The majority of the access is via existing trackways and although these trackways are thought to be haulage routes associated with the mining activity it is not believed that their use will cause damage and is considered to have no archaeological impact.

Two exceptions are however noted which require the breaking of new ground. Monitoring may be an option although the area is believed to be of low archaeological potential.

Grid Connection - The scale of the works is considered too small to have a significant impact.

9.0 Conclusion

The archaeological character of the area affected by the proposed scheme of works is dominated by Post-Medieval industrial remains associated with the nineteenth and early twentieth century gold extraction industry for which the area to the north of Dolgellau is well known.

The significance of these industrial remains is considered to be high and of national importance. However the route of this scheme has been designed so as to minimise the breaking of virgin ground and to avoid standing structures. The reuse of existing leats associated with mining activities is not a destructive process and will simply involve the removal of debris which will be used to rebury the pipes.

The topography, wooded nature and limited soil depths in this area have all contributed to it being assigned a low potential for archaeological activity pre-dating the use of the valley by extraction industries.

Therefore overall the proposed development is considered to have low-moderate potential for impacting negatively on the archaeology of the area and with mitigation this risk can be further reduced.

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Appendix A.

Cwm Mynach Micro Hydro Consultation Document

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Cwm Mynach Micro Hydro Consultation Document

N. Bard, May 2013

1 Introduction

Trydafon Ltd, a joint venture between Derwent Hydro Power Ltd, a leading UK hydro developer, and a local landowner, wishes to develop a run of river micro hydro scheme on Afon Cwm Mynach. The project will be rated at 100kW. There is an existing hydro scheme at the site which has not generated for several years and has fallen into disrepair. The project would re-use some of the existing infrastructure.

This document has been prepared to supply key stakeholders (Snowdonia National Park, Natural Resources Wales and RSPB with a description of the proposals so that they may give feedback on the project before ecological surveys are carried out and applications for Planning Consent and Abstraction Licence are made.

Natural Resources Wales (<u>PermitReceiptCentre@NaturalResourcesWales.gov.uk</u>) were contacted on 15/5/2013 and supplied with preliminary information on the site and abstraction licence preapplication form and environmental checklist. A response is yet to be received.

This document contains a description of the site followed by a section on the environmental considerations and proposed assessment work. Feedback is welcomed on any aspect of the design or proposed environmental impact assessments.

2 Site Location

The site is located on the Afon Cwm Mynach, this is a tributary of the Mawddach, which flows into the north side of the estuary, approximately 3km west of Dolgellau. The proposed intake site is at grid reference SH 6890 1995. The site is within the county of Gwynedd and within Snowdonia National Park. The location is shown in the red ellipse in Figure 1 below.

NB Hydro Services



Figure 1 – Site location

There is an SAC, Meirionydd Oakwoods and Bat Sites, and Coed Garth Gell RSPB nature reserve to the west of the Afon Cwm Mynach. The river is not included in these areas but much of the pipeline route is either on the boundary of or just within them.

3 Scheme Description

3.1 Layout

The initial proposed layout is shown on Figure 2 below. A more detailed version is shown in the Site Plan drawing CWM/SP01. This drawing also features some photos of the site. The proposed design has been chosen to minimise impact on the nature reserve and SAC. It is expected that the scheme will have a minimal impact on that area.



Figure 2 – Basic Layout

As shown in the figure, the project would involve the diversion of water from the stream using an intake at SH 68901995. A pipeline (or penstock) would transfer the water down the hill to a powerhouse (or shed) built at the bottom of the hill. Inside this small building the water would pass through a turbine causing it to rotate. The turbine would be connected to a generator which would turn the kinetic energy into electrical energy. The water would exit beneath the floor of the powerhouse and return to the stream via a tailrace pipe.

3.2 Intake

There is an existing stone weir which was used to supply the existing hydro scheme. This has fallen into disrepair. It is proposed to rebuild it in reinforced concrete. The crest level of the new structure would be equal to the level of the previous structure. The new intake would be an

overshot 'Coanda' type which would be self cleaning. The maximum bar spacing considered for the screen would be 10mm preventing any ingress of fish. A notch would provide the Hands Off Flow (HOF) by purely passive means. For the intake structure the extent of concrete work will be small and will be clad with local material to minimise visual impact.

Immediately downstream of the intake site a tributary, the Nant Cesailgwm, meets the river. This makes up approximately a third of the flow in the river. It is proposed not to abstract any water from this tributary thus leaving a significant fraction of the flow unaffected by the hydro scheme.

3.3 Penstock

The penstock is the pipeline which transports the water between the intake and the powerhouse. Based on the above layout, the penstock would be approximately 850m long and a maximum of 500mm diameter. It would be made of welded polyethylene. The pipeline route has been chosen to minimise impact on the woodland and it can be implemented whilst affecting very few trees.

Four sections are shown on the site plan:

- Section A The old hydro scheme was fed by a leat or open channel. The pipe would be laid within the existing leat in order to minimise impact on the woodland. The current leat has filled with debris, mainly leaves. It is proposed to remove this prior to laying the pipe and then reinstate it on top of the pipe to hide it. There are 3 pipe bridges where the leat crosses small streams. It is proposed to construct similar structures for the new pipe. The lowest 50m of Section A are the pipeline of the existing hydro scheme. It is proposed to lay the new pipe along this route either above ground or underground and seek guidance on what would be the most appropriate.
- Section B There is an existing track which runs parallel to the river. In order to minimise the impact of the scheme on the woodland it is proposed to lay the pipe on the uphill side of this track. This would involve cutting a bench at the side of the track on which to lay the pipe. The pipe would then be covered over to minimise visual impact. It would be necessary to widen the track by up to 2m in places in order to facilitate construction access along the route
- Section C A section of the existing track is along a steep side slope and consists of a dry stone wall on the downhill side in-filled to make the track surface. This part of the track is not stable enough to allow construction machinery to pass over it and thus it is necessary to construct a short stretch of new track just over 100m long through the woodland to avoid this part of the existing track. For the majority of this part of the route the pipe could be buried in this zone (minimising visual impact) or laid above ground (minimising impact on tree roots). The final section of this part adjacent to the dry stone

wall (approximately 25m) the pipe will run relatively steeply and it will be necessary to bury the pipe for structural reasons

 Section D – the final short section (approximately 20m) of pipe would be laid down a steep bank. It is proposed to bury this part of the pipe to minimise visual impact and for structural reasons

3.4 Turbine House

The turbine house will house the turbine, generator and control system. It will be a small (approx 5m x 5m) building built into a sloping bank in the corner of a yard. It is proposed to construct a grass roof for environmental reasons and so that the building will be invisible from above. It is proposed to clad the building in timber to be in keeping with a new building which is soon be constructed approximately 15m away. Feedback on building materials for the turbine house is welcomed.

3.5 Tailrace

The tailrace is a channel which returns water from the sump below the turbine. A short length of twin wall culvert is proposed of approximately 600mm diameter. This will be buried beneath the yard. The yard is shown in Figure 3 below.



Figure 3 - Yard

3.6 Outfall

The outfall is the point at which the water will be returned to the river. This will be screened with a grille to prevent any possibility of entry by fish or mammals. There is a flood wall separating the yard from the river. The outfall will be located downstream of the flood wall in order that flood protection is not affected by the project

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3.7 Access

The entrance from the road (A496) will be used and no modification will be necessary. Construction vehicles will use existing tracks with 2 exceptions:

- Pipeline section C new section of 3m width track
- A short length (approx 50m) of new track to allow construction vehicles to access the intake.

Access for turbine house construction will be via the road in front of the cottages at the bottom of the hill. The construction compound will be located in the yard in this area.



Figure 4 – Yard in which construction compound will be located

3.8 Grid Connection

There is an existing three phase, high voltage line runs between the cottages and the A496. A new pole mounted transformer will be installed and an underground cable run to the turbine house.

3.9 Technical Characteristics

Some initial estimates of key variables related to the performance of the scheme are shown in Table 1 below.

Catchment Area (including Nant Cesailgwm)	11.24 km ²			
Gross head	74 m			
Mean Flow (including Nant Cesailgwm)	543 l/s			
Length of Deprived Reach	840m			
Channel Slope	0.09			
Turbine Rated Flow	200 l/s			
Hands Off Flow	Q95 of Afon Cwm Mynach plus the Nant			

	Cesailgwm		
Penstock length	850 m		
Penstock diameter	450 mm OD		
Electrical Power Output	100 kW		
Net Energy yield/yr	556,000 kWh		
Carbon dioxide offset/yr	240 tonnes/year		
Equivalent no. of homes ¹	123		

 Table 1 - Possible Design Parameters and Energy Yield

4 Environmental Considerations

This section contains information on the various environmental considerations. An environmental scoping report has been carried out by Baker Consultants and this is included as an Appendix.

4.1 Designated Areas

A designated area search has been carried out in the vicinity of the site. The results are shown in Figure 5 below.



Figure 5 – Designations

¹ Based on average electricity consumption of 4,500 kWh/year

The cross hatched area above is Meirionydd Oakwoods and Bat Sites SAC and the blue is Coed Garth Gell RSPB reserve. It can be seen that the river is not within these areas but the path which marks their eastern boundary is the proposed route for most of the pipeline. The site also lies completely within Snowdonia National Park.

The SAC is designated primarily for oak sessile woods, alluvial forests with alder, and lesser horseshoe bat. The RSPB reserve is noted for several species including 7 UKBAP species.

The implications of the SAC (and RSPB reserve) on the development are discussed in Section 4.2 of the ecological scoping report. It is believed that the project can be undertaken without having a significant effect on the site. It is hoped that the ecological assessments to be undertaken will confirm this. The following sections detail the assessments to be undertaken and feedback is welcomed on the scope of all assessments as well as if there are any issues which have not been included but should be.

4.2 Otter

It is proposed to carry out an otter survey over the area to confirm whether the project would have any impact on this species.

4.3 Fish

The zone of the deprived reach consists mainly of bedrock and waterfalls. A example of the deprived reach is illustrated in Figure 6 below. There are impassable waterfalls within the deprived reach which would prevent migratory fish access more than a short distance upstream of the outfall. It is not expected that significant fish habitat is present.

- opyrilds

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Figure 6 – Deprived reach

It is proposed to carry out a qualitative fish habitat survey of the deprived reach as well as the area upstream and downstream of the hydro project. Advice is sought as to whether electrofishing is necessary and the level of detail required.

4.4 Bryophytes

The river runs through a sheltered gorge with bryophyte populations. It is understood that some survey work may have been carried out already on this river. More research will be carried out on whether this survey work is sufficient as a baseline study for the hydro project. Any advice and help identifying existing survey work would be welcomed.

4.5 Hydrology

A Low Flows 2000 study will be used to estimate the mean annual and monthly flows in the river.

4.6 Trees

Despite the location of the project within woodland it is believed that construction can be completed whilst affecting only a very few trees. Guidance is sought on the scope and level of tree surveying work.

4.7 Bats

Very few mature trees will be affected by the development. The ecological scoping report noted that the mature trees do not appear to support features that could be root sites. However it is proposed that any trees to be removed as part of the development will be surveyed to ensure no roosts are present. The ecological scoping report also discusses lesser horseshoe bats and states:

Lesser Horseshoe bats *Rhinolophus hipposideros* are also part of the SAC designation and any impact upon this species would need to be considered as part of the Regulation 48 assessment. Given the nature of the woodland and the limited nature of the works it is unlikely that Lesser Horseshoe bats would be affected in this case.

4.8 Noise

The turbine house will be located approximately 25m from the nearest dwelling. A turbine of this size is unlikely be audible from this distance, especially given the semi buried turbine house design and the background noise of the river. In the event that there was any problem with noise there are various solutions that can be implanted such as acoustic baffles and acoustic cladding. Therefore it is not proposed to carry out any formal noise assessment.

4.9 Archaeology

There is a gold mine located close to the path at the north end of the site and some other obvious features associated with it that would be close to, but not touched by the works. Feedback is requested on whether any archaeological survey work is required.

4.10 Landscape and Visual Impact

The entire project is located within a wooded area and in a valley. The zones of visual impact will be very limited indeed and therefore it is not proposed to carry out a formal landscape and visual impact assessment.

Appendix A – Site Plan

NB Hydro Services drawing CWM/SP01.

Appendix B – Ecological Scoping Report

Ecological Scoping Survey Potential HEP Site at Afon Cwm-Mynach, Dolgellau, Baker Consultants, June 2009

Appendix B.

Sites of Archaeological Interest Within a 500m Radius of the Proposed Development Site (All Information Sourced from the Gwynedd Historic Environment Record)

PRN/NPRN	Site/Artefact Description	Туре	Period	Designation	Grid Reference
PRN 12186	Smithy for Coed Garth Gell	Work shop	Post- Medieval		SH 68862004
PRN 20593	Gold mine, Maes Tryfer	Gold Mine	Post- Medieval		SH 68851980
PRN 20632	Gold mine, Hendreforion	Gold Mine	Post- Medieval	20	SH688020 30
PRN 20637	Gold levels, Cesailqwm Mawr	Level Crossing	Post- Medieval	2	SH 69002000
PRN 21804/ NPRN 34127	Garthgell mine	Mine structures	Post- Medieval		SH 68802010
PRN 21908	Tynycoed Mines	Gold Mine	Post- Medieval		SH 68602040
PRN 20592	Cambrain Taicynhaeaf	Gold Mine	Post- Medieval/ Modern		SH 66201940
NPRN 403003	A small Hydroelectric pumping station	Pumping station structure	Post- Medieval/ Modern		SH 68871929
NPRN 8463	Soar Chapel	Chapel	Post- Medieval		SH 68971979
C	303	, 			



Appendix C. Location and Direction of Photographic Plates Referred to in the Report Text