Hydro and Wind Consultancy, Design & Installation

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Birley Hay Farm Hydroelectric Power Scheme

Environmental Report

Document Control

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Renewables First – Company

Renewables First is one of the UK's leading hydro and wind power specialists and has been delivering hydro and wind projects for over ten years. We provide all of the services from in-house resources to take a project from initial feasibility stage, through all of the consenting and engineering design stages and on to construction and commissioning. We use our experience of the installation and operational phases to provide feedback into the design stages of the next projects, ensuring that our customers benefit from our whole-project exposure.

Contents

1 Introduction

This document accompanies the water resources abstraction licence application and hydroelectric power scheme application for the proposed hydroelectric power (HEP) scheme located at Birley Hay Farm, Birley Hay, Ridgeway, Sheffield.

A cross-flow turbine system is proposed for installation in what was formerly a waterwheel house for the mill on the site.

The maximum abstraction proposed for the scheme is Q_{mean} in line with Table C of 'Guidance for run-of-river hydropower development'. Key parameters that allow higher levels of abstraction and departure from table A in the document are listed below with supporting information included in the subsequent sections of this report.

1. Not prevent Water Framework Directive objectives from being achieved (see the 'Water Framework Directive' section of 'Guidance for run-of-river hydropower development').
2. Maintain or improve fisheries, fish passage and fish migration (see the 'Fish passage and screening' section of 'Guidance for run-of-river hydropower development').
3. Not have unacceptable impacts (effects) on protected sites or species (see the 'Nature conservation and heritage' section of 'Guidance for run-of-river hydropower development').
4. Not have unacceptable impacts on the rights of other water users, including anglers.

A completed WR325 Environmental Site Audit Checklist is also attached for reference.

2 Site details

2.1 Site description

Figure 1 to Figure 7 show the current layout around the installation location. There is an existing weir which discharges flow from the mill pond into the downstream channel. There is also an existing wheelhouse where the turbine will be located. From this wheelhouse there is a culvert which discharges into the river approximately 300 metres downstream from the weir.

Figure 1: view looking across the existing weir.

Figure 2: view of the intake location (red) with the weir location also shown (blue).

Figure 3: view of the mill pond from the intake location.

Figure 4: view of the wheelhouse (intake to the left).

Figure 5: entrance to the culvert in the wheelhouse.

Figure 6: discharge from the culvert to The Moss.

Figure 7: view looking across The Moss from the culvert discharge.

2.2 Hydrological data

The water level from the crest of the weir to the bottom of the culvert in the turbine house is 8.0 metres.

The Flood Estimation Handbook Web Service has been used to give an estimated catchment area of 11.29 km2.

The nearest EA gauging station is number 27025 on the Rother at Woodhouse Mill. When scaled for the catchment area, Q_{mean} was found to be 142 litres/sec. The catchment area for this station is much larger than at Birley Hay Farm. Therefore, the LowFlows 2 programme has been used to estimate the flow data for the site. The flow data from LowFlows is given in Table 1 and a flow duration curve is also provided (Figure 8).

Flow exceedance (%)	Gross flow rate (m^3/s)
Q_{10}	0.297
Q_{20}	0.185
Q_{30}	0.132
Q_{40}	0.100
Q_{50}	0.078
Q_{60}	0.063
Q_{70}	0.051
Q_{80}	0.040
Q_{90}	0.032
Q_{95}	0.026
Qmean (Q30)	0.136
Q_{95}/Q_{mean}	0.19

Table 1: flow exceedance for the site from LowFlows 2.

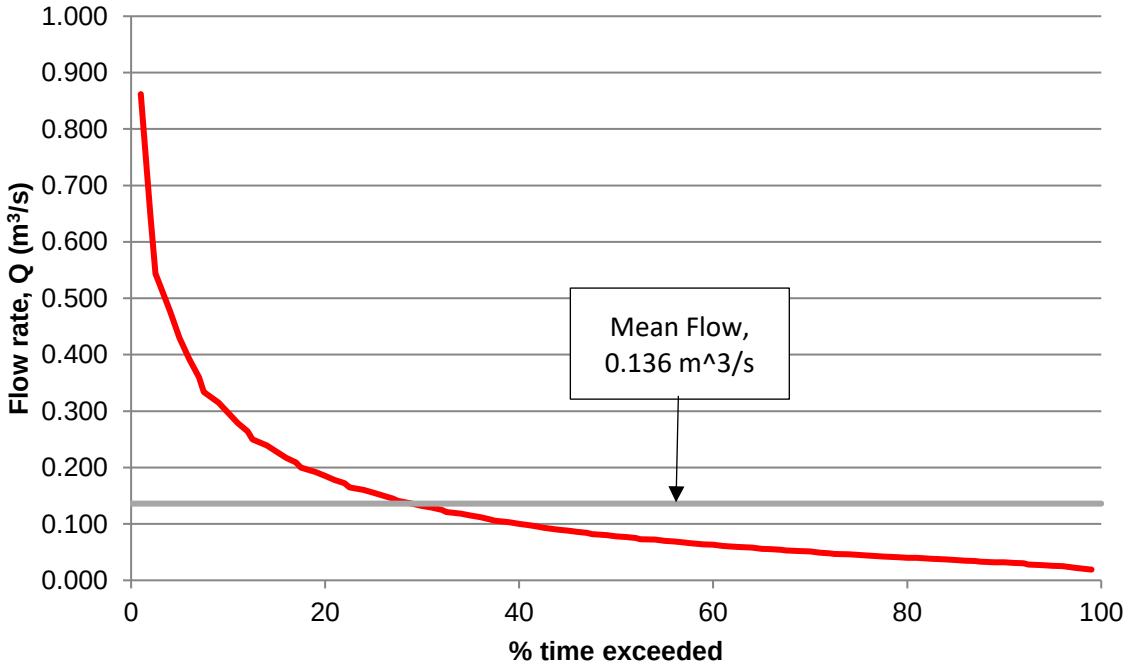

Figure 8: flow duration curve for the site.

3 Proposal

3.1 Proposal summary

The HEP system consists of a crossflow turbine installed in the old wheelhouse. The scheme is expected to generate a peak electrical power output of 7 kW.

3.2 Summary of hydrology information

It is proposed that the HEP scheme flow is Q_{mean}, which in this case is 136 litres/sec. The hands-off-flow across the weir is proposed to be set at Q_{95}, which in this case is 26 litres/sec. The HEP scheme will take 100% of the flow above Q_{95} up to Q_{mean}. Any flow above this will be discharged over the weir.

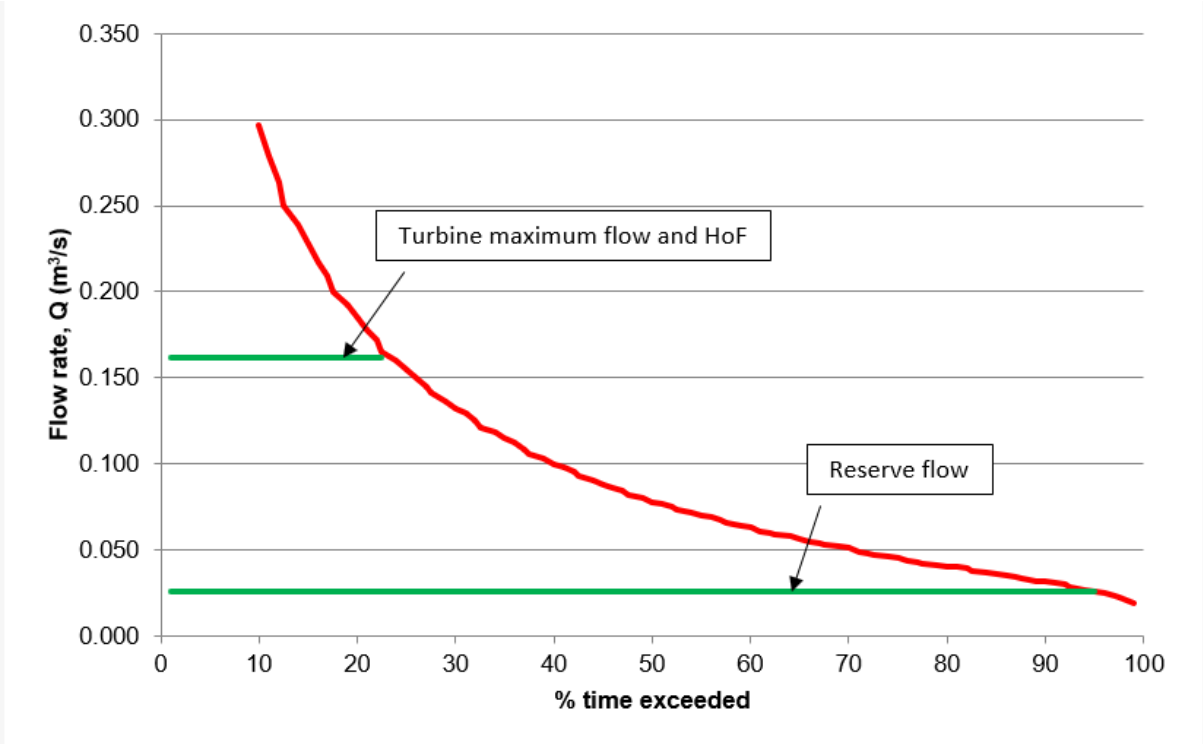

Figure 9: flow duration curve with turbine flow.

Table 2 outlines the key hydrological information for the proposed HEP system.

Turbine intake location (mill pond)	SK 39756 80351
Power house location (wheelhouse)	SK 39772 80350
Outfall location (culvert)	SK 39984 80381
Depleted reach	300 m
Turbine type	1 no. crossflow turbine
Turbine rated flow	0.136 m^3/s
Hands-off-flow	0.026 m^3/s
Rated system head	8.0 m
Maximum hourly abstraction	490 m^3
Maximum daily abstraction	11,750 m^3
Maximum annual abstraction	2,585,000 m^3

Table 2: key hydrological information for the HEP system.

3.3 Layout

Refer to the site layout drawings.

3.4 Operation

Flow will enter the penstock pipe through the intake screen in the mill pond. This flow will be directed through to the power house and into the turbine. The flow will discharge from the turbine into a sump which will be connected to the existing culvert.

The flow through the turbine will be controlled to maintain the level in the mill pond using a head sensor. This level will be set to maintain the hands-off-flow over the existing weir.

Any excess flow will continue to spill over the existing weir.

4 Ecology

4.1 Designations

A desktop review of ecology designations was undertaken using the MAGiC online database.

The site is not within a SSSI, SAC, RAMSAR, SPA, NNR, LNR, NP or AONB designation.

The proposal is within the SSSI impact risk zone for the following sites:

- Moss Valley Meadows SSSI – 0.7 km away
- Moss Valley SSSI – 0.7 km away
- Moss Valley Woods SSSI – 1.3 km away
- Totley Wood SSSI – 7 km away
- Crabtree Wood SSSI – 9 km away

The proposal will not impact upon any of these sites.

The proposed development is not within a priority habitat.

4.2 Fish and aquatic habitats

The Environment Agency Ecology & Fish Data Explorer has been used to carry out a desk study of the fish species that could be impacted by the scheme.

The fish species shown in Table 3 have been recorded during surveys in The Moss upstream of the site. All these species could therefore be present upstream of the intake.

The fish species shown in Table 4 have been recorded during surveys in The Moss downstream of the site. All these species could therefore be present at the outfall location.

No upstream fish migration is currently possible between the outfall and intake due to the existing weir.

Brown / sea trout
Lamprey sp.
Bullhead
Stone loach

Table 3: fish species recorded at location 3908 upstream of the proposed scheme.

Brown / sea trout
Gudgeon
Roach
Perch
Bullhead
3-spined stickleback
Minnow
Stone loach

Table 4: fish species recorded downstream of the scheme on The Moss at locations 3909, 23867 and 40606.

Eels have not been recorded in surveys around the site. However, the site is within 30 km of the tidal limit. Therefore, a mix of size of eels could be expected.

A 6mm aperture intake screen will be installed at the intake location to prevent fish entry into the turbine.

No outfall screen will be installed at the tailrace due to the air gap between the turbine runner and the tailwater level.

5 Geomorphology

A separate geomorphology assessment for the depleted reach has been included with the hydropower application.

6 Flood Risk

The Environment Agency flood map for the area shows the site located within flood risk Zone 3 (Figure 10). A flood risk assessment should therefore be submitted as part of the planning application.

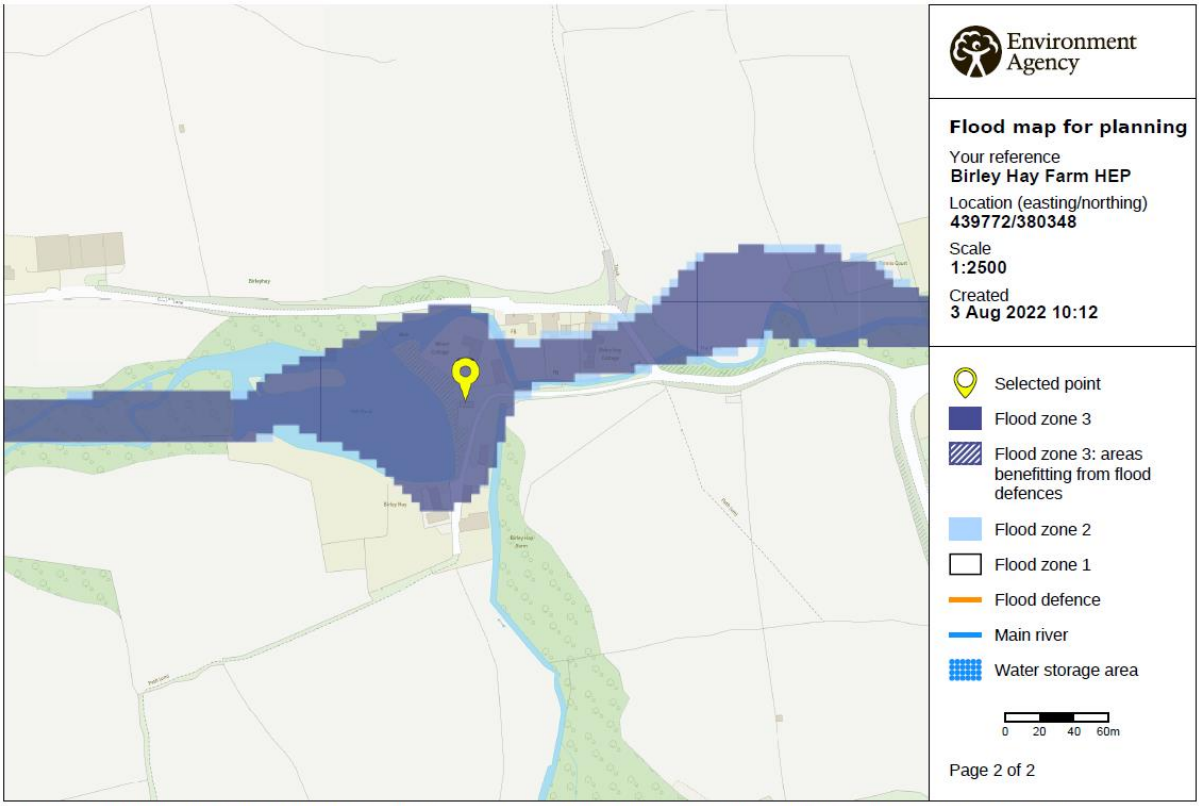

Figure 10: EA flood map extract.

The proposed HEP scheme will not change the run-off from the site as it will be installed within the existing building.

When the HEP scheme is operational, the flood levels upstream of the weir will be reduced due to the flow through the turbine. When the scheme is not operational, there will be a negligible change in the flood levels.

Construction and maintenance work on the weir will only be carried out during low flow conditions when any impact from reducing the weir length will be small.

Overall, the proposal is considered to not present any significant additional flood risk.

7 Water Framework Directive

The WFD objectives for The Moss from Source to River Rother water body (shown in Table 5) have been assessed. The proposed installation will have no or negligible effect on these objectives.

Classification Item	Status	Year
Ecological	**Good**	2027
Biological quality elements	**Good**	2027
Fish	**Good**	2027
Invertebrates	**Good**	2015
Macrophytes and Phytobenthos Combined	**Good**	2015
Physico-chemical quality elements	**Good**	2015
Ammonia (Phys-Chem)	**Good**	2015
Dissolved oxygen	**Good**	2015
Phosphate	**Good**	2015
Temperature	**Good**	2015
pH	**Good**	2015
Hydromorphological Supporting Elements	**Supports good**	2015
Hydrological Regime	**Supports good**	2015
Supporting elements (Surface Water)	**Not assessed**	2015
Specific pollutants	**Not assessed**	2015
Chemical	**Good**	2015
Priority hazardous substances	**Does not require assessment**	2015
Priority substances	**Does not require assessment**	2015
Other Pollutants	**Does not require assessment**	2015

Table 5: WFD objectives for the Exe (Barle to Culm) water body.

8 Human impacts

8.1 Navigation

The watercourse is not used for navigation, so the scheme will have no impact.

8.2 Recreational use

Any flows or water levels downstream of the culvert or upstream of the intake will be unchanged. The depleted reach is not used for angling activities. Therefore, angling will be unaffected by the proposal.

8.3 Heritage

There are no scheduled monuments, world heritage sites or listed buildings that will be affected by the proposed scheme.

8.4 Landscape and visual

The installed equipment will all be below bank level or within the existing wheelhouse building. Any changes to the building will be covered by a planning application.

9 Conclusions

This proposed HEP scheme meets the necessary requirements for an abstraction licence.

An assessment has been completed to show that there will be no significant adverse impact on ecology, geomorphology, flood risk and human uses of the watercourse and any impacts can be mitigated effectively.

The scheme is not considered to impact on an any Water Framework Directive objectives for the impacted water body.

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Birley Hay Farm

Fisheries assessment

Site visit date: 18th August 2023
Report completed: 08th December 2023
Author: Adrian Ezard

Contents

Introduction

Birley Hay Farm is an historic water mill (OS grid reference SK397802). The River Moss runs through the site and is a tributary to the River Rother approximately 4.5 km downstream.

The mill pond upstream of the old wheel house was originally used for retaining water to power the mill during short periods of low flow or when needing to run all three wheels concurrently. The original mill previously operated a forge and scythe-grinding mill using three waterwheels. The mill was closed in 1938 and mostly dismantled in 1944.

There is a spillway weir at the end of the mill pond which allows water to bypass the mill during periods of high flow. Without the mill in operation, this spillway weir has become the main channel for flow.

The survey was carried out during a dry period when the flows appeared to be around Q95 or less.

Existing infrastructure

Figure 1 shows the layout of the Birley Hay Farm site and course of the River Moss. The locations marked are shown in photographs below. The location of the dam overspill weir is shown below and in figure 2 below.

There is an intake pipe approximately 1.5 m below the current spill level of the pond that would supply water to the original wheels or turbines. This pipe is still 'live' and has an operable valve on the end of it.

There is a small tributary, Figure 5, joining the River Moss, approximately 85 m downstream of the spill weir.

The original outfall from the mill wheel passed down a 200 m long culvert, emptying back into the River Moss.

It is proposed to install a new hydroelectric turbine within the old wheel house. A revised tailrace arrangement was considered but the head loss, ownership and access and additional costs involved have discounted this option.

This report records the status of the river prior to any changes being made, with particular focus on the proposed depleted reach.

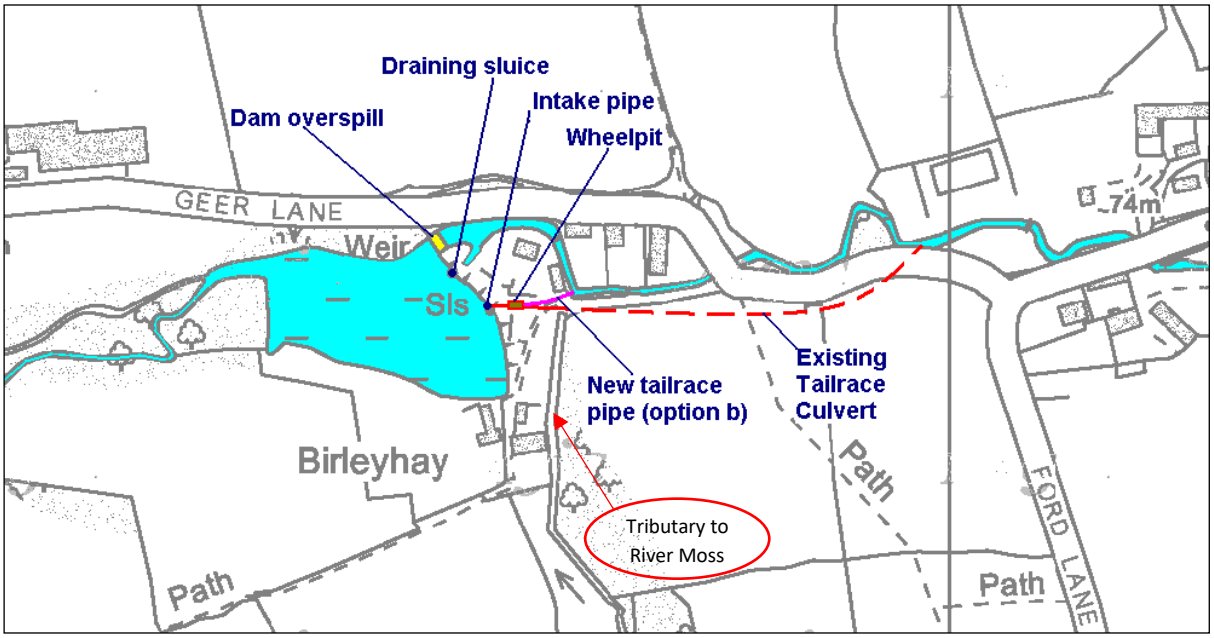


Figure 1: Birley Hay Farm site layout (photo locations indicated).

Figure 2: Overspill dam weir from above and below.

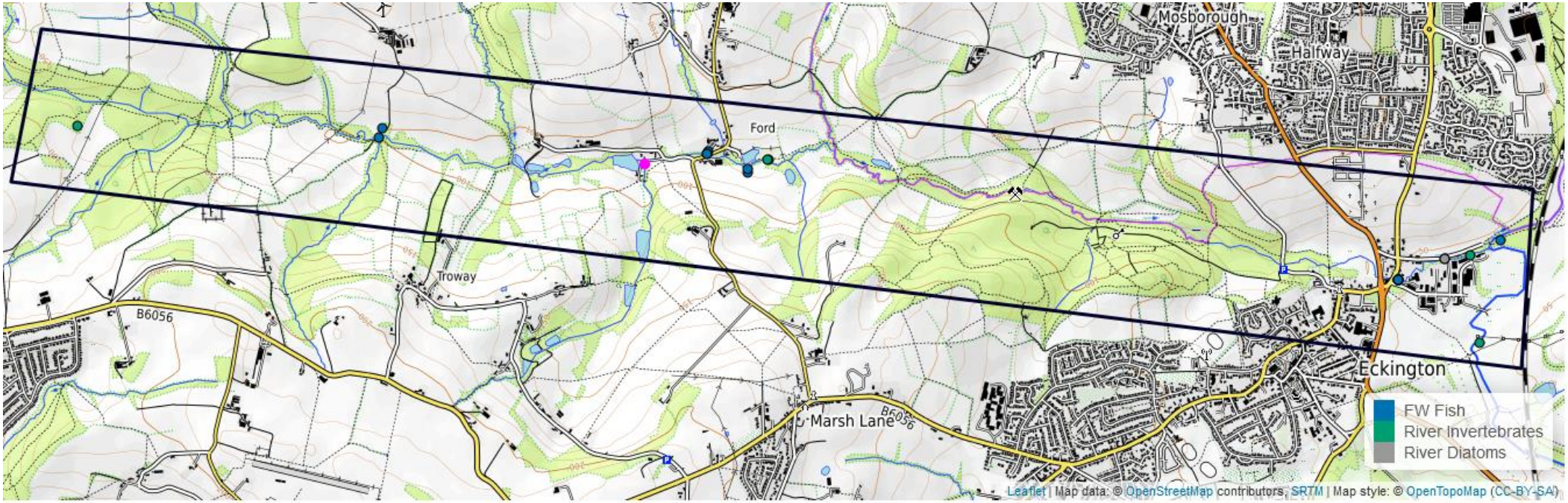
Figure 3: Mill Pond draining sluice and intake pipe to turbine house location

Figure 4: Wheel pit culvert entrance and culvert outfall.

Figure 5: Tributary culvert outfall, 85m downstream of weir.

Existing fisheries data

The Environment Agency Ecology & Fish Data Explorer has been used to plot historical fish surveys on The Moss. The points are shown in Map 1 below and the data shown in Table 1.



Map 1 – Fisheries survey locations

SITE_ID	SITE_NAME	SURVEY_ID	EVENT_DATE	SPECIES_NAME	ALL_RUNS
3908	The Moss at Povey Farm	109645	15/07/2002	Brown / sea trout	33
3908	The Moss at Povey Farm	109645	15/07/2002	Lamprey sp.	
3908	The Moss at Povey Farm	109645	15/07/2002	Bullhead	
3908	The Moss at Povey Farm	109645	15/07/2002	Stone loach	
3908	The Moss at Povey Farm	110096	11/03/1994	Brown / sea trout	11
3908	The Moss at Povey Farm	110096	11/03/1994	Bullhead	

3908	The Moss at Povey Farm	110096	11/03/1994	Lamprey sp.	
3909	The Moss at Ford	109648	09/05/2002	Brown / sea trout	6
3909	The Moss at Ford	109648	09/05/2002	Gudgeon	2
3909	The Moss at Ford	109930	29/01/1992	Brown / sea trout	5
3909	The Moss at Ford	109930	29/01/1992	Roach	91
3909	The Moss at Ford	109930	29/01/1992	Perch	4
3909	The Moss at Ford	109930	29/01/1992	Bullhead	
3909	The Moss at Ford	109930	29/01/1992	3-spined stickleback	
3909	The Moss at Ford	110097	24/02/1994	Brown / sea trout	14
3909	The Moss at Ford	110097	24/02/1994	Roach	5
3909	The Moss at Ford	110097	24/02/1994	Gudgeon	2
3909	The Moss at Ford	110097	24/02/1994	Perch	1
3909	The Moss at Ford	110097	24/02/1994	Minnow	
3910	The Moss at Eckington	103309	08/09/2006	Brown / sea trout	26
3910	The Moss at Eckington	103309	08/09/2006	Stone loach	
3910	The Moss at Eckington	103309	08/09/2006	Bullhead	
3910	The Moss at Eckington	109875	12/12/1988	Brown / sea trout	3
3910	The Moss at Eckington	109875	12/12/1988	Bullhead	
3910	The Moss at Eckington	109875	12/12/1988	Stone loach	
3910	The Moss at Eckington	109875	12/12/1988	Minnow	
3910	The Moss at Eckington	109907	10/12/1984	Perch	1
3910	The Moss at Eckington	109907	10/12/1984	Stone loach	
3910	The Moss at Eckington	109907	10/12/1984	Bullhead	
3910	The Moss at Eckington	109907	10/12/1984	Minnow	
3910	The Moss at Eckington	109907	10/12/1984	3-spined stickleback	
3910	The Moss at Eckington	110099	24/02/1994	Roach	1
3910	The Moss at Eckington	111128	01/09/1990	Brown / sea trout	2
3910	The Moss at Eckington	111128	01/09/1990	Stone loach	
3910	The Moss at Eckington	111128	01/09/1990	Bullhead	
3910	The Moss at Eckington	111128	01/09/1990	3-spined stickleback	

3910	The Moss at Eckington	111128	01/09/1990	Minnow	
3910	The Moss at Eckington	129269	01/09/2011	Brown / sea trout	18
3910	The Moss at Eckington	129269	01/09/2011	Bullhead	16
3910	The Moss at Eckington	129269	01/09/2011	Minnow	2
3910	The Moss at Eckington	129269	01/09/2011	Stone loach	7
3910	The Moss at Eckington	151570	31/08/2017	Brown / sea trout	7
3910	The Moss at Eckington	151570	31/08/2017	Bullhead	8
3910	The Moss at Eckington	151570	31/08/2017	Stone loach	3
23867	Ford Bottom	103321	08/09/2006	Perch	1
23867	Ford Bottom	103321	08/09/2006	Roach	
23867	Ford Bottom	103321	08/09/2006	Minnow	
23867	Ford Bottom	103321	08/09/2006	Stone loach	
23867	Ford Bottom	103321	08/09/2006	Bullhead	
23867	Ford Bottom	129270	01/09/2011	Roach	11
23867	Ford Bottom	129270	01/09/2011	Perch	1
23867	Ford Bottom	129270	01/09/2011	Minnow	14
23867	Ford Bottom	129270	01/09/2011	Bullhead	12
23867	Ford Bottom	129270	01/09/2011	Brown / sea trout	4
30361	Moss confluence	111092	17/10/1995		
40606	DS Ford Bottom Mill Pond	129271	01/09/2011	Brown / sea trout	1
40606	DS Ford Bottom Mill Pond	129271	01/09/2011	Bullhead	7
40606	DS Ford Bottom Mill Pond	129271	01/09/2011	Minnow	11

Table 1 – Historical fisheries data

The EA fish survey data locations have been plotted in Google Earth below to show the Survey ID of each site in relation to Birley Hay Farm and the ten weirs (red points) downstream of Birley Hay presenting eight barrier locations to migration. There are multiple weirs also on the River Rother beyond that. The first of these is also shown (yellow point).

River Survey

During the survey, photographs and details were recorded at between 15 m and 25 m spacing down the river.
It should be noted there was little change in any of the river bed along the course of the survey.
The positions of the assessment locations are shown in Figure 6 below.

©Google Earth

Figure 6: baseline survey assessment locations.

Location A & B

Location A & B have been shown in figure 2 above.

Location C

Location C is looking down the river toward the cottage on the first bend below the weir. Further photos show the nature of bed, bank and maximum pool depth below the weir in that area. Bed material is mostly larger stones.

Location D

Location D is looking down the river toward the cottage. Shallower narrow rocky channel approx. 2.5 m wide.

Location E

Location E is showing depth of corner adjacent to the bend by the Mill Cottage. Bed material is generally silty with large stones.

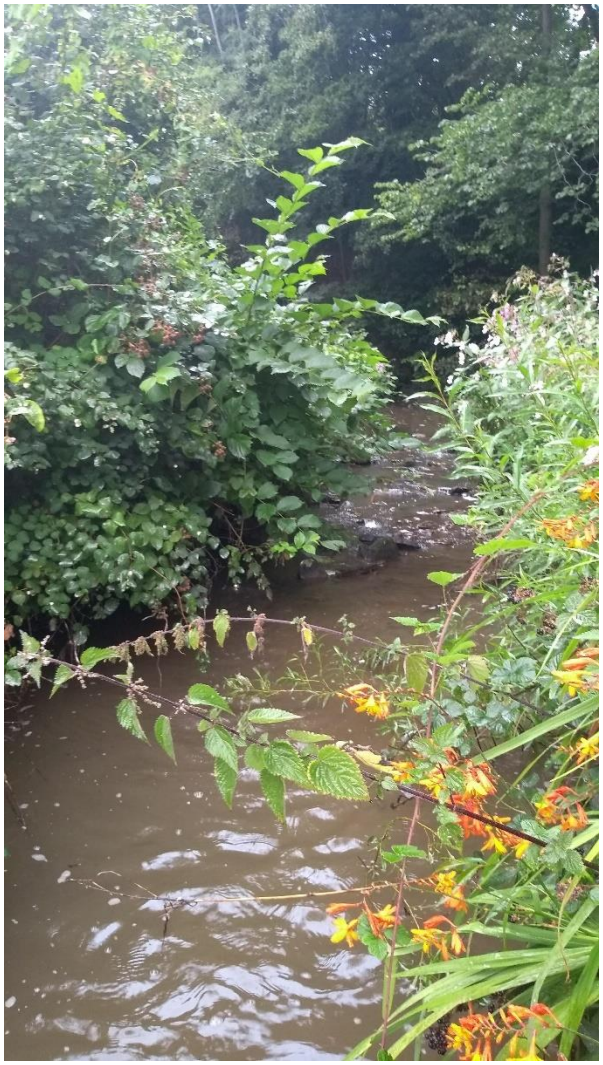
Location F

Location F is looking downstream just below the bend at location E. Depth and bed material remains consistent with location E. Outfall of culvert from small tributary between E and F also shown below.

Culvert outfall of tributary to the Moss shown in figure 1.

Location G

Location G shallows again. Bed material remains mostly larger stones but build-up of silt and some smaller stones on banks. River approximately 3 m wide.



Left bank / right bank facing downstream

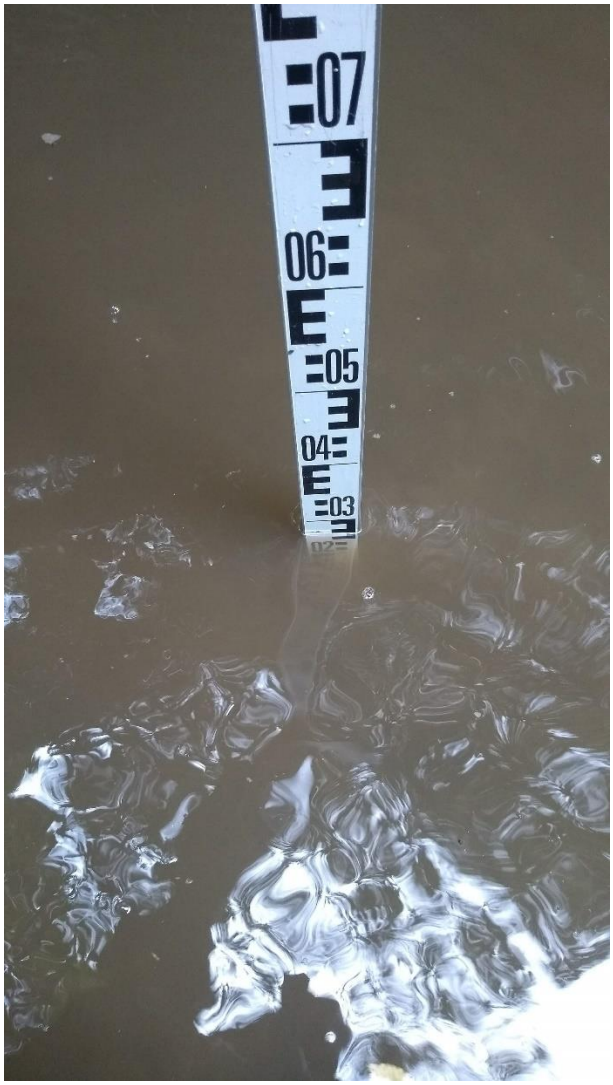
Location H

Location H, the river shallows and widens further. Bed material on banks has higher content of gravels and smaller stones, otherwise still fairly large rocks throughout the larger channel.

Figure 7: location 6 – overgrown foliage around bypass channel (grid reference SY 90630 93934)

Location I

Location I becomes a ‘man-made’ channel from location H toward the bridge at location J. Depth and width are uniform. Bed material is a mix of rubble and stones. Still silty.



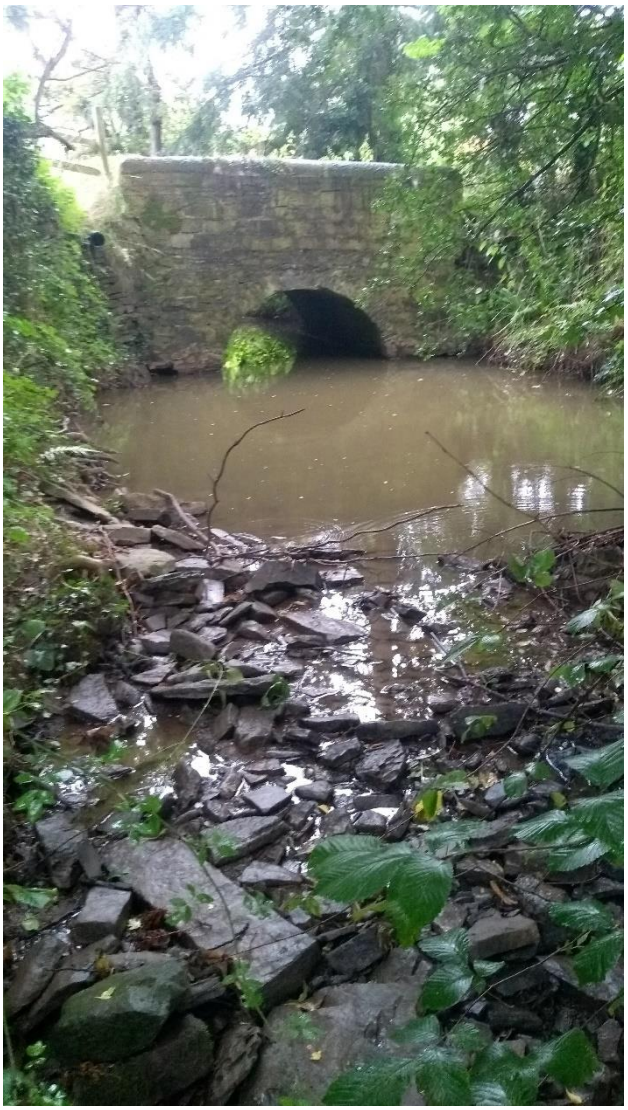
Location J

Location J is upstream of the bridge. Depth becomes too deep to wade (over 1.3 under bridge). Bed is all rock/stone with no small material evident.

Location K

Location K is looking upstream toward the bridge and across the ‘natural’ weir and small tributary ditch.

Material deposited from upstream, through bridge scour during high flow events, explaining lack of bed material immediately upstream.



Location L

Location L the river widens, shallows and slows again. Bed material is uniform mix of rocks and shale.

Location M

Location M, the river continues with a mix of deeper pools and shallow reaches over a distance of around 25m.

Location N

Location N, the river continues with a mix of deeper pools and shallow reaches over a distance of around 50m.

Location O

Location O wider shallow reach on bend toward the outfall location. Larger stones under water, smaller shale and gravels on one bank.

Location P

Location P is looking upstream and downstream from approx. 15m upstream of the culvert outfall location.

Location Q

Location Q is looking near the outfall downstream and showing the outfall.

Findings and Conclusion

Although the survey was undertaken during a period of rainfall there had been little rain in the preceding weeks – hence the low flows on the site.

The water was relatively slow flowing over most of the reach examined and was very silty.

No fish were visible at any point during the survey.

The previous survey data shows that Brown Trout, Gudgeon, Roach and Perch have been found below this reach, above the weir at Ford.

The proposed hydro scheme would not affect the flows or environment at any of the locations fish have been found.

The scheme would use a 10 mm intake screen to prevent the ingress of any fish into the turbine from the mill pond. The preserved flow /Hands off flow, would be Q95, matching the conditions on the day of the survey and would again not affect any fish within the depleted reach.

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Birley Hay Farm

Geomorphology assessment

Site visit date: 18th August 2023
Report completed: 26th August 2023
Author: Adrian Ezard

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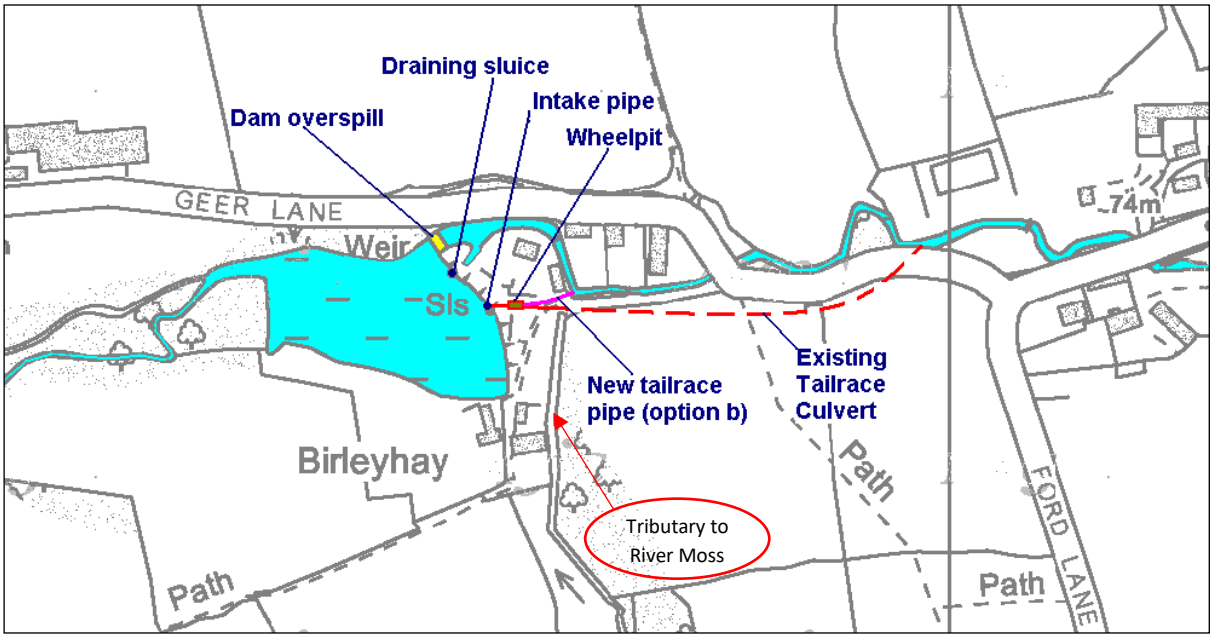

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Figure 3: Mill Pond draining sluice and intake pipe to turbine house location

Figure 4: Wheel pit culvert entrance and culvert outfall.

Figure 5: Tributary culvert outfall, 85m downstream of weir.

Flow Duration Curve

The Flood Estimation Handbook Web Service has been used to give an estimated catchment area. This gives a catchment area of 11.29 km^2.

The nearest EA gauging station is number 27025 on the Rother at Woodhouse Mill. When scaled for the catchment area, Qmean was found to be 142 litres/sec. However, the catchment area for this station is much larger than at Birley Hay Farm. When compared to the nearest four gauging stations within a 7km radius, all with larger catchments, the mean flow was found to be approximately 145 lites/sec.

The catchment was also checked against data from LowFlows 2. This gave a more conservative estimate of flows but was sufficiently close to other flows to justify using it to model the site given the much smaller relative catchment. The LowFlows data is given below:

Q95	Flow exceeded 95% of the time	26	litres/sec
Q85	Flow exceeded 85% of the time	36	litres/sec
Q50	Median Flow – flow exceeded 50% of the time	78	litres/sec
Q40	Flow exceeded 40% of the time	100	litres/sec
Q10	Flow exceeded 10% of the time	297	litres/sec
Qmean (Q29)	**Average Flow**	**136**	**litres/sec**
Q95:Qmean	Ratio of dry flow to average flow	19%	

Table 1: key flow data

The River Moss is classified as having the highest impact Abstraction Sensitivity Band of ASB3.

The Q_{95}/Q_{mean} ratio on the site is 0.19 which is classified as Medium base flow.

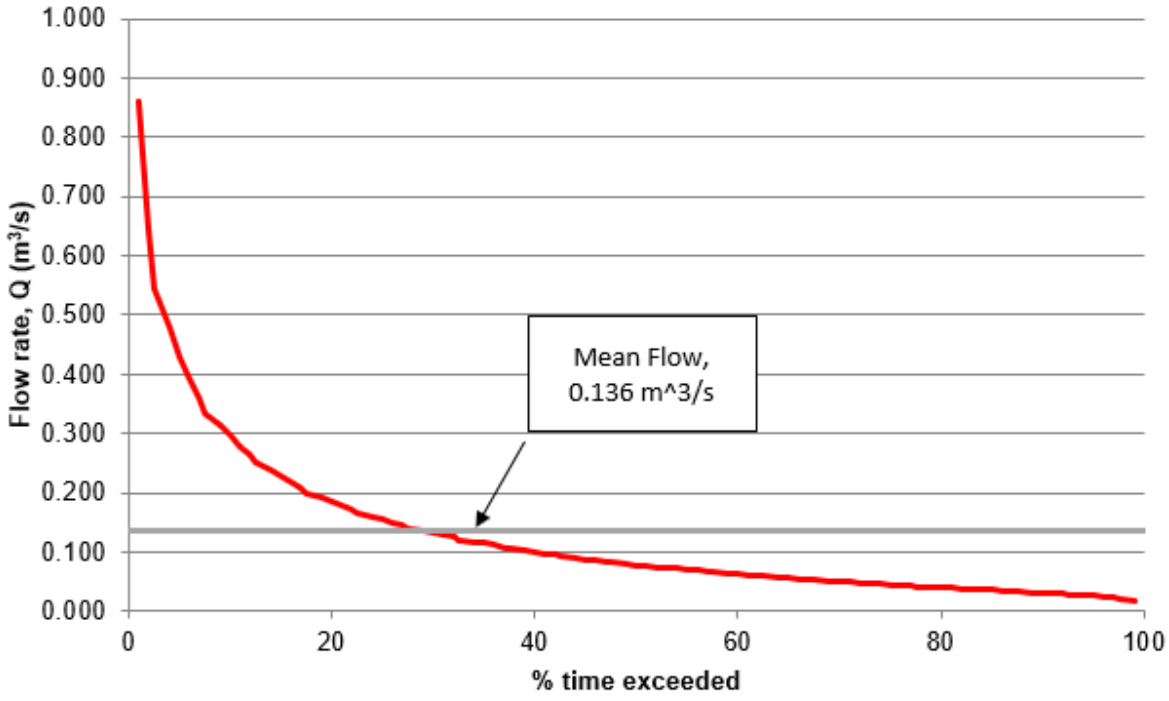


Figure 6: flow duration curve for the River Moss at Birley Hay Farm

The catchment of the tributary is approximately 1.8 km2. Based on the above data, this would add a Qmean flow of around 21 l/s to the flows in the proposed depleted reach at a point 85 m below the weir.

Flow splits

There is no current flow split on the site. All flows, when the mill was in use, would have been delivered via the wheelhouse and culvert up to the rated flow of the waterwheel turbines. All flow above this level would have been discharged down the bypass spillway.

With the hydro system installed, the flow would be split such that the hands-off-flow (currently proposed to be Q_{95} flow) will always pass over the spillway and down the River Moss. The level to maintain this flow will be maintained by the turbine control system using a level sensor in the pond.

The hydro system will then take all flow above Q_{95} flow up to the rated flow of the turbine, (proposed to be Q_{mean}). Flow above this level will spill over the weir and down the river as at present.

Baseline Survey

During the baseline survey, photographs and details were recorded at between 15 m and 25 m spacing down the river.
It should be noted there was little change in any of the river bed along the course of the survey.
The positions of the assessment locations are shown in Figure 7 below.

Figure 7: baseline survey assessment locations.

Location A & B

Location A & B have been shown in figure 2 above.

Location C

Location C is looking down the river toward the cottage on the first bend below the weir. Further photos show the nature of bed, bank and maximum pool depth below the weir in that area. Bed material is mostly larger stones.

Location D

Location D is looking down the river toward the cottage. Shallower narrow rocky channel approx. 2.5 m wide.

Location E

Location E is showing depth of corner adjacent to the bend by the Mill Cottage. Bed material is generally silty with large stones.

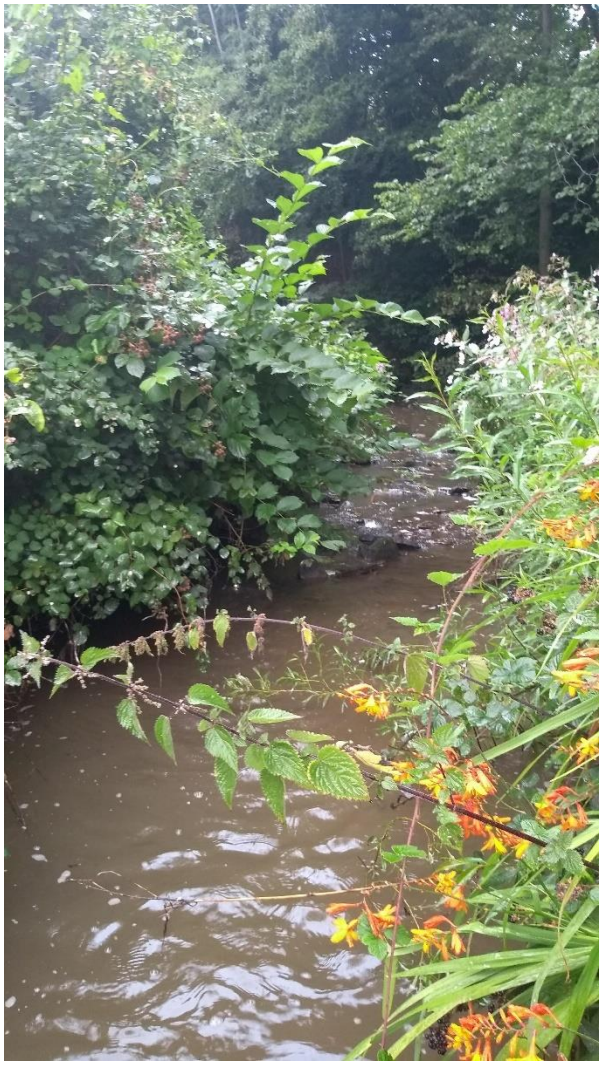
Location F

Location F is looking downstream just below the bend at location E. Depth and bed material remains consistent with location E. Outfall of culvert from small tributary between E and F also shown below.

Culvert outfall of tributary to the Moss shown in figure 1.

Location G

Location G shallows again. Bed material remains mostly larger stones but build-up of silt and some smaller stones on banks. River approximately 3 m wide.



Left bank / right bank facing downstream

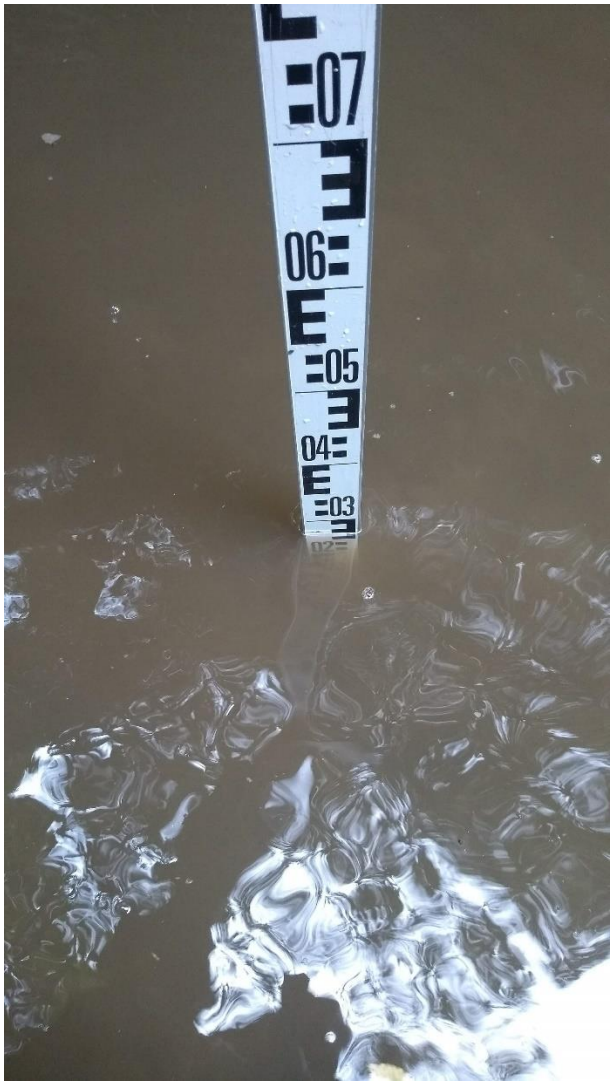
Location H

Location H, the river shallows and widens further. Bed material on banks has higher content of gravels and smaller stones, otherwise still fairly large rocks throughout the larger channel.

Figure 8: location 6 – overgrown foliage around bypass channel (grid reference SY 90630 93934)

Location I

Location I becomes a ‘man-made’ channel from location H toward the bridge at location J. Depth and width are uniform. Bed material is a mix of rubble and stones. Still silty.



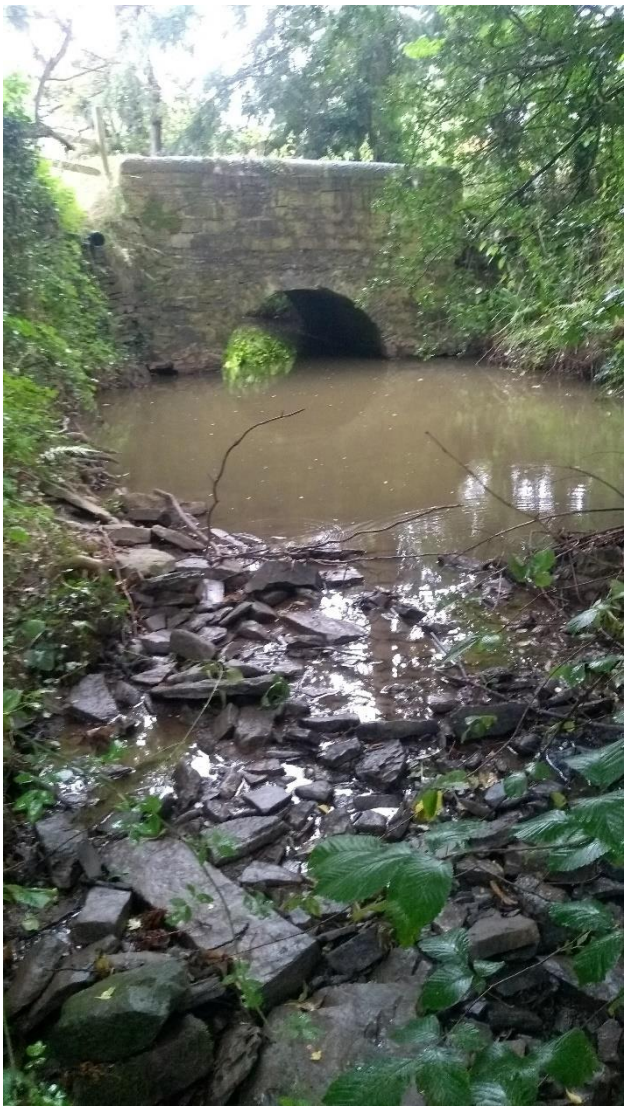
Location J

Location J is upstream of the bridge. Depth becomes too deep to wade (over 1.3 under bridge). Bed is all rock/stone with no small material evident.

Location K

Location K is looking upstream toward the bridge and across the ‘natural’ weir and small tributary ditch.

Material deposited from upstream, through bridge scour during high flow events, explaining lack of bed material immediately upstream.



Location L

Location L the river widens, shallows and slows again. Bed material is uniform mix of rocks and shale.

Location M

Location M, the river continues with a mix of deeper pools and shallow reaches over a distance of around 25m.

Location N

Location N, the river continues with a mix of deeper pools and shallow reaches over a distance of around 50m.

Location O

Location O wider shallow reach on bend toward the outfall location. Larger stones under water, smaller shale and gravels on one bank.

Location P

Location P is looking upstream and downstream from approx. 15m upstream of the culvert outfall location.

Location Q

Location Q is looking near the outfall downstream and showing the outfall.