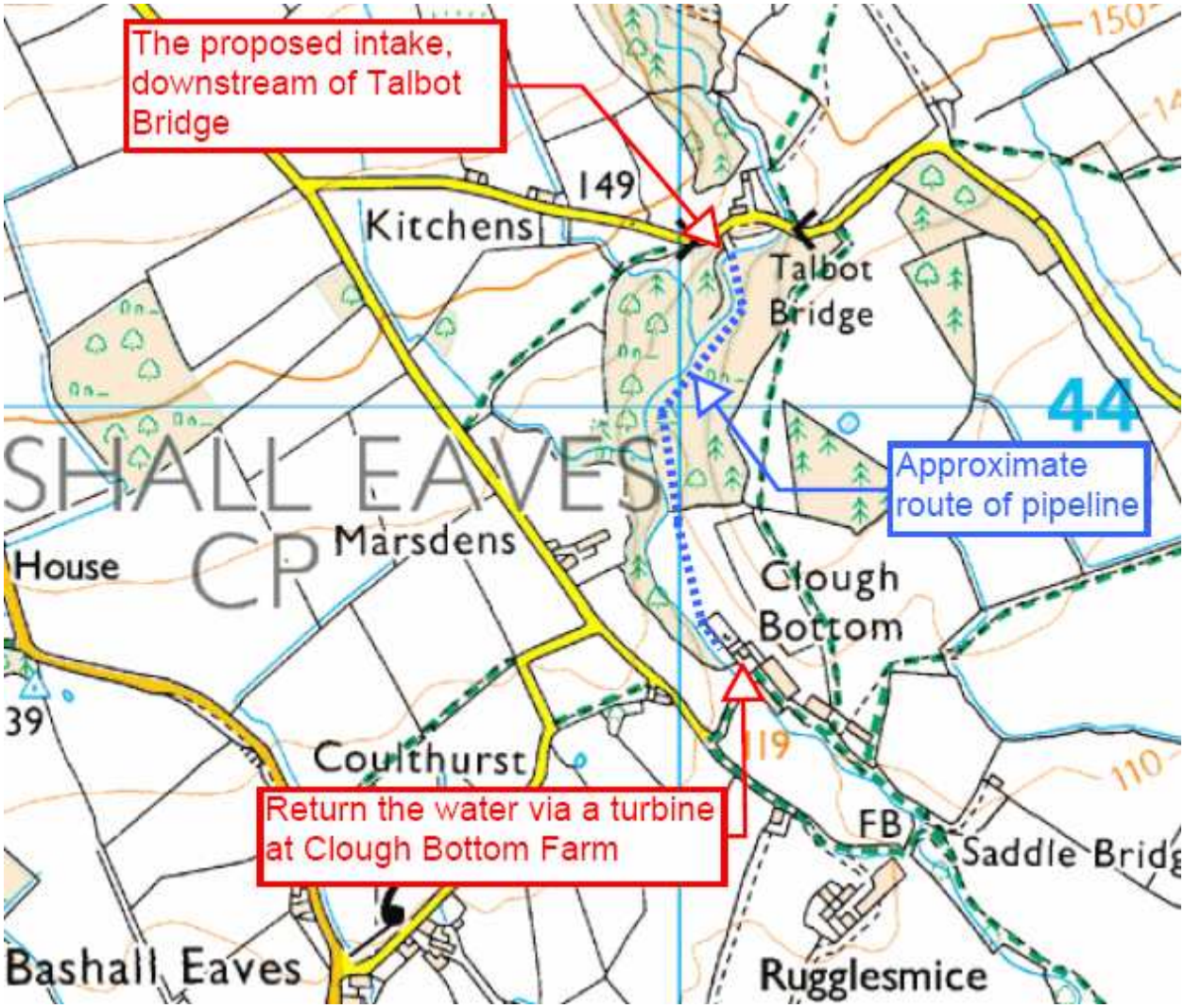
Site 3: Clough Bottom Farm, Bashall Eaves

Site Assessment

Figure 1 Map showing general layout



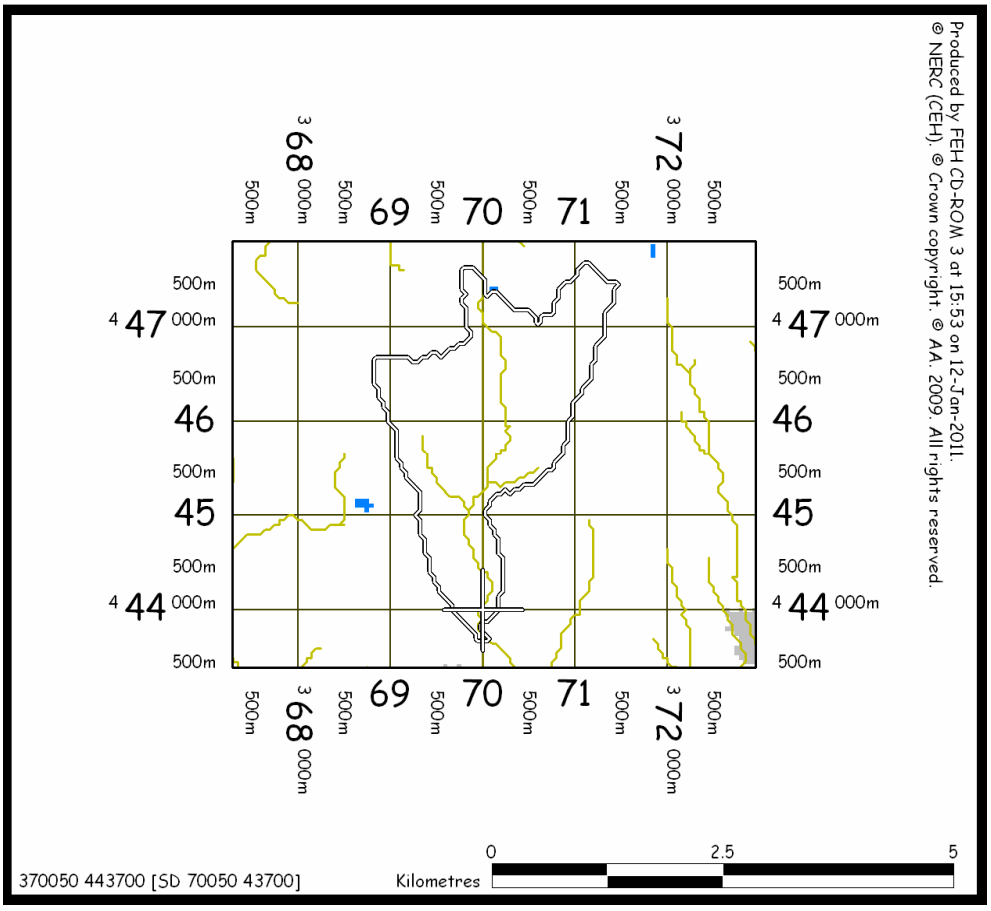
Clough Bottom Farm is a working organic farm and broader business near Bashall Eaves which includes self-catering cottages. A hydro scheme would complement this complex well. The scheme here involves a relatively long pipeline through potentially difficult ground. However, the skill sets of available workers on site will help to counter the challenging pipeline route. The intake is situated just downstream of Talbot Bridge, with the powerhouse at Clough Bottom Farm. The pipeline runs along the bottom of the small valley.

Figure 2 The weir and fishpass at Talbot Bridge

Figure 3 An old pump house

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	370050, 443700
Powerhouse Grid Reference	370030, 443740
Catchment Area	4.83 km^2
Annual Rainfall	1457 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. 'Q_{95}' refers to the flow rate which is exceeded 95% of the year.

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

Table 1 Mean flow rate and flow rate at Q_{95}

Period	Mean Flow Rate [m^3/s]	Flow Rate at Q_{95} [m^3/s]
Annual	0.154	0.0151
January	0.243	0.0378
February	0.185	0.0316
March	0.202	0.0327
April	0.135	0.0257
May	0.088	0.0157
June	0.0608	0.0121
July	0.0655	0.0116
August	0.107	0.00966
September	0.119	0.0118
October	0.17	0.0161
November	0.223	0.0284
December	0.256	0.0402

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m^3/s]
5	0.561
10	0.376
20	0.221
30	0.148
40	0.102
50	0.073
60	0.054
70	0.04
80	0.028
90	0.019
95	0.015
99	0.01

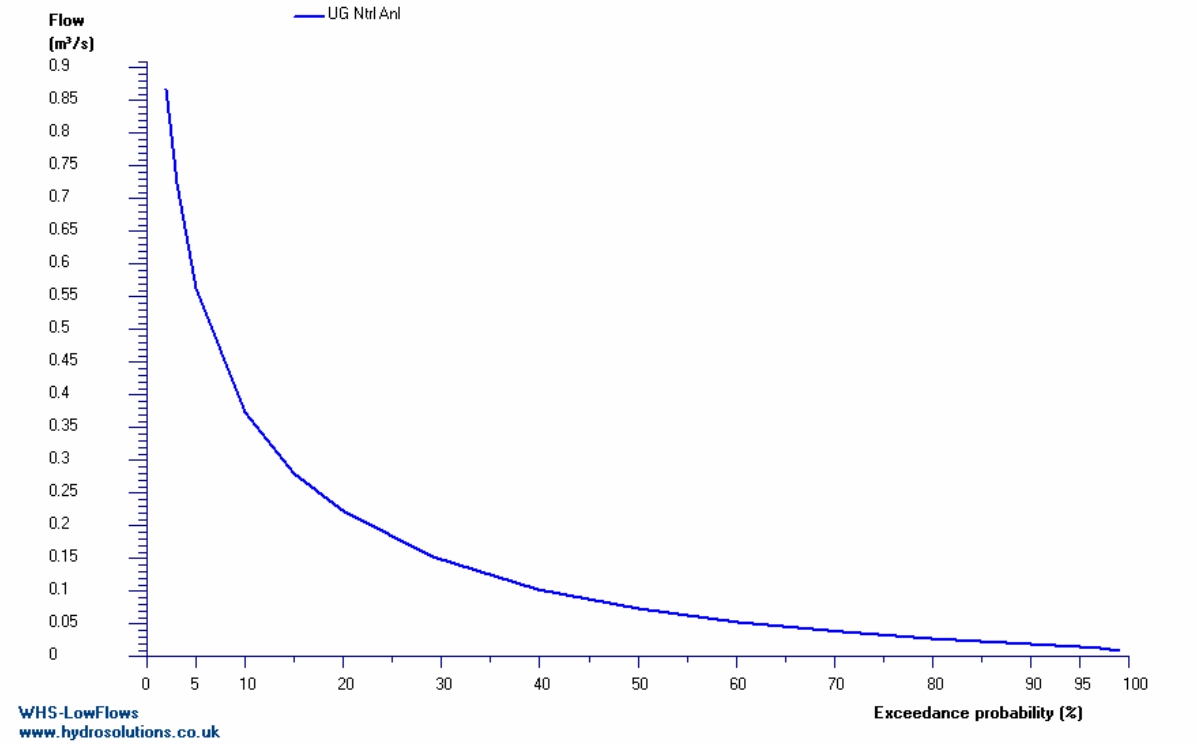


Figure 5 Annual flow duration curve produced using low flows software

Hydropower Analysis

Site: Clough Bottom
Run Date / Time: 12 January 2011 at 16:03

Mean Flow: 0.13 m3/s
Provisional Rated Flow: 0.14 m3/s
Residual Flow: 0.013 m3/s
Rated Flow: 0.13 m3/s
Gross Hydraulic Head: 12.00 m
Nett Hydraulic Head: 11.40 m

Applicable Turbines	Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Propellor	34.5	34.1	12.4	11.9	0.096
Crossflow	42.6	42.2	11.4	10.6	0.032
	MWh	**MWh**	**kW**	**kW**	**m3/s**

BFI = 0.7; therefore HOF = Q90 = 0.013

Table 3 Hydropower Analysis

Gross Head [m]	12
Net Head [m]	11.4
Design Flow [m³/s]	0.14 m³/s
Rated Capacity [kW]	10 kW
Average Annual Energy Output [MWh]	40MWh
Average annual Carbon Dioxide offset	17 tonnes

Impact Assessment

Clough Bottom Farm itself dates back to the 17th century. It is not thought at this stage that any construction for a hydro scheme would impact the historic buildings on this site.

It will be necessary to gain advice from an Ecologist to ascertain the degree of environmental assessment required at this site. Braddup Wood South which is along the beck is a Biological Heritage Site.

This land is within the Forest of Bowland Area of Outstanding Natural Beauty, and is classified as Undulating Lowland Farmland with Parkland in the Forest of Bowland Landscape Character Assessment.

Statutory Requirements

It will be necessary to apply to the Environment Agency for an abstraction license and permission to complete in-river works, and to the council for planning permission.

Budget Development Cost

The total budget cost for the whole scheme is approximately **£390,000**. 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%. See Table 4.

Revenue and Simple Payback period

The energy generated at this site would be used by the farm and associated buildings. It is not expected that a grid connection would be required here; hence the payback time is calculated according to the predicted energy use of the business at Clough Bottom Farm. This will save the developer the expense of connecting to the grid. Excess energy produce by the hydro scheme will be used in a heating system.

Under the current government feed-in tariff regulations, hydropower schemes receive a generation tariff according to their rated capacity. Schemes less than 15kW receive 19.9p/kWh. This generation tariff is received regardless of how the electricity is used. The owner has indicated that the electricity would be used on site, thereby offsetting import costs. This increases the value of the generated electricity by the import tariff, which we have assumed is 5p/kWh.

In conclusion, the total value of the generated electricity would be 24.9p/kWh, giving an average annual value of approximately **£9,960**.This works out as a simple payback time of 43 years.

Conclusion

A hydro scheme on this site would be a useful green source of power for the complex. It would not be a sufficient amount of energy alone to meet the needs of the site, but would make a significant contribution.

The pipeline route provides a challenge, but it is anticipated that a significant amount of the construction will be completed by the site owner. This will reduce costs.

As a commercial venture it seems unlikely that this scheme is economically viable. However, if the site owner was able to complete much of the work as ‘free labour’ then it may be considered worthy of development.

Table 4 Development Budget Cost

Budget Scheme Cost Estimate
Clough Bottom Farm

ITEM	UNIT	QUANTITY	MIN	MAX
Turbine				
Turbine Quotation	No	1	£40,000.00	£50,000.00
Grid Connection				
Grid Connection	No	1	£5,000.00	£6,250.00
Civils				
Weir	m^3	30	£15,000.00	£18,750.00
Fish Pass	m^3	10	£5,000.00	£6,250.00
Weir Screen Length	m	5	£10,000.00	£12,500.00
Fish Pass Length	m	5	£10,000.00	£12,500.00
Pipe Installation	m			
Rock	m	100	£11,000.00	£13,750.00
Gravels	m	300	£12,000.00	£15,000.00
Soft	m	100	£5,500.00	£6,875.00
Pipe Materials	No	1	£10,000.00	£12,500.00
Temporary Access	m			
Rock	m	0	£0.00	£0.00
Gravels	m	1000	£80,000.00	£100,000.00
Soft	m	200	£11,000.00	£13,750.00
Temporary Access on Good Ground	m	100	£4,000.00	£5,000.00
Powerhouse				
Powerhouse	kW	10	£15,000.00	£18,750.00
Prelims				
Duration	Months	4	£12,000.00	£15,000.00
Sub Total				
Sub Total			£245,500.00	£306,875.00
Professional Fees				
Professional Fees			£36,825.00	£61,375.00
Sub Total				
Sub Total			£282,325.00	£368,250.00
Contingency				
Contingency			£56,465.00	£73,650.00
GRAND TOTAL			£338,790.00	£441,900.00

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