COMMON LAND Tir Comin Plwyf Penmachno (C.L.25)
Parish of Penmachno
County of Conwy

Proposed micro-hydro and domestic water system for Hafod y Rhedwydd.

n.b. For completeness, this document describes the entire system with 850 m of pipe from extraction point down to the turbine hut. Only the extraction system and the upper 220 m of pipe lie within Tir Comin Plwyf Penmachno (CL. 25).

1. Introduction

The proposed system will generate electricity for the off-grid cottage Hafod y Rhedwydd (LL24 0RF) and improve its domestic water supply. The works will install water collection boxes in the stream above the cottage and a buried pipe to carry the water to the cottage.

The cottage is completely off-grid. This is part of its attraction but also a drawback. Over the years we have used a number of generators (both petrol and Diesel) but they are all noisy, smelly and polluting. Often the petrol generator is left running when little or no power is required (some guests even leave it running all night despite being provided with battery bedside lights and torches). The generator can be heard from the road 50m away.

Depending on the level of water in the stream, the system will generate between 0.35 kW and 9 kW. There is no connection for export to the National Grid so the system is much smaller than most grid-connected micro-hydro schemes (the upper limit of 9 kW is constrained by the pressure drop along the pipe). The control system will adjust the flow rate to match the power required in the cottage, so it will take no more water than necessary; a fibre-optic link from the extraction point (buried beside the pipe) will send stream level readings to the control system.

The micro-hydro system will eliminate the need to burn petrol in a generator and significantly cut down the Rayburn's 2000 litres/year heating oil consumption. The saving in carbon dioxide emissions should be at least 4300 kg per annum. In dry weather the power should be sufficient to run a UV sterilizer, a refrigerator, some LED lights, the satellite broadband and (intermittently) a kettle or microwave.

In wet weather there will be sufficient power to run electric radiators to provide some background heating. The Rayburn and sitting room oil stove together currently produce about 10 kW of heat. Electric radiators should therefore largely eliminate the need to burn oil for heating in wet weather. In dry weather the oil appliances will still be necessary.

The system will also provide a reliable sterilised water supply. Water currently comes from a nearby spring but this regularly dries up and has too little pressure for any filtration or sterilisation. Bottled water is provided for drinking but holiday letting agencies are now demanding a sterilised water supply from all taps.

The cottage lies just outside the common land boundary; the planned extraction point within CL. 25 is however the only location from which a gravity feed is possible (downstream from this point the stream lies deep within a gorge). The extraction point is 35 m higher than the house which will give enough pressure for a peat removal filter prior to a chlorine or UV sterilising system. The pipe diameter will be mostly 110 (possibly 125) mm; the initial flat section is 160 mm.

Construction and subsequent water extraction limits will be in accordance with the Natural Resources Wales abstraction licence, planning permission and watercourse consent (all granted March 2019). The drawings and supporting documents are available at http://www.hafodyr.co.uk/?page_id=111.

No part of the system will be fenced-off. The development will not in any way impede walkers or spoil the view.

2. Benefits to the local community and people using the common.

2.1 The works will improve the quality of accomodation for people using Hafod y Rhedwydd as a base from which to explore the surrounding countryside. It is anticipated that an increase in bookings (back to levels of a few years ago) will lead more people to visit the common as well as safeguarding the continued employment of our local caretaker.

2.2 The micro-hydro system will result in a significant (4300 kg/year) reduction in CO_2 emissions by greatly reducing the need to run the petrol generator and Rayburn. There will be less generator noise and fumes. (The abstraction licence does not allow hydro-power extraction during the driest 5% of the year so the generator cannot be eliminated completely).

2.3 The road past the cottage can be dangerous in winter. Sometimes the council close the road; if not closed, drivers have to decide whether to chance the 10-mile trip across the moors (up to 1650 feet above sea level) based on the low-level weather in their village. Quite apart from the risk of being stuck with no mobile phone signal, miles from the nearest habitation, there is a danger when the road is icy of skidding on steep sections and tumbling down the hillside.

The nearest online weather stations at the moment are Mynydd Llandegai (16 miles away on the other side of Snowdonia) and the Ogwen Rescue webcam (12 miles away in the same direction), both too far away to be any use to drivers. Weather station sensors (wind speed, rainfall, temperature – Figure 14 below) and a web-cam will be mounted on the settling tank and connected to a web page via the fibre-optic link and the satellite broadband dish at Hafod y Rhedwydd. This is a good position for the sensors since it is higher than the cottage and not in the lee of the hill. The weather station webpage should be valuable both to drivers and walkers.

2.4 The spread of Lyme disease poses a risk to visitors to the countryside all across the UK. Ticks are common across the country but the rate of infection with the *Borrelia Burgdorferi* parasite varies from region to region. Relatively little is known about the distribution of the parasite or how it spreads.

Lyme disease is fortunately less severe in North Wales at the moment than in some other parts of the UK and Europe. Like malaria, it occurs when a parasite passes via a bite (tick/mosquito respectively) into the blood stream. The antibiotic doxycycline is effective if taken within 48 hours of being bitten; many people however do not seek medical aid in this time or even realise they have been bitten. There is no vaccine against it or even the equivalent of an anti-malarial prophylactic (chloroquine etc) that can be taken long-term. See:

- John Caudwell article
- 8-year old from Blaenau Ffestiniog
- 60 tablets a day attempt to cure
- Disease in Wales doubles in past year
- Mother left paralysed

- Lyme dominates life after 9 years treatment

If *B. Burgdorferi* became more widespread in tick populations across the UK many people would be deterred from taking their children walking in the countryside. The land around Hafod y Rhedwydd has a generous supply of ticks. It is not uncommon to pick up 5-6 in a few hours walking; some spots are particularly well-endowed.

I contacted Salford University's Dr Richard Birtles in September 2018 asking if a sample of perhaps 200 ticks collected during the construction of my micro-hydro scheme might make a useful contribution to his database. He was very enthusiastic since he has taken no samples in North Wales, his nearest at the moment being 20 miles further south at Lake Vyrnwy.

Hopefully this will in some small way assist the fight against the disease and benefit all users of the countryside.

3. Maps and photographs of the route.

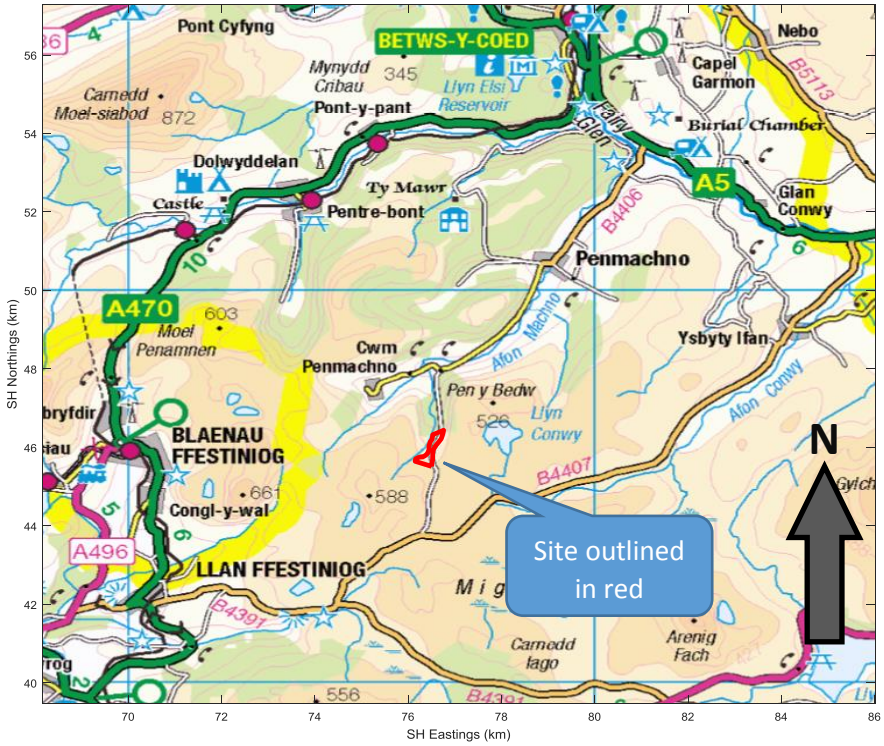


Figure 1. General location map. Map scale 1: 125000 (grid squares are 10 km wide). OS map is © Crown Copyright, reproduced by permission of Ordnance Survey®. (Map purchased from Blackwell's Mapping Online 9/12/2018, order number BW1-900530-43094-091218).

Figure 2. Hafod y Rhedwydd.

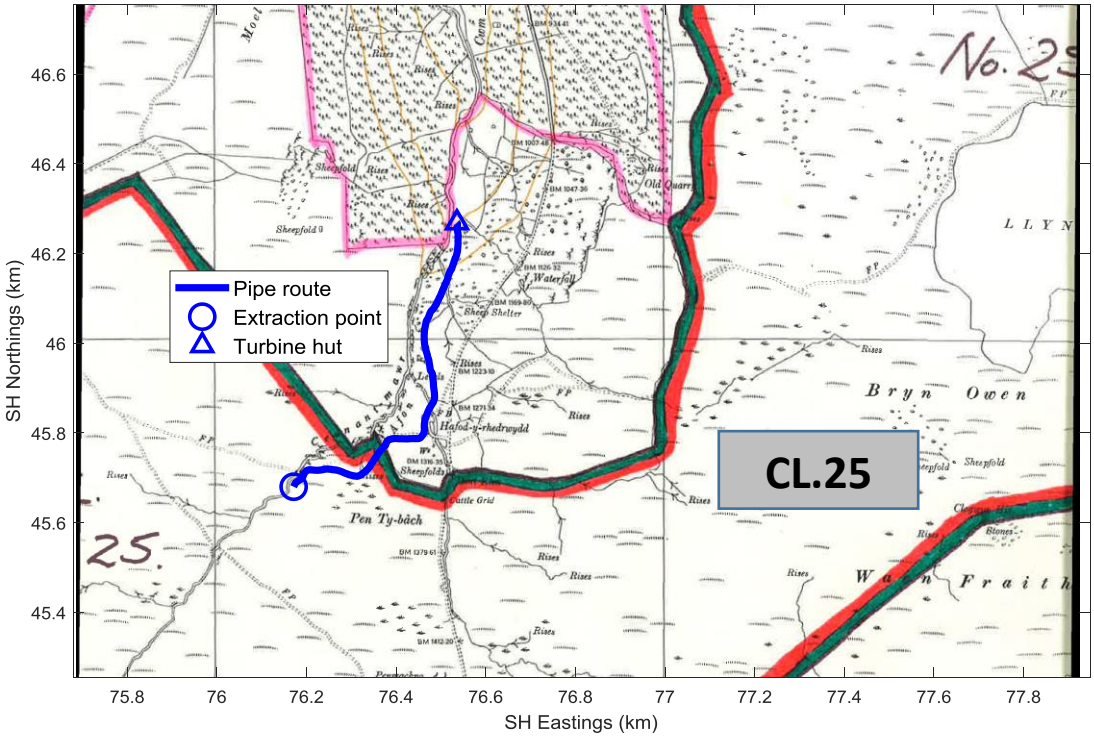
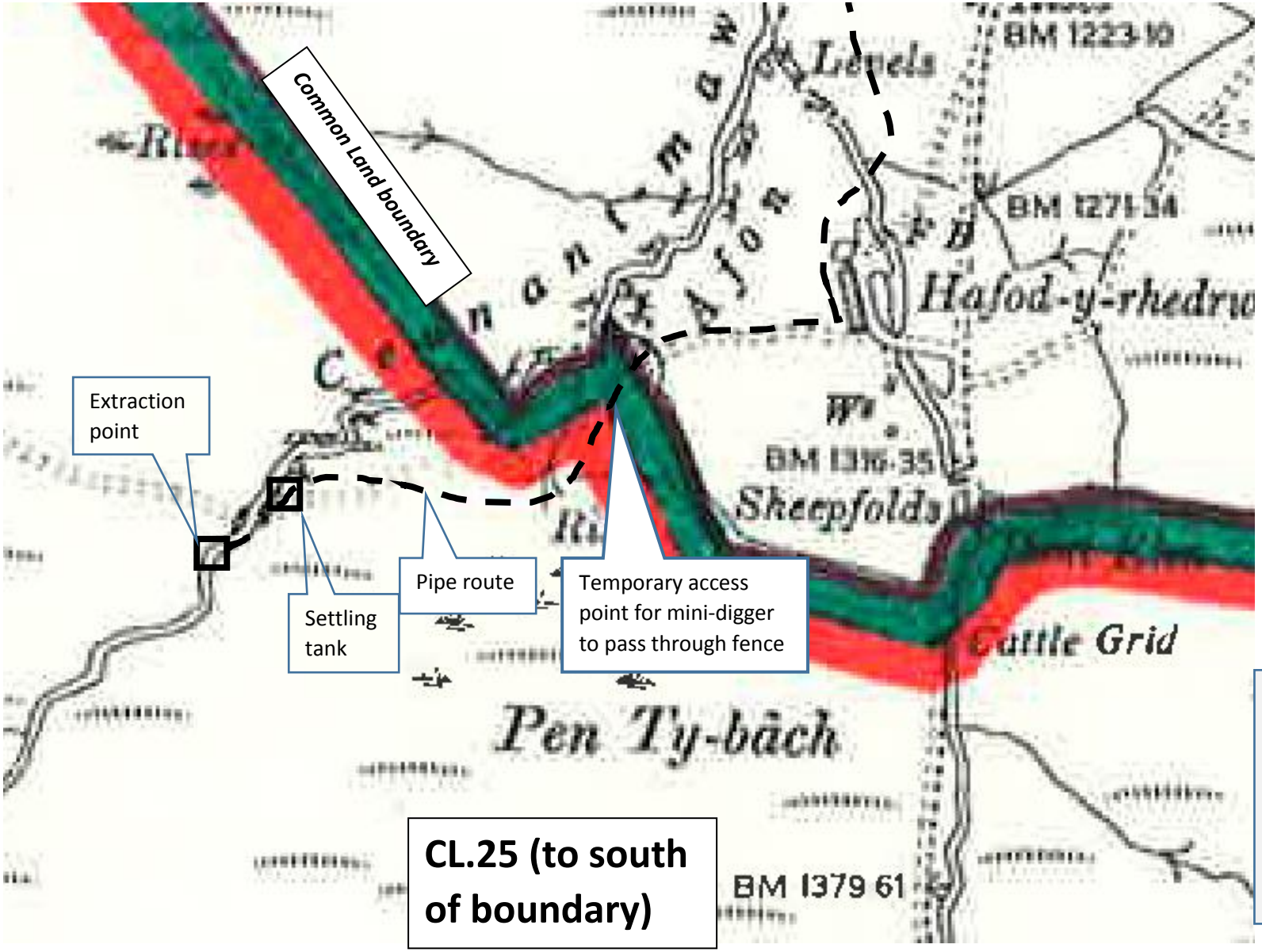


Figure 3. Proposed water extraction point and pipe route across CL.25 Tir Comin Plwyf Penmachno (original 1967 map from Conwy Council showing the common's boundary).

Figure 4. Enlarged section from Figure 3.



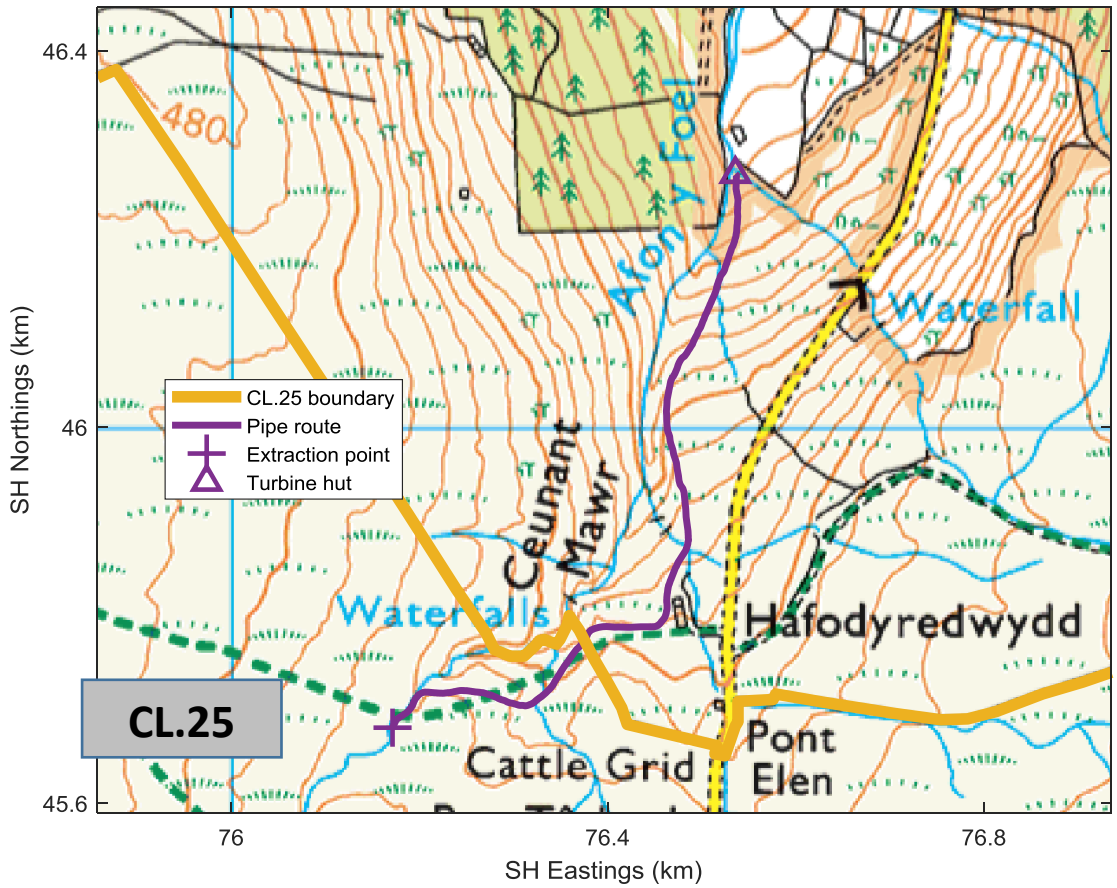


Figure 5. Common land boundary and pipe route from Figure 3 copied onto a modern Ordnance Survey map. Map scale 1: 10000 (grid squares are 1 km wide). OS map is © Crown Copyright, reproduced by permission of Ordnance Survey. (Map purchased from Blackwell's Mapping Online 5/12/2018, order number BW1-899389-43094-051218). Extraction at grid reference SH 76164 45687.

The pipeline will have a tee-off to the house for domestic water before continuing for another 475m down towards the bottom of the valley. A 65mm flexible conduit buried alongside the pipe will carry a steel-wire armoured power cable and an optical fibre for control signals.

All pipes and wires will be buried (possibly only partially buried for the initial 47 m where the stream falls away until the pipe is above bank level - this section will pass through heather and be hidden as plants grow over it).

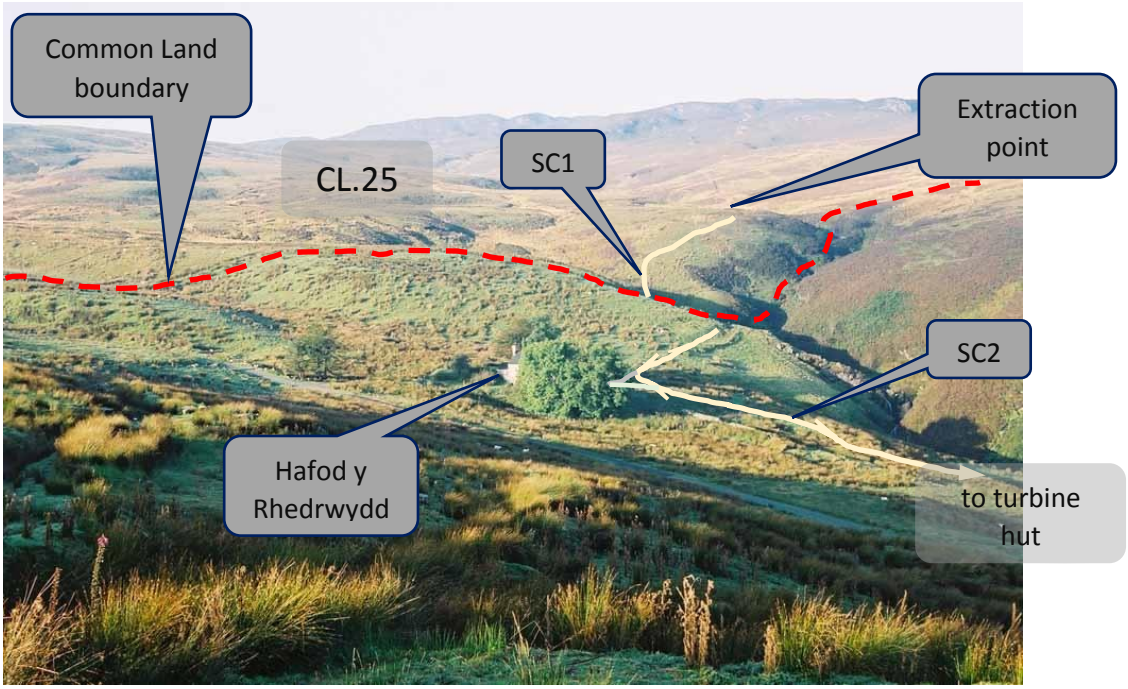


Figure 6. Pipe route with tee-off to cottage. The pipe will be buried into bedrock where it crosses two small streams (SC1, SC2) so it does not interfere with the flow or appearance of the stream.

4. Ecology

The Migneint-Arenig-Dduallt moorlands cover 200 km^2 and are designated both as SAC/SPA (Special Area of Conservation, Special Protection Area) and SSSI. In this area the SAC habitat features include blanket bog and dry heath whilst the SPA species are Hen Harrier, Merlin and Peregrine.

The micro-hydro scheme will lie just within the northern edge of the SAC/SPA/SSSI (Figure 7). The route, abstraction system and construction methodology are the result of extensive discussions with environmental officers from the Snowdonia Park Authority and Natural Resources Wales. The planning consent is subject to conditions designed to ensure that there can be no adverse effect on habitats or species in the protected area. All construction work will be supervised by a suitably qualified Ecological Clerk of Works.

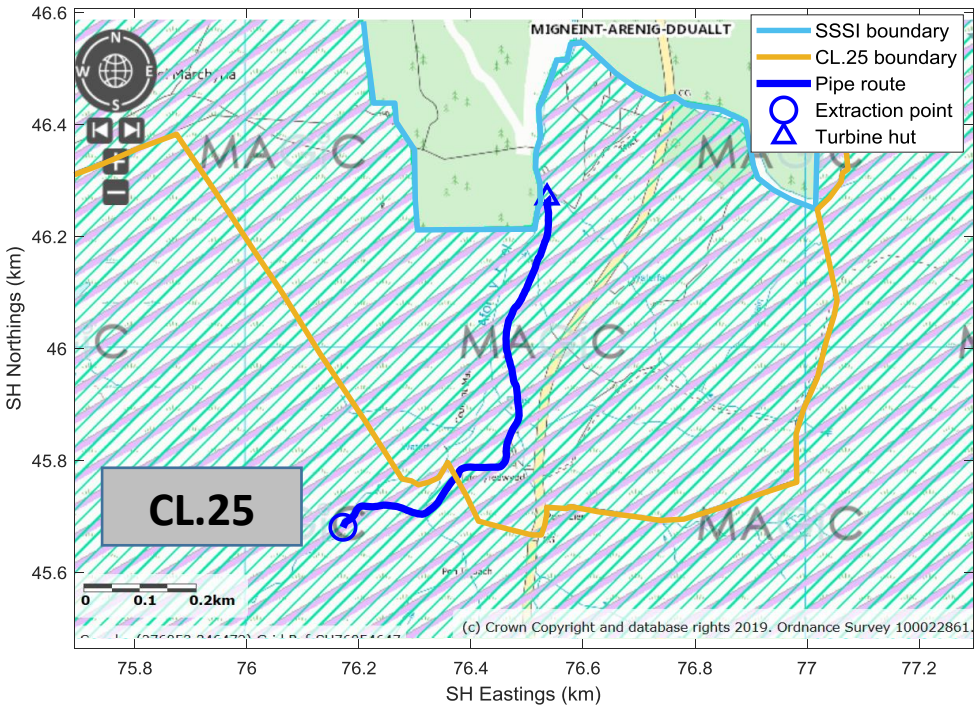


Figure 7. Map showing the SAC, SPA and SSSI-designated areas (shaded). Source: https://magic.defra.gov.uk/MagicMap.aspx

5. Summary of works:

(a) within the common:

(1) To install water extraction screens in Afon y Foel in accordance with an abstraction licence from Natural Resources Wales.

(2) To place a settling tank approximately 30m from the extraction point to prevent entrained air from entering the pipeline.

(3) To bury 220 m of pipe and conduit from the extraction point to the common's boundary fence.

(b) outside the common (for reference only):

(4) To bury a further 630 m of pipe and conduit running outside the common's boundary down to the cottage and turbine hut.

(5) To build a hut to house the turbines, alternators and associated equipment.

(6) To return water to Afon y Foel where it passes the turbine hut.

(7) To transport materials as required for the construction. No new tracks will be required (see Construction Method statement http://www.hafodyr.co.uk/files/Construction method.pdf). Lightweight equipment (powered wheel barrow, mini-digger and hand tools) will be used to minimise any environmental impact. All spare materials will be removed from site at the end.

6. Further details

6.1 Works within Tir Comin Plwyf Penmachno

(i) The hardware will limit the extraction rate to safeguard the remaining water level and include features to ease fish passage.

Figure 8. Small waterfall at the extraction point. Stick with tape at 1 m intervals to show scale. This waterfall landing on a stone slab is currently too high for fish to jump.

NRW have requested that the scheme facilitate fish passage, both up and down-stream. To achieve fish jump heights of less than 25 cm there will be a plunge pool below the lower weir crest and a downstream weir to raise the level below the plunge pool, Figures 9 & 10. This improves the environment: at the moment the pair of deep pools above and below the extraction point are separated by a waterfall that is too high for fish to jump.

Figure 9. Extraction point, looking upstream.

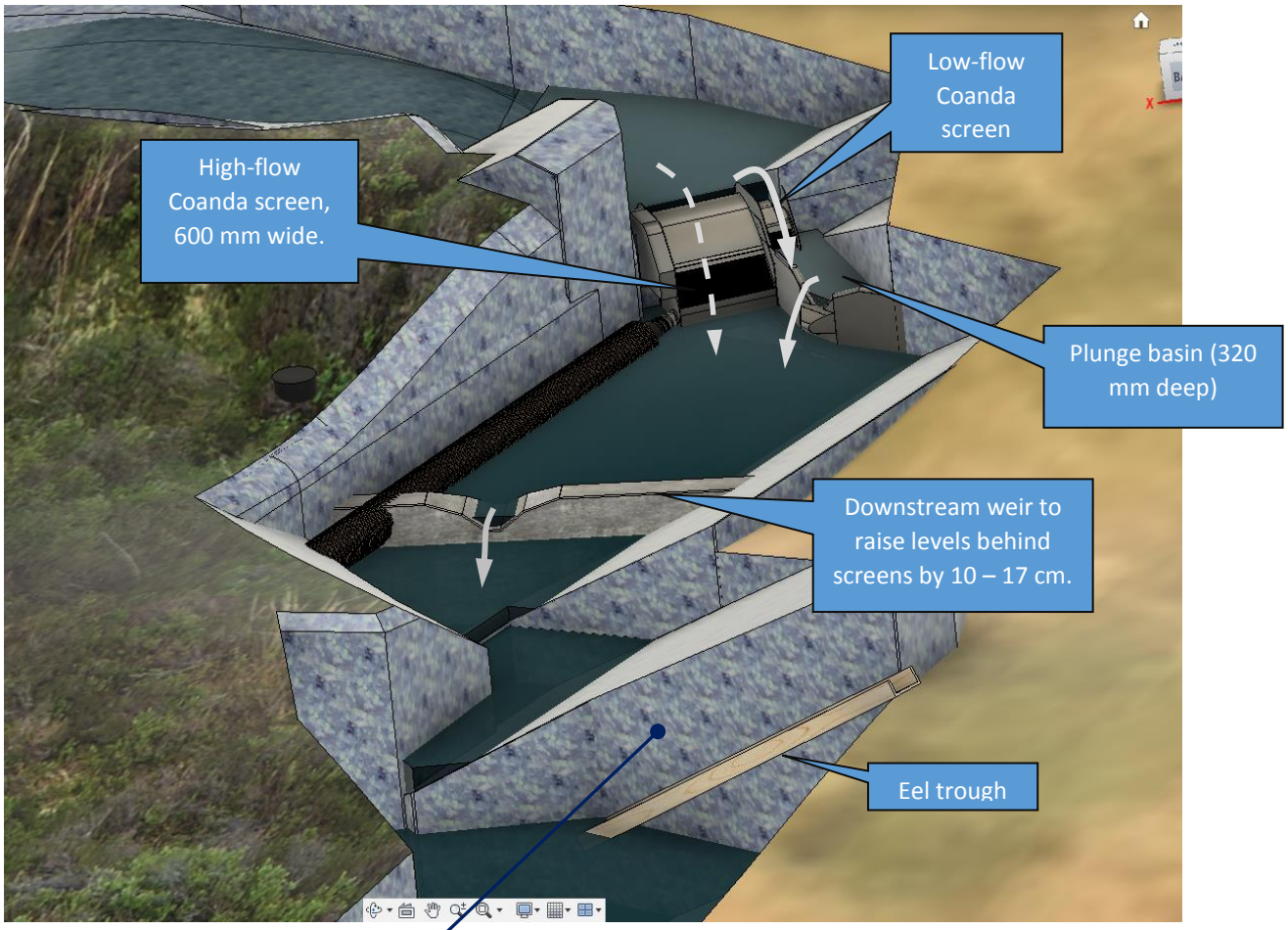


Figure 10. Schematic diagram of the proposed abstraction system. Fish can progress up and downstream in three stages (white arrows), with jumps of less than 25 cm. Water levels shown for stream flow of 4 litres/sec. At higher stream levels, water starts to flow over the high flow screen (dashed arrow). n.b. ***Grey features are existing bedrock***.

The stream at the extraction point is invisible from a distance (Figures 11 & 12) due to the lie of the land and the height of the banks each side.

Figure 11. Extraction point (arrowed) lies behind a spur and is not visible from a distance.

Figure 12. From close-up, the extraction system will be hidden down between the stream banks.

(ii) The settling tank (Fig. 13) will be made from a short vertical section of pipe (0.5 – 0.6 m diameter × 2 m high, partially buried) that will be held against the rock face beside the stream.

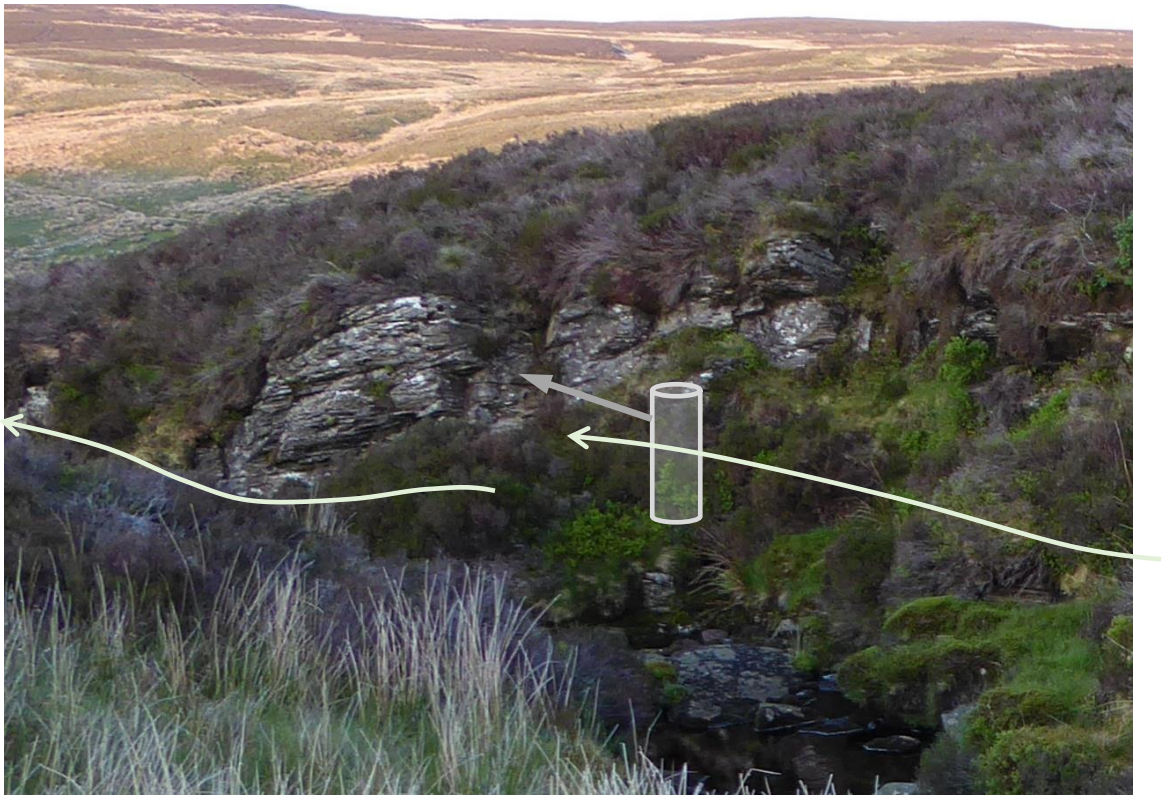


Figure 13. The settling tank will be bolted into a cleft in the rock face.

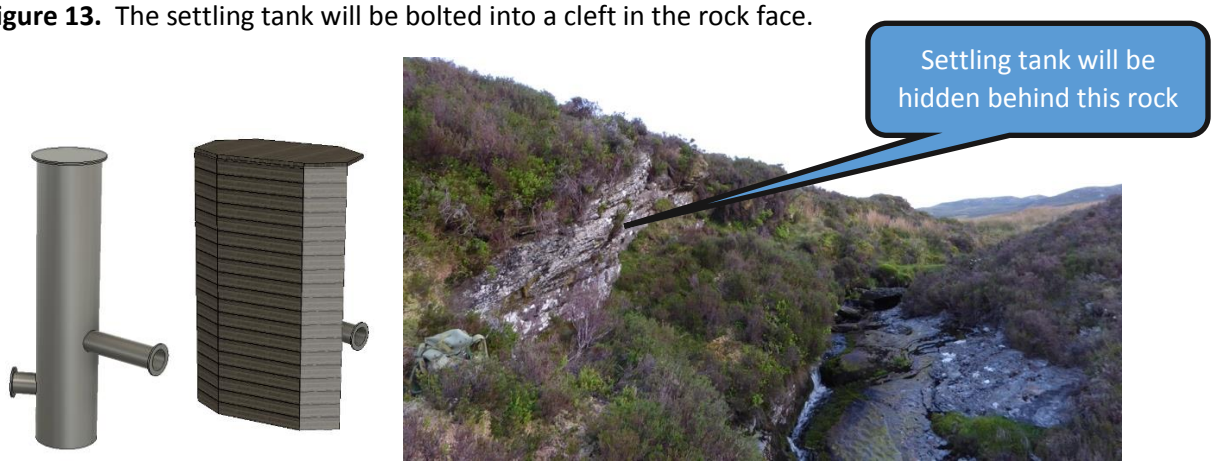


Figure 14. (a) Settling tank construction, (b) appearance of wooden fencing cover, (c) view looking upstream. The tank will be insulated to avoid freezing and hidden behind a shiplap fencing panel.

Figure 15. Appearance of a typical anemometer (18" long by 5" wide)

The pipe will be buried in a trench; it will be invisible once vegetation has regrown. Turf and soil will be separated during trenching so the turf can be replaced afterwards after back-filling the trench. The pipe will be mostly 110 - 125 mm diameter and will be buried about 20 cm deep (i.e. a trench 20 cm wide × 30 cm deep, where soil depth allows).

6.2 Works outside the common (included for context and completeness).

The turbine hut will be built of stone and have a shallow-pitch turf roof (using turf from the foundation area). It is 170 m from the road at the bottom of a steep slope so will be barely visible.

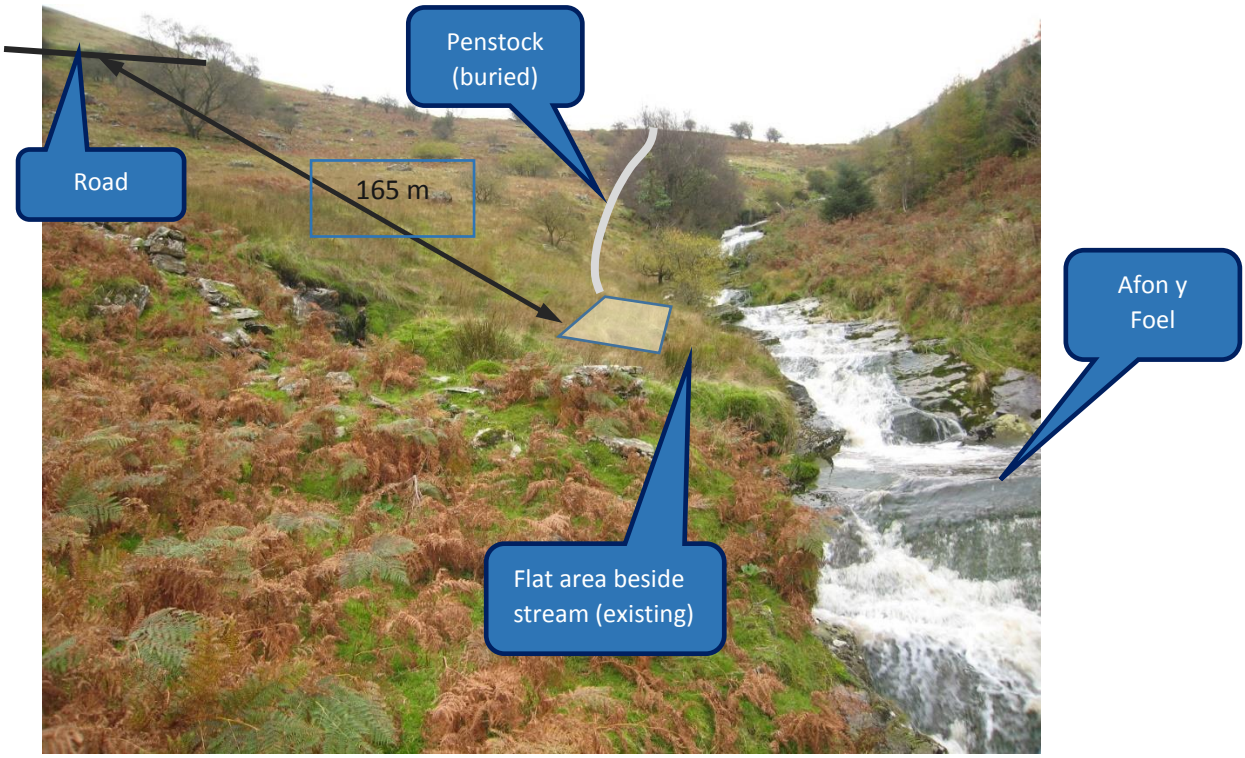


Figure 16. Site for turbine hut, 475 m down from the cottage (not on Common Land).

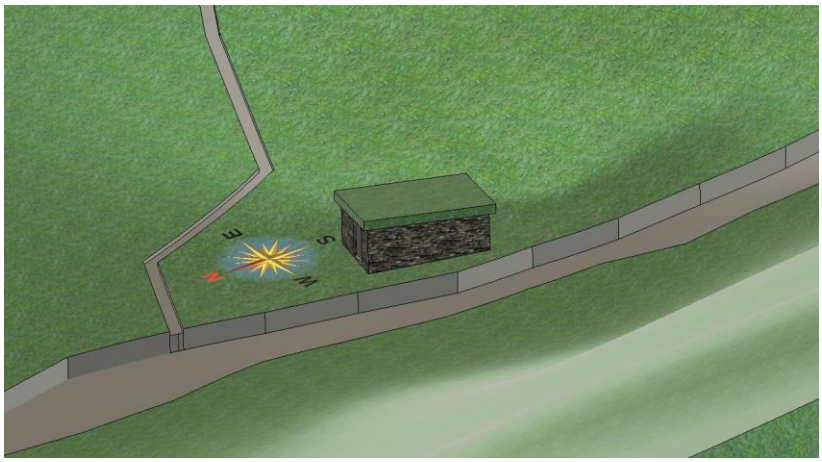


Figure 17. Turbine hut appearance. Wall dimensions (external) 4.6 m long × 2.8 m wide. Internal height (floor-ceiling) 1.52 – 1.66 m; roof overhang 20 cm. Stone walls with turf roof.

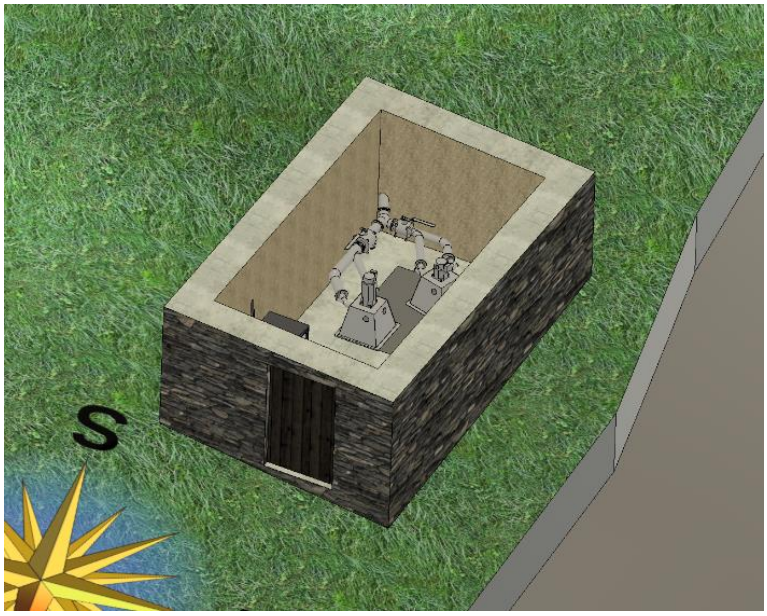


Figure 18. Internal layout showing normal and dry weather turbines. The tailrace duct runs out to the river bank from the sump below the turbines.

Links

This document is available online (with working hyperlinks) at
http://www.hafodyr.co.uk/files/HyR_common_land_details_v4.pdf

R.W.Moss
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