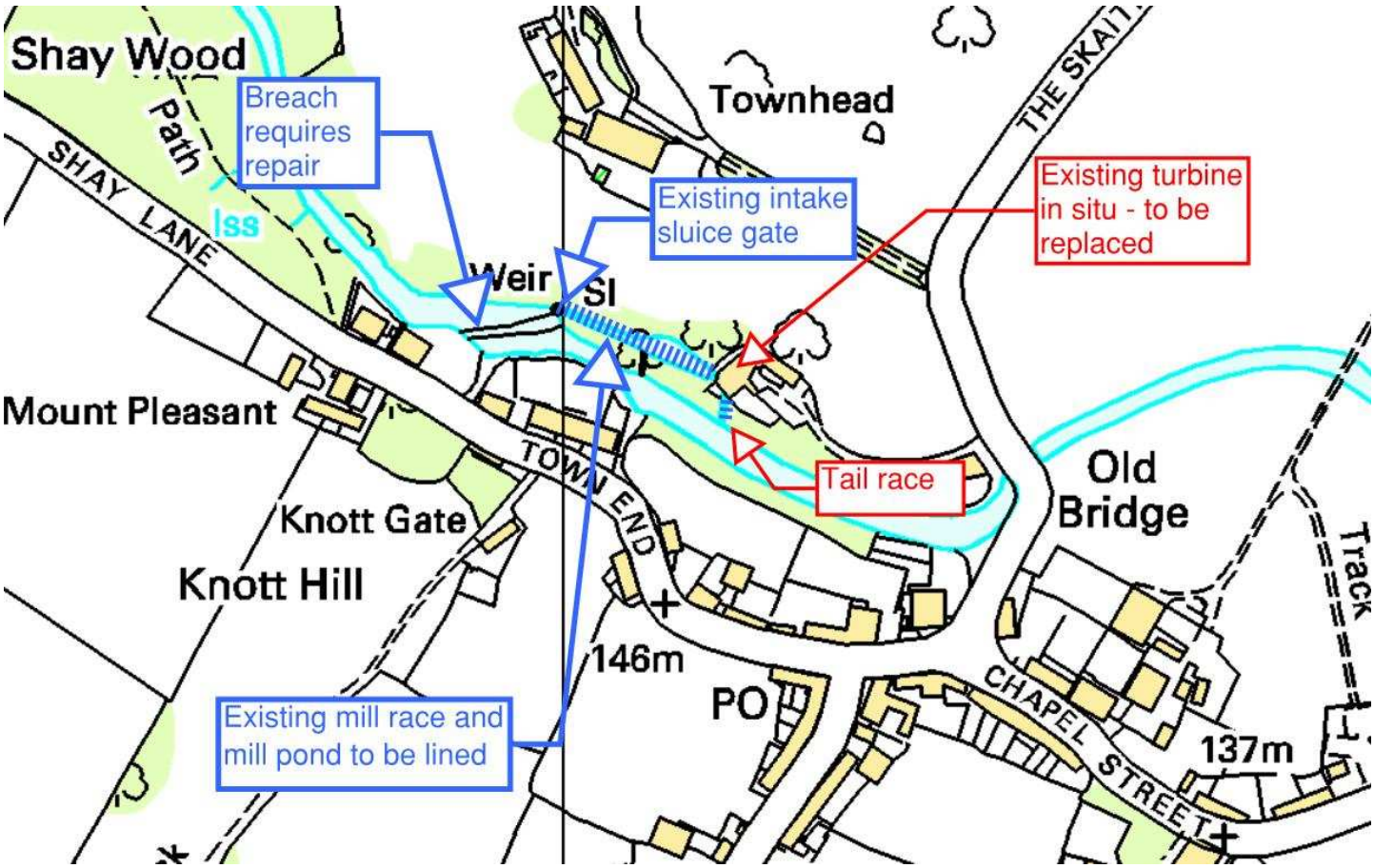
Site 16: Slaidburn Saw Mill

Site Assessment

Figure 1 Map showing general layout



Mill House in Slaidburn is a former water-powered corn mill, disused in 1850, rebuilt in 1912 as a saw mill. It is now a private dwelling.

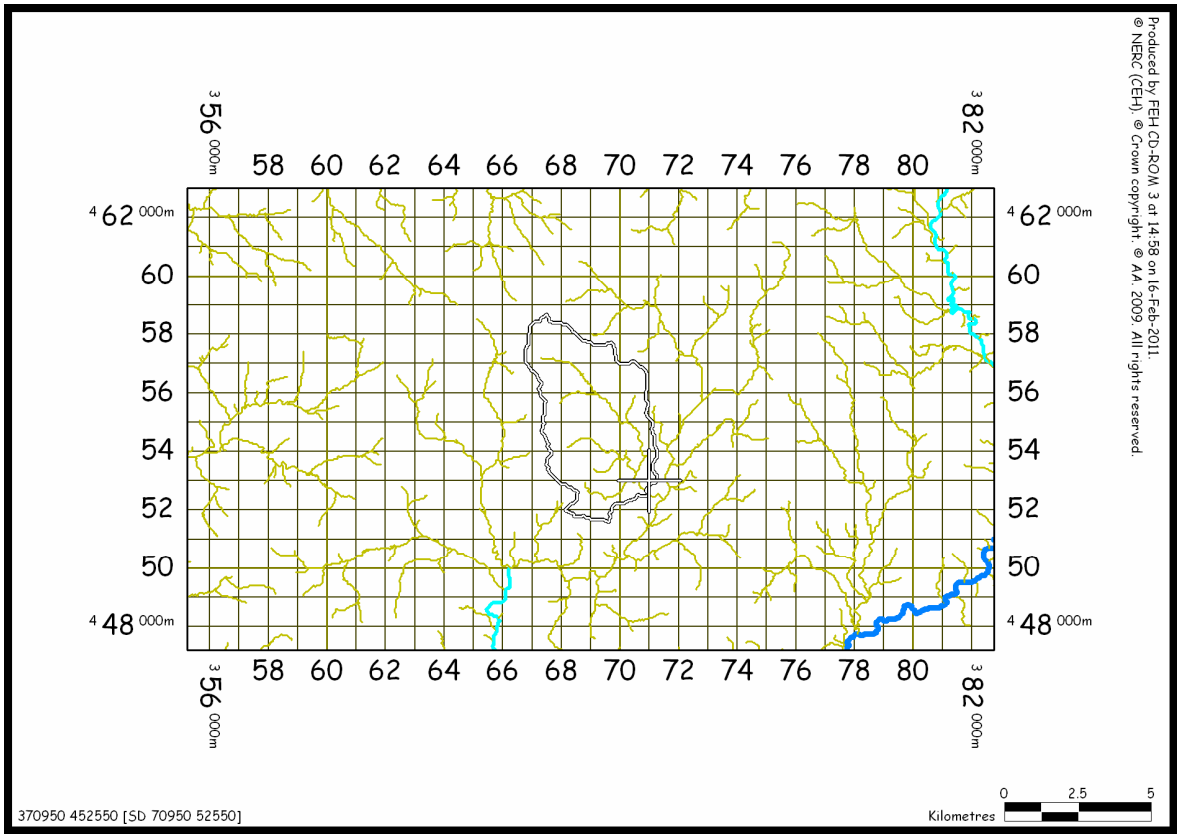
The mill had a functioning hydro scheme historically until approximately 1995 and a turbine remains in situ in the mill building, although it is in need of repair. Electricity has never been generated on the site and water power has been used solely for mechanically powering the mill machinery. The intake weir and sluice gate, leat and mill pond also remain, but all would require some remediation improvements. The option for re-instatement of a scheme at this site involves utilising some of the existing infrastructure to take the water out of the stream at the current weir location, down to the mill building and through a turbine before returning the water back to the river along the existing tail race. The intake weir has been breached at some point and this would need to be repaired to realise full capacity. A number of sluices need to be replaced along the leat as well as lining the mill pond. It is likely that a new turbine would need to be installed, although repair of the current turbine has not been investigated for this study. To produce electricity, a new generator would also be required in the mill.

Figure 2 The mill pond looking towards mill

Figure 3 The existing turbine (damaged)

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	370997, 452556
Powerhouse Grid Reference	371072, 452522
Catchment Area	20.4 km^2
Annual Rainfall	1768 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.

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

Period	Mean Flow Rate [m³/s]	Flow Rate at Q_{95} [m³/s]
Annual	0.851	0.112
January	1.328	0.252
February	0.88	0.175
March	1.114	0.235
April	0.63	0.138
May	0.446	0.11
June	0.328	0.0805
July	0.392	0.0871
August	0.569	0.0946
September	0.744	0.116
October	0.994	0.133
November	1.305	0.186
December	1.481	0.294

Table 2 Annual flow duration data

Exceedance Probability	Flow Rate [m³/s]
5	2.98
10	1.985
20	1.17
30	0.8
40	0.581
50	0.438
60	0.336
70	0.255
80	0.188
90	0.136
95	0.112
99	0.083

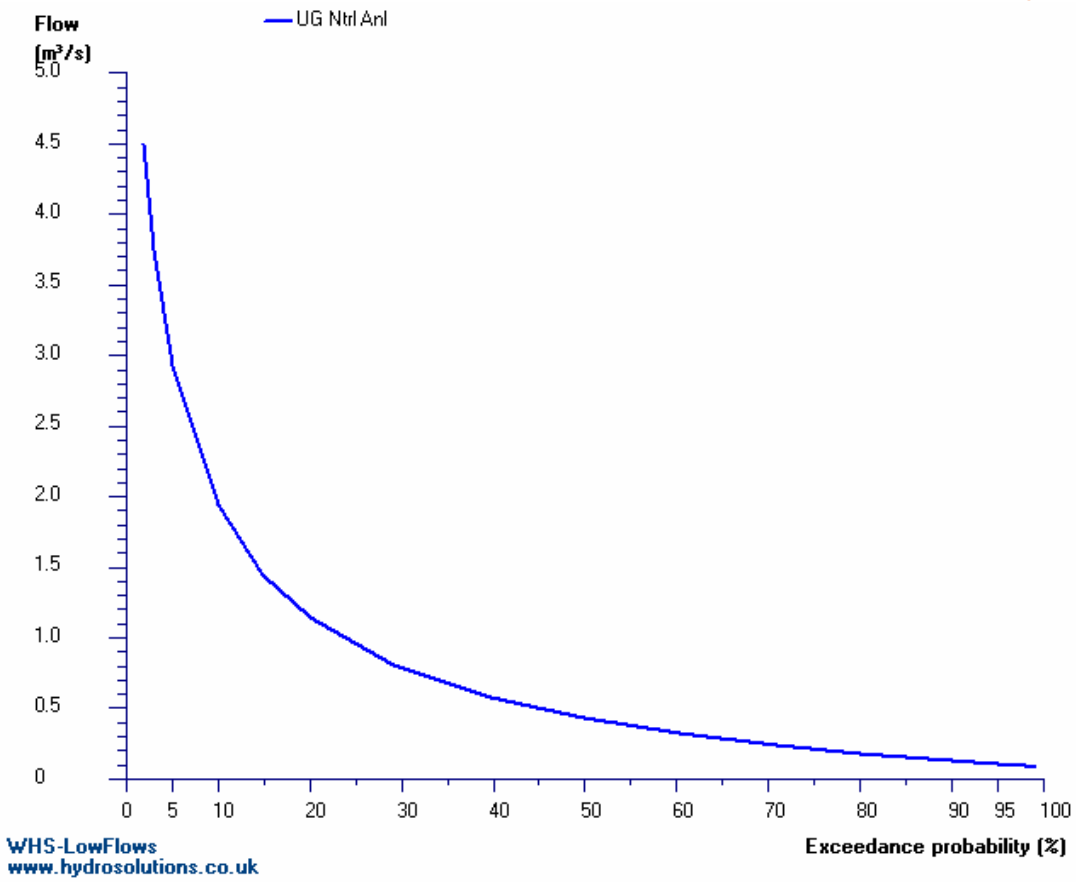


Figure 5 Annual flow duration curve produced using low flows software

Hydropower Analysis

Site: Slaidburn (Site 16)
Run Date / Time: 17 February 2011 at 15:41

Mean Flow: 0.82 m3/s
Provisional Rated Flow: 0.90 m3/s
Residual Flow: 0.080 m3/s

Rated Flow: 0.82 m3/s
Gross Hydraulic Head: 2.50 m
Nett Hydraulic Head: 2.38 m

Applicable Turbines	Gross Annual Average Output	Nett Annual Average Output	Maximum Power Output	Rated Capacity	Minimum Operational Flow
Propellor	47.8	47.4	16.7	16.0	0.61
Crossflow	60.9	60.2	15.3	14.3	0.20
	MWh	MWh	kW	kW	m3/s

Table 3 Hydropower Analysis

Gross Head [m]	2.50 m
Net Head [m]	2.38 m
Design Flow [m³/s]	0.82 m³/s
Rated Capacity [kW]	15 kW
Average Annual Energy Output [MWh]	54 MWh
Average annual Carbon Dioxide offset	29 tonnes

Impact Assessment

Slaidburn Mill is within the Forest of Bowland AONB. The site lies in the character area of Undulating low-land farmland with parkland, and comprises the saw mill and mill pond on the site of the medieval corn mill. The corn mill was working on the site up until 1912, when it was rebuilt as a saw mill. In both instances the mill was powered by a water wheel. At some point, the water wheel was replaced by a turbine that mechanically drove the mill machinery up to around 1995. Some of the fabric of the corn mill survives, including the hydro power infrastructure. The mill is a two-storey stone built structure and is now used as a storage facility and workshop.

If a scheme were pursued here it would be the refurbishment of an historic scheme, or the reinstatement of the more recent turbine. The area of construction is well away from any public access and it is not thought the development would have any significant visual impact. In respect of impact on fisheries, the intake weir includes a fish pass, though screens would be required on the tail race.

Statutory Requirements

In-river works will be required to repair the weir, 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. An ecologist will advise on the extent of environment assessment required.

Budget Development Cost

The total budget cost for the whole scheme is **£116,070**. 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%.

Table 4 Development Budget Costs

Budget Scheme Cost Estimate
Slaidburn Saw Mill

ITEM	UNIT	QUANTITY	MIN	MAX
Turbine				
Turbine Quotation	No	1	£40,000.00	£50,000.00
Grid Connection				
Grid Connection	No	1	£0.00	£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	0	£0.00	£0.00
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	0	£0.00	£0.00
Temporary Access on Good Ground	m	0	£0.00	£0.00
Powerhouse				
Powerhouse	kW	15	£15,000.00	£18,750.00
Prelims				
Duration	Months	3	£9,000.00	£11,250.00
Sub Total				
Sub Total			£73,000.00	£91,250.00
Professional Fees				
Professional Fees			£10,950.00	£18,250.00
Sub Total				
Sub Total			£83,950.00	£109,500.00
Contingency				
Contingency			£16,790.00	£21,900.00
GRAND TOTAL			£100,740.00	£131,400.00

Revenue and Simple Payback period

It is unlikely that a grid connection is required for this scheme, and instead the energy will be used on site at the mill workshop and mill cottage. The simple payback can therefore be worked out according to the electricity bills saved by the mill. An estimate of the grid connection cost has been acquired however, assuming that a Propeller or Crossflow turbine is used.

Under the current government feed-in tariff regulations, hydropower schemes receive a generation tariff according to their rated capacity. Schemes less than or equal to 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/kW.

In conclusion, the total value of the generated electricity would be **22.3 p/kWh**, giving an average annual value of approximately **£11,232.** The simple payback, taken as the budget scheme cost divided by the annual value of electricity generated, is **10.3 years**.

Conclusion

This is a small scheme using the existing infrastructure and the power generated could be used to supply both the workshop and the attached cottage. The site owner is in a good position to do the construction themselves using the estate maintenance team. This will keep costs to a minimum, and is likely to result in the main cost being the turbine.

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