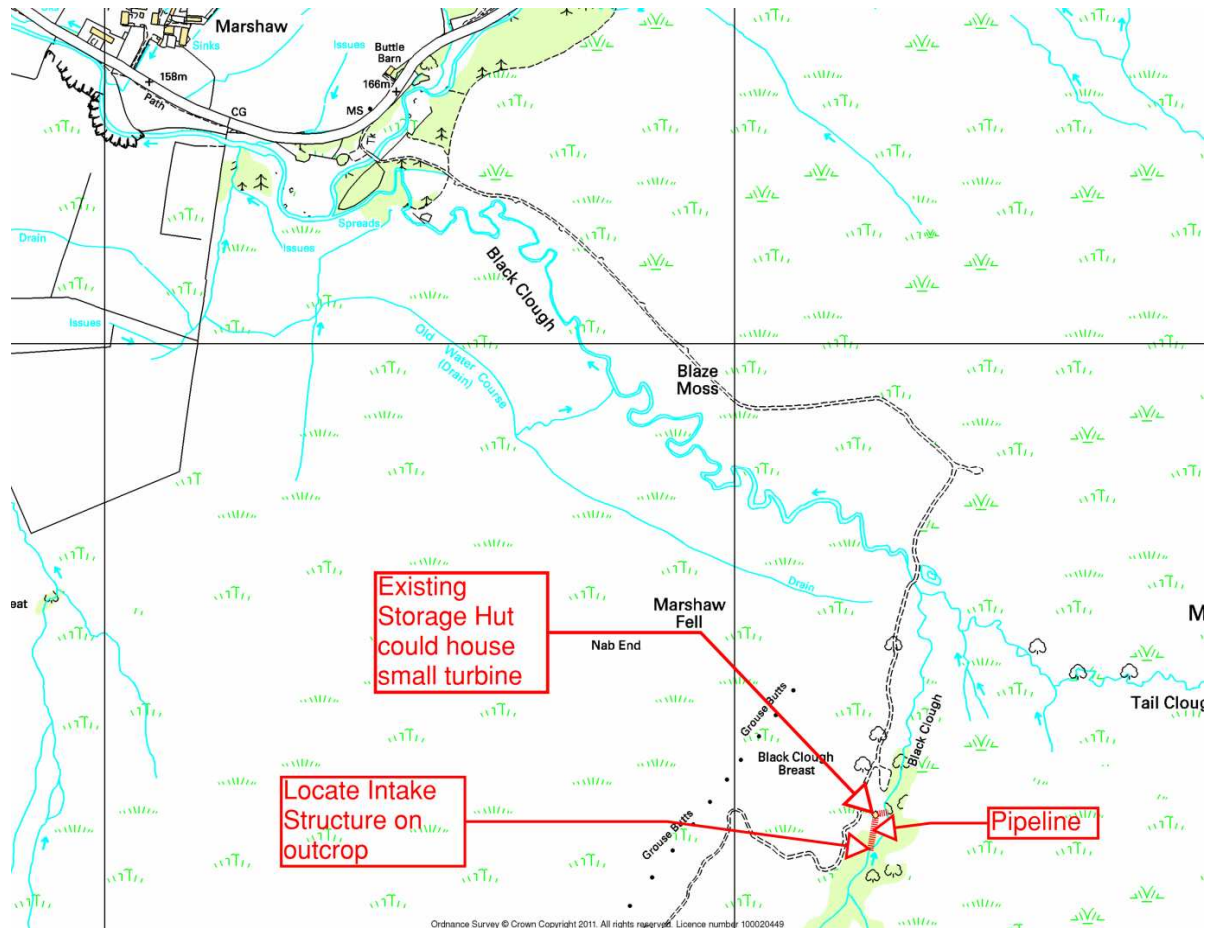


Site 34: Old Watercourse, Marshaw

Site Assessment

Figure 1 Map showing general layout



Site Assessment

Marshaw Old Watercourse is shown to be located to the south west of Black Clough on Marshaw Fell. A site visit was undertaken and the line of the old watercourse is not identifiable. Further south along the track there is a small hut that appears to be used for storage. This is situated approximately 15m west of Black Clough Watercourse. The watercourse in this reach is steep and fast flowing.

There is good access to the site via an existing metalled road. The owner of the site has not been identified and there is no visible history of hydropower at site. There is no electrical power in the area and any hydropower generation could only be used on site.

A weir could be constructed on the watercourse approximately 20m upstream of the hut. This would provide approximately 4m of head and would take water from immediately upstream of the weir into a short length of pipe to a turbine located in the hut. The water would then be returned to the channel.

The area is open access land and recent works to provide off road parking adjacent to the B6478 suggest that the site provides amenity. One possibility would be to use the hut for refreshments, powered by a hydro turbine.



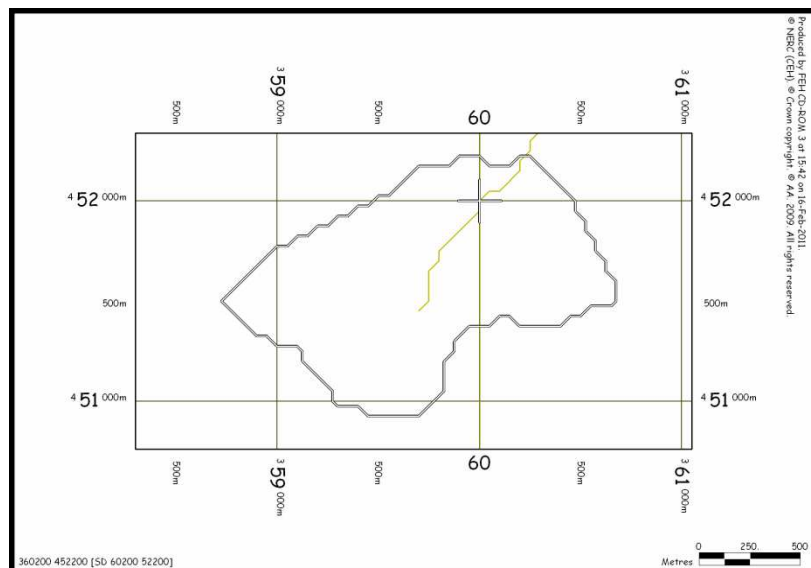
Figure 2 Weir constructed in channel



Figure 3 View of stone hut where turbine could be located

Catchment Analysis

Figure 4 Catchment boundary defined by Flood Estimation Handbook Software



The Flood Estimation Handbook software is used to determine the following catchment descriptors, for the proposed intake location, selected during the site visit.

Intake Grid Reference	360219, 452204
Powerhouse Grid Reference	360226, 452258
Catchment Area	1.44 km ²
Annual Rainfall	1818 mm

There are not understood to be any abstractions at this location.

Annual Flow Statistics

Low Flows software is used to produce a Flow Duration Curve (FDC), which demonstrates how the river flow varies throughout the year. It presents the percentage time of the year each flow rate is exceeded. A particular notation is used to refer to FDC flow rates; e.g. 'Q₉₅' refers to the flow rate which is exceeded 95% of the year.

Table 1 Mean flow rate and flow rate at Q₉₅

Period	Mean Flow Rate [m ³ /s]	Flow Rate at Q ₉₅ [m ³ /s]
Annual	0.0708	0.0077
January	0.111	0.0212
February	0.0821	0.0149
March	0.0974	0.0197
April	0.051	0.0114
May	0.033	0.00678
June	0.0282	0.00565
July	0.0329	0.0062
August	0.0405	0.00553
September	0.0735	0.00891
October	0.093	0.0109
November	0.102	0.0164
December	0.106	0.0223

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m ³ /s]
5	0.25
10	0.166
20	0.098
30	0.067
40	0.049
50	0.036
60	0.028
70	0.021
80	0.015
90	0.01
95	0.008
99	0.006

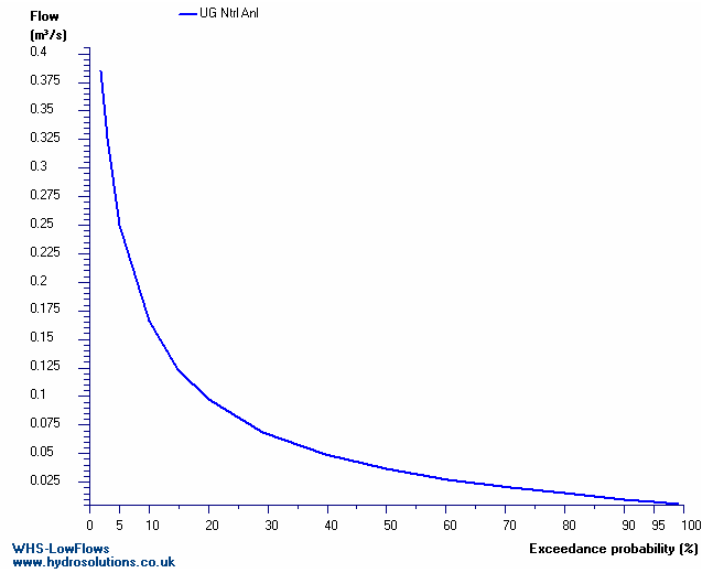


Figure 5 Annual flow duration curve produced using low flows software

Hydropower Analysis

Site: Marshaw (Site 34)					
Run Date / Time: 17 February 2011 at 16:02					
		Mean Flow: 0.066 m ³ /s		Rated Flow: 0.066 m ³ /s	
		Provisional Rated Flow: 0.073 m ³ /s		Gross Hydraulic Head: 4.00 m	
		Residual Flow: 0.007 m ³ /s		Nett Hydraulic Head: 3.80 m	
Applicable Turbines	Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Crossflow	7.8	7.8	2.0	1.8	0.017
	MWh	MWh	kW	kW	m³/s

Table 3 Hydropower Analysis

Gross Head [m]	4.00 m
Net Head [m]	3.80 m
Design Flow [m ³ /s]	0.066 m ³ /s
Rated Capacity [kW]	1.8 kW
Average Annual Energy Output [MWh]	7.8 MWh
Average annual Carbon Dioxide offset	4.2 tonnes

Impact Assessment

Marshaw is within the Forest of Bowland AONB and is classified as being within Undulating Lowland Farmland. The area is also designated as SSSI moorland and marshland.

If a scheme were pursued on Black Clough the turbine would be housed in an existing building. Though the scheme would be in a SSSI it is not thought that the development would have any significant environment impact.

Statutory Requirements

In-river works will be required to build the intake weir and the tail race, and the Environment Agency will need to be consulted in order to acquire consent for this, as well as to apply for an abstraction license. Work in the river will only be allowed between May and September. Planning permission is likely to be required for the repair of the weir. An ecologist will advise on the extent of environment assessment required.

Conclusion

This scheme would seem fairly straightforward to build. There is good access for construction. The visual impact would be small and any noise impact would be contained within the turbine hut. The greatest challenge at this site would be to find a use for the energy.

Further Information

This site report is produced by Inter Hydro Technology on behalf of Forest of Bowland AONB, and funded by a partnership including Lancashire County Council, Lancaster & District Local Strategic Partnership, Pendle Borough Council and Ribble Valley Local Strategic Partnership.

This site report should be read in conjunction with the rest of the Forest of Bowland AONB Hydro Feasibility Study which can be downloaded at

<http://www.forestofbowland.com/climatechange#hydro>