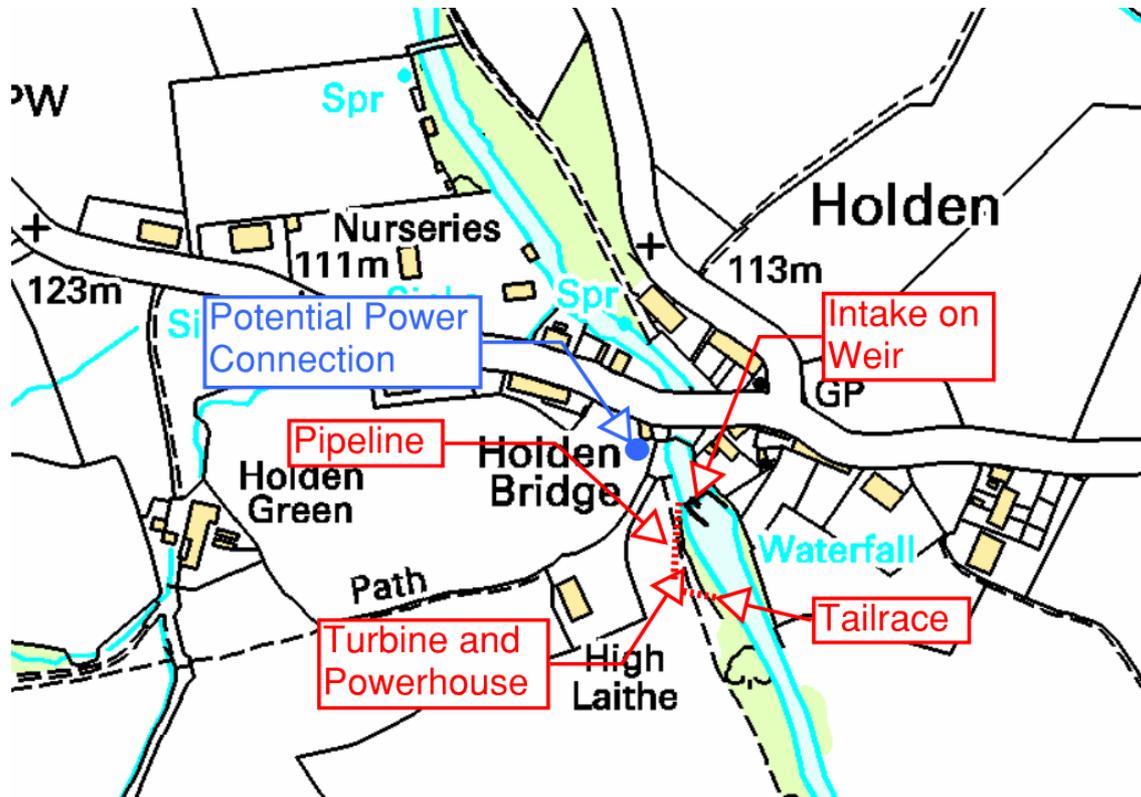


Site 36: Holden Clough Village Weir

Site Assessment

Figure 1 Map showing general layout



Site Assessment

Holden weir is located 25m downstream of Holden Bridge on Barret Hill Brow. There is good site access on the west bank through a gate to pasture land. The owner of the site has not been identified and there is no visible history of hydropower at site. Local power supply lines are located adjacent to the site.

The weir (waterfall) provides in the region of 5m of head. Water could be abstracted from the river immediately upstream of the weir and sent through a short length of pressure pipe to a turbine located just downstream of the weir, before being returned to the channel.



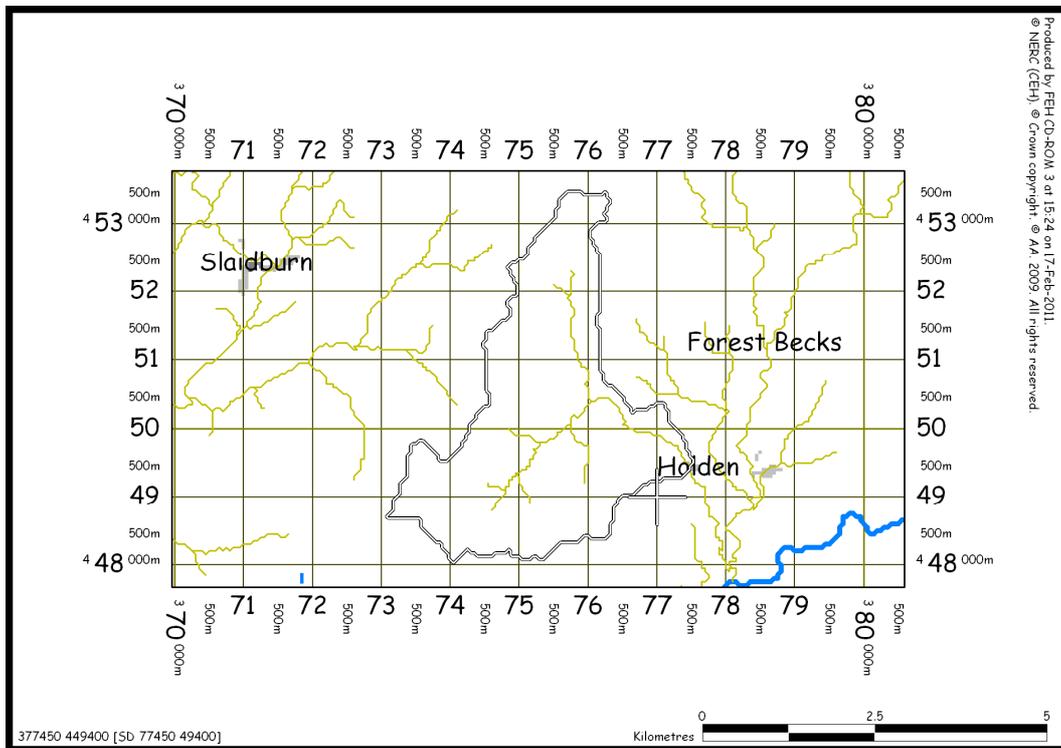
Figure 2 View of drop over weir



Figure 3 View of weir from downstream

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.

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

Intake Grid Reference	337460, 449433
Powerhouse Grid Reference	337,462, 449397
Catchment Area	10.29 km ²
Annual Rainfall	1405 mm

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	0.332	0.035
January	0.582	0.0899
February	0.405	0.0688
March	0.418	0.0659
April	0.239	0.0448
May	0.158	0.0323
June	0.128	0.0302
July	0.126	0.027
August	0.199	0.0252
September	0.235	0.0315
October	0.411	0.0432
November	0.49	0.0559
December	0.597	0.0796

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m ³ /s]
5	1.215
10	0.795
20	0.463
30	0.309
40	0.215
50	0.152
60	0.11
70	0.08
80	0.059
90	0.043
95	0.035
99	0.025

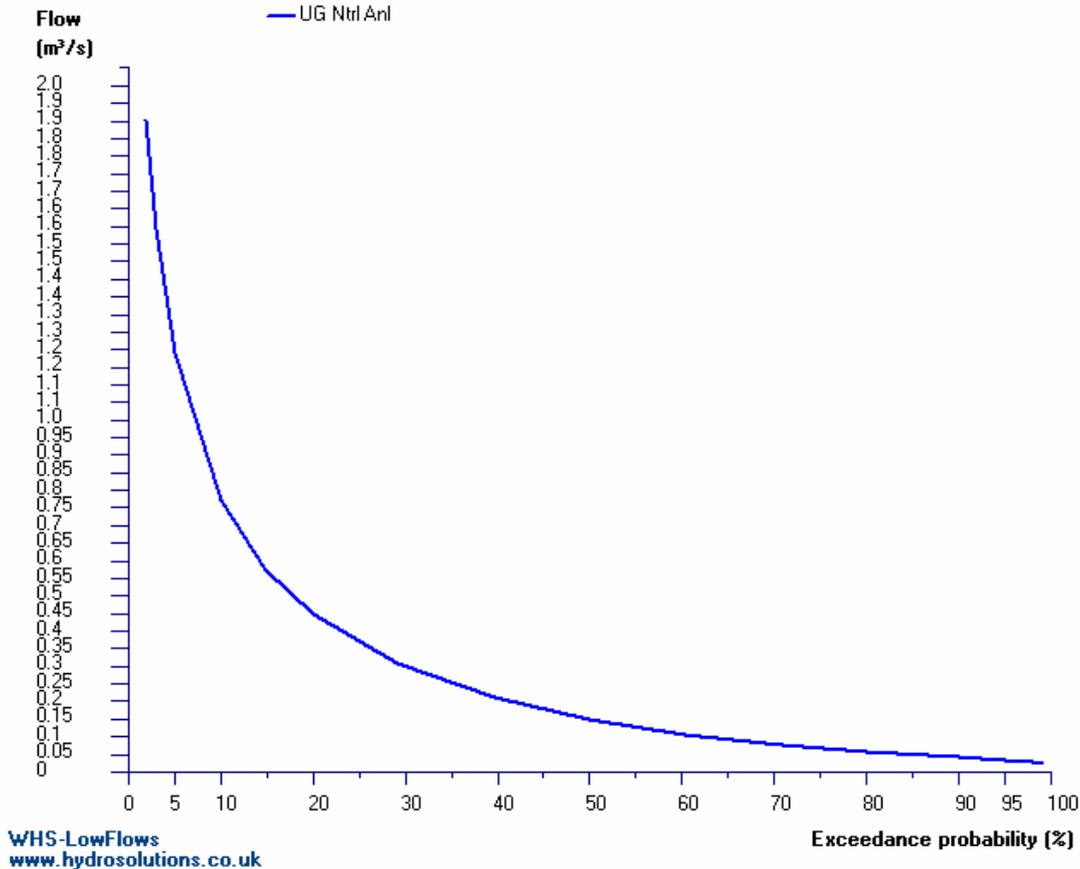


Figure 5 Annual flow duration curve produced using low flows software

Hydropower Analysis

	Site: Holden (Site 36)				
	Run Date / Time: 17 February 2011 at 16:13				
	Mean Flow: 0.32 m ³ /s		Rated Flow: 0.32 m ³ /s		
	Provisional Rated Flow: 0.35 m ³ /s		Gross Hydraulic Head: 5.00 m		
	Residual Flow: 0.028 m ³ /s		Nett Hydraulic Head: 4.75 m		
Applicable Turbines	Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Propellor	37.0	36.7	13.1	12.6	0.24
Crossflow	47.1	46.6	12.0	11.2	0.076
	MWh	MWh	kW	kW	m³/s

Table 3 Hydropower Analysis

Gross Head [m]	5.00 m
Net Head [m]	4.75 m
Design Flow [m ³ /s]	0.32 m ³ /s
Rated Capacity [kW]	12.5 kW
Average Annual Energy Output [MWh]	41.5 MWh
Average annual Carbon Dioxide offset	22.5 tonnes

Impact Assessment

Holden Clough is within the Forest of Bowland AONB and is classified as being within Undulating Lowland Farmland with Wooded Brooks. The area is also designated as having scope for increased woodlands.

If a scheme were pursued on Holden Brook the turbine house could be constructed to a design sympathetic to the surrounding agricultural buildings. It is not thought that the development would have any significant visual impact. In respect of fisheries, migratory species if present cannot migrate beyond the foot of the waterfall, and therefore it is not thought that a fish pass would be required.

Statutory Requirements

In-river works will be required to build the intake at the 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.

Budget Development Cost

The total budget cost for the whole scheme is **£180,340**. It should be noted that the civil works costs can vary considerably as material costs fluctuate. Likewise, mechanical and electrical (M&E) equipment costs vary in accordance with demand. Professional fees should be considered subject to change, as the scope of licensing and planning requirements are not yet defined. Consequently the budget estimate at this stage should be considered accurate to plus or minus 20%.

Revenue and Simple Payback Period

Energy produced by a hydro scheme at this weir could be used by the community of Holden Clough, or sold to the national grid. Due to the relatively remote location of the village, a grid connection may be problematic, but this has yet to be confirmed.

Under the current government feed-in tariff regulations, hydropower schemes receive a generation tariff according to their rated capacity. Schemes less than 15 kW receive 19.9p/kWh. This generation tariff is received regardless of how the electricity is used. The current base value of electricity per kilowatt hour on top of this has been assumed as 3p/kWh.

In conclusion, the total value of the generated electricity would be 22.9 p/kWh, giving an average annual value of approximately **£36,400**. The simple payback, taken as the budget scheme cost divided by the annual value of electricity generated, is **19 years**.

Conclusion

This scheme would seem fairly straightforward to build. There is existing access for ease of construction. Consideration should be made as to whether electricity generated could be used locally.

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>

Table 4 Budget development costs

Budget Scheme Cost Estimate

Holden Weir

	ITEM	UNIT	QUANTITY	MIN	MAX
Turbine					
	Turbine Quotation	No	1	£50,000.00	£62,500.00
Grid Connection					
	Grid Connection	No	1	£5,000.00	£0.00
Civils					
	Weir	m ³	10	£5,000.00	£6,250.00
	Fish Pass	m ³	0	£0.00	£0.00
	Weir Screen Length	m	2	£4,000.00	£5,000.00
	Fish Pass Length	m	0	£0.00	£0.00
	Pipe Installation	m			
	Rock	m	100	£11,000.00	£13,750.00
	Gravels	m	0	£0.00	£0.00
	Soft	m	0	£0.00	£0.00
	Pipe Materials	No	1	£0.00	£0.00
	Temporary Access	m			
	Rock	m	0	£0.00	£0.00
	Gravels	m	0	£0.00	£0.00
	Soft	m	150	£8,250.00	£10,312.50
	Temporary Access on Good Ground	m	150	£6,000.00	£7,500.00
Powerhouse					
	Powerhouse	kW	12	£15,000.00	£18,750.00
Prelims					
	Duration	Months	4	£12,000.00	£15,000.00
Sub Total					
	Sub Total			£116,250.00	£139,062.50
Professional Fees					
	Professional Fees			£17,437.50	£27,812.50
Sub Total					
	Sub Total			£133,687.50	£166,875.00
Contingency					
	Contingency			£26,737.50	£33,375.00
GRAND TOTAL				£160,425.00	£200,250.00