Stage 1 Geomorphology Assessment

This document provides additional information relating to the construction of a Micro Hydro Scheme on the Nant Ffynnon-wen.

TGVHydro

TGVHydro are a not-for-profit Social Enterprise. The Green Valleys Community Interest Company, a community-owned social enterprise that helps communities across Wales reduce their carbon emissions, solely owns TGVHydro Ltd.

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Non-technical Summary:

This small-scale hydropower scheme, with a depleted reach of 670m, proposes two intake structures, both structure will be up to 400mm in height above the existing level to enable the structures to operate in accordance with the published hydropower good practice guidelines. The watercourse is dominated by exposed bedrock throughout the entirety of the depleted reach. The depleted reach contains a series of natural falls throughout reach ranging from 0.5m – 2.5m. The gradient of the depleted reach is approximately 8.7% and has resulted in very limited opportunities for natural in stream sedimentation or vegetation.

TGVHydro propose to install two small intakes (one main intake and one feeding intake) on neighboring watercourses. Both intakes for the micro hydro scheme are within easily accessibly sections of each watercourse. From the feeding intake the scheme proposes for a feeding pipe to run for approximately 300m to connect to the main intake. The main penstock pipe will leave the main intake ad will continue on the right hand bank (looking downstream) for the initial section of its route. The pipe will cross the watercourse just downstream of a confluence and will be trenched following a field edge fence line for the middle reaches of its route, before entering a steep bank, flanked with scrub and immature trees before entering a dingle area where the turbine house is to be located. (See Figure 1, additional site plans have also been submitted as part of the supplementary information for this hydropower application).

The stream progresses in a north-westerly direction, the upper sections of the watercourse area surrounded by acid grassland, lower sections of the watercourse continues to be flanked by acid grassland and also scattered immature tree by mature trees throughout the depleted reach. This proposal seeks a peak abstraction of 22.0 l/s and is proposing a HOF of Q95 (5.4 l/s) and abstraction of 70% of the flows above HOF up to Qmean (a 70/30 split).

We have followed NRWs guidance notes for geomorphology micro hydropower assessments, Stage 1. We have to point out however that some of the requirements for photographs have not been able to be completed due to direct stream access being too unsafe due to the incised nature of the terrain or the upstream locations beyond our permitted access. We have done as much as is reasonably possible given the site constraints.

Location of Images and Figures

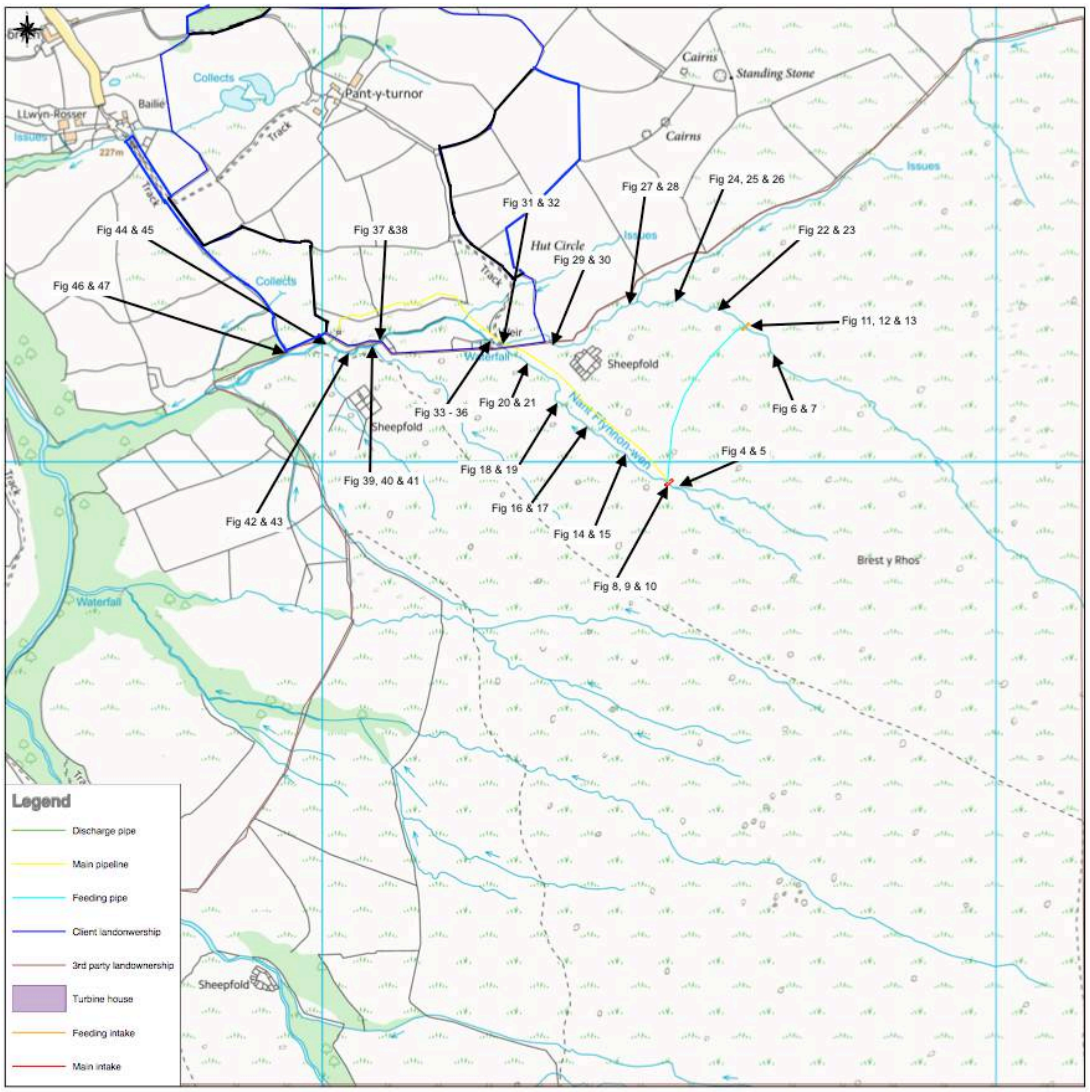

Figure 1: Location plan of all referenced images and photos (NTS)

Overview of Site Geology

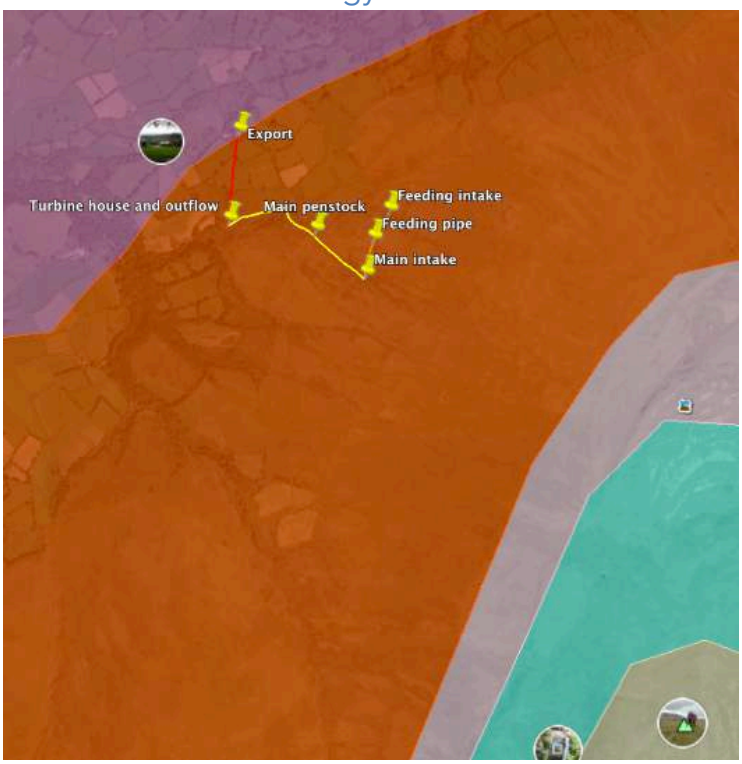

Figure 2: Bedrock geology of the area around the watercourse. Proposed scheme components also indicated.

The underlying solid bedrock geology is limestone rock at the upper section of the catchment and sandstone rock within the remainder of the catchment area, the immediate stream valley supports a dominance of exposed bedrock.

Scheme Vital Statistics

Length of depleted reach: 460m

Scheme head:	57m (from intake to discharge – not mechanical head)	
NGR:	Intake (main):	SN 76512 21969
	Intake (feeding):	SN 76628 22209
	Discharge:	SN 76006 22175
Gradient:	8.7%	
Head line flow:	22.0 l/s (Qmean)	
Output:	8.2 kW (peak power)	
Height of main Intake (existing):		296.000m AOD
Height of main Intake (existing):		296.000m AOD
Height of proposed Discharge:		239.000m AOD

Site Photographs

Catchment area and upstream of Intake locations

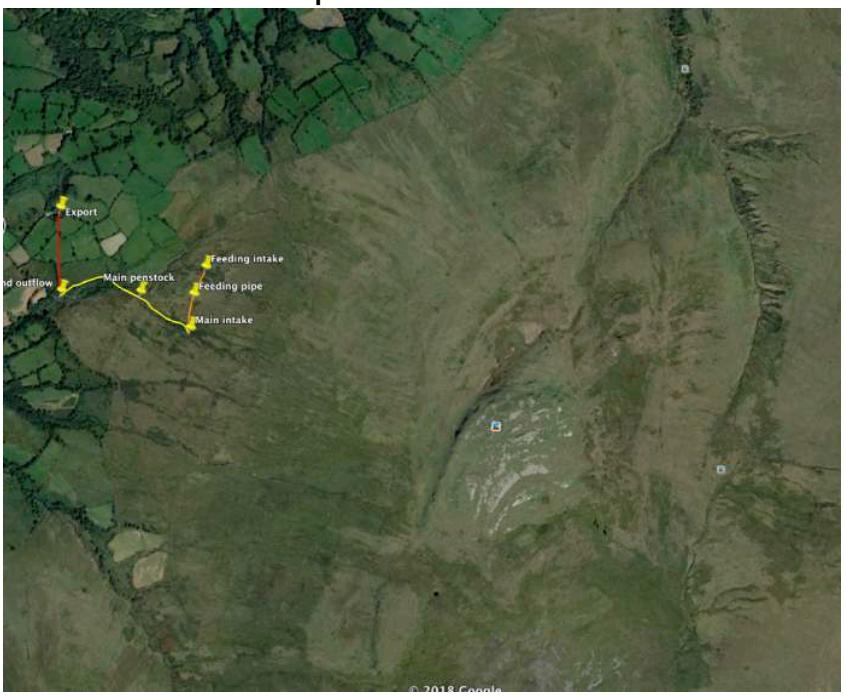

***Fig 3a**: Showing the aerial view of intake and catchment area.*

***Fig 3b**: Showing the catchment areas of intake locations.*

Fig 4 (u/s) & 5 (d/s): *The watercourse upstream of the main intake. The watercourse is dominated by bedrock overlaid with small gravels (SN 76540 21962).*

Fig 6 (u/s) & 7: *The watercourse upstream of the feeding intake (SN 76672 22149).*

Intake Locations

Fig 8 (u/s), 9 (d/s) & 10 (close up of watercourse bed): *Main Intake location, 500mm wide channel, watercourse is dominated by bedrock overlaid with small gravels, both banks are well vegetated promoting a stable environment (SN 76512 21969)*

Fig 11 (u/s), 12 (d/s) & 13 (close up of watercourse bed): *Feeding Intake location, 500mm wide channel, watercourse is dominated by bedrock overlaid with small gravels, both banks are well vegetated promoting a stable environment (SN 76628 22209).*

*Photo illustration of the scale of the impoundment works at the main intake location (*SN 76512 21969*) (intake tank in yellow and pipe line in red). A detailed construction methodology to limit the impact from the construction would be submitted with any formal application.*

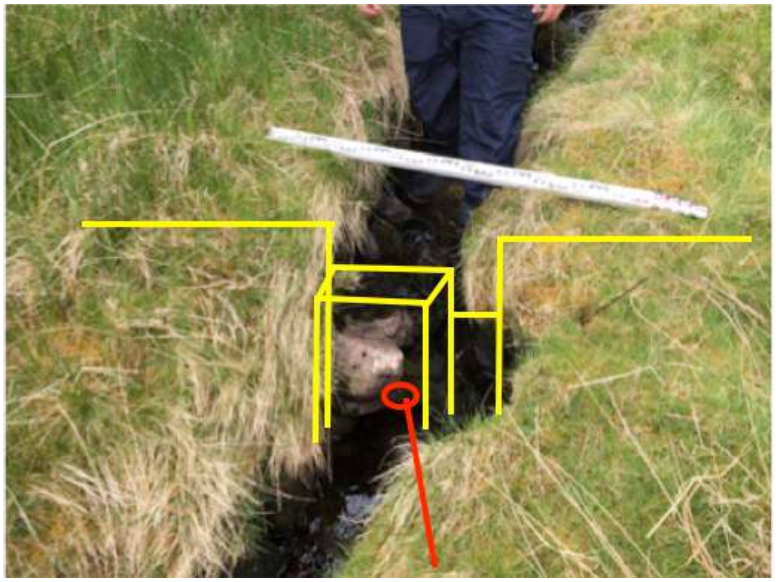

Photo illustration of the scale of the impoundment works at the feeding intake location (SN 76628 22209) (intake tank in yellow and pipe line in red). A detailed construction methodology to limit the impact from the construction would be submitted with any formal application.

Photos of the depleted reach from the main intake to the confluence

Fig 14 (u/s) & 15 (d/s): *Photos taken within the depleted reach from the main intake, in-channel materials consisting of a mixture of cobble sizes, both banks are well vegetated promoting a stable environment (SN 76447 22013).*

Fig 16 (u/s) & 17 (d/s): *Channel environment remains the same as that shown in figs 14 and 15 (SN 76392 22052).*

Fig 18 (u/s) & 19 (d/s): *Smaller in-channel material, both bank remain to be well vegetated (SN 76345 22092).*

Fig 20 (u/s) & 21 (d/s): *Smaller in-channel material, both bank remain to be well vegetated (SN 76304 22146).*

Photos of the depleted reach from the feeding intake to the confluence

Fig 22 (u/s) & 23 (d/s): *Watercourse is very similar to the main depleted reach, in-channel materials consisting of a mixture of cobble sizes, both banks are well vegetated promoting a stable environment (SN 76584 22229).*

Fig 24 (u/s) & 25, 26 (d/s): *Watercourse remains to be similar as the upper reaches of the watercourse (SN 76517 22237).*

Fig 27 (u/s) & 28 (d/s): *Watercourse remain similar to upper sections of the depleted reach, moss covered rocks and well vegetated bank promote a stable environment (SN 76455 22235).*

Fig 29 (u/s) & 30 (d/s): *Photos taken upstream of the confluence, the watercourse bed consists of bedrock sheet with lose cobbles overlaid section of the bedrock (SN 76347 22173).*

Photos of the deleted reach between the confluence to the outflow location

Fig 31 (u/s) & 32 (d/s): *Photos taken at the confluence of the two watercourses to be used for the hydroscheme, watercourse bed predominately bedrock overlaid with a mixture of cobbles sizes, with smaller gravels towards the outer ends of the channel, both banks are well vegetated promoting a stable environment (SN 76264 22175).*

Fig 33 - 36: *Photos taken at 2.5m waterfall, waterfall is solid bedrock and appears impassable even during high flows. Bedrock, moss covering and surrounding vegetation promoting a stable environment (SN 76246 22179).*

Fig 37 (u/s) & 38 (d/s): *Stream bed mixture of cobble sizes and moss covered larger boulders throughout the width of the watercourse. The moss covered material and bank vegetation promote a stable environment (SN 76048 22178).*

Fig 39 (u/s) & 40 (d/s) & 41: *Stream bed continues to be a mixture of cobble sizes and moss covered larger boulders throughout the width of the watercourse. The moss covered material and bank vegetation promote a stable environment (SN 76075 22171).*

Fig 42 (u/s) & 43: *Stream bed continues to be a mixture of cobble sizes and moss covered larger boulders throughout the width of the watercourse. The moss covered material and bank vegetation promote a stable environment (SN 76032 22162).*

Fig 44 (u/s) & 45 (d/s): Discharge point (discharge point indicated in red) *stream bed continues to be a mixture of cobble sizes and moss covered larger boulders throughout the width of the watercourse. The moss covered material and bank vegetation promote a stable environment (SN 76006 22175).*

Fig 46 (u/s) & 47: *Downstream of outflow location, channel continues to be a mixture of cobble sizes and moss covered larger boulders throughout the width of the watercourse. The moss covered material and bank vegetation promote a stable environment. Historical impoundment is also shown within the above photos (SN 75948 22160).*

Intake Details and Sediment Retention

The proposed intake structures (for both intakes) on the watercourse are to be pre-fabricated stainless steel and will be impacted with clay. The highest point of both intakes will rise above the existing watercourse bed by 400mm. We anticipate that this small increase in height will have a small impact on this immediate area of watercourse (700mm wide) in terms of sediment transfer through this watercourse. However, due to the presence of the HOF notch extending 67mm and 101mm (respectively) below weir crest this leaves the potential for sediment of only negligible amounts. We do not believe that this potential for sediment entrainment over long periods would occur as higher periods of flow will likely flush this out, as evidenced by similar falls within the depleted reach.

Significance of Impact

We believe that the small-scale weirs will not cause any significant impact. However, we have proposed an intake design of minimal possible height and width to reduce both the scale of the impoundment and the potential to cause impact.

Retention of Sediment

The intake requires the creation of a small impoundment in order to function properly. Over a period of years there is therefore the potential for up to 0.016m^3 and 0.014 m^3 of sediment to be retained (this is a theoretical maximum although the HOF notch would not enable this quantity to ever be retained with a much more likely quantity being negligible). At HOF notch crest level the total possible retention of water or sediment is calculated as an insignificant amount. Taken in the context of the watercourses natural sedimentary processes and the downstream presence of large scale falls and bedrock exposures we do not believe that the retention of sediment would have any measurable impact on the wider watercourse status as measured by the WFD and any long term impact would not be possible to measure or quantify.

Impact of Flow Regime on Erosion and Deposition

The hydro scheme will affect the levels of water flow throughout the depleted reach. For the main intake - the HOF of Q95 and maximum abstraction of 12.0 l/s (Qmean) alongside a 70/30% split flow; and for the feeding intake – the HOF of Q95 and maximum abstraction of 10 l/s (Qmean) alongside a 70/30% split flow, will result in zero difference in naturally occurring low flows and a limited change to higher flows. It is accepted that sedimentology deposition generally occurs in low flows (which are unchanged by the proposals) and that sediment transfer occurs in the higher flows (which are not changed to any significant level) and we therefore conclude that the scheme will have no meaningful impact on erosion or deposition within the depleted reach, and consequently will have no measurable impact on the current status of the watercourse.

Discharge

A drain sump will be incorporated into the slab directly beneath the turbine unit. This sump will discharge the water passing through the turbine unit to the stream channel through a 1 x 300 mm diameter plastic twin-wall Agripipe. The end of the pipe will be screened with a 10mm s/s mesh and the pipe will be surrounded by a combination of loose stones and boulders fixed to the existing bedrock shelf. The pipe will stop short of the stream and discharge onto an existing bedrock shelf that will dissipate energy as it enters the watercourse.

Construction

All efforts will be undertaken to minimise the potential impact on sedimentology during the construction phase

Conclusion

A small-scale short-term impact may will occur as result of the small impoundment weir being built but will be limited through utilizing the proposed methodologies.

Although the watercourse has not been formally assessed in line with the WFD it is considered to potentially have a status of up to 'moderate'.

TGVHydro are confident that the potential status of the watercourse will not be significantly affected by the proposed hydro scheme.