

Archimedean Screw
Hydropower installation at
Bullhouse Mill

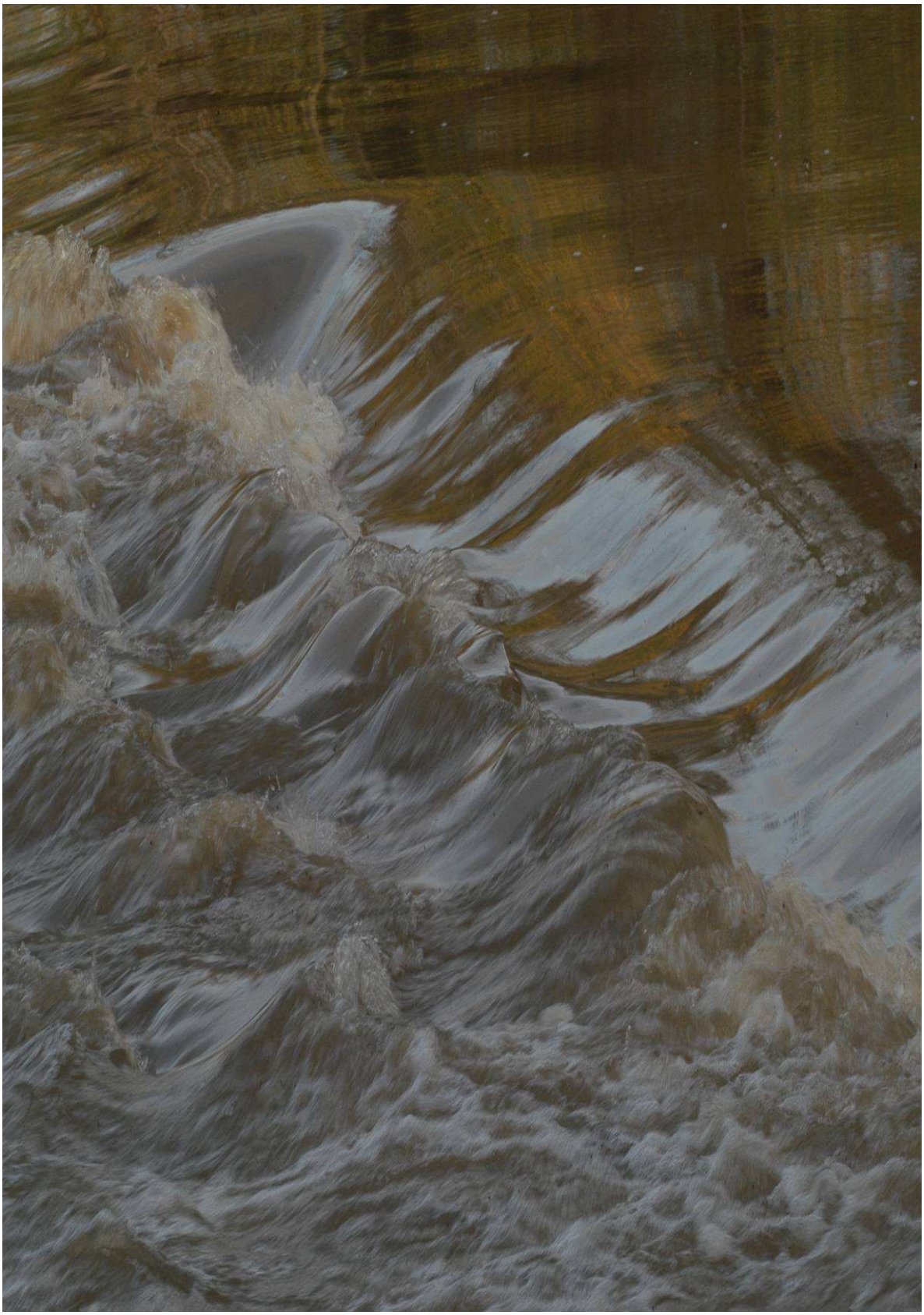
DETAILED PROJECT PLAN

15 April 2011

Lead consultant: Stuart Moore

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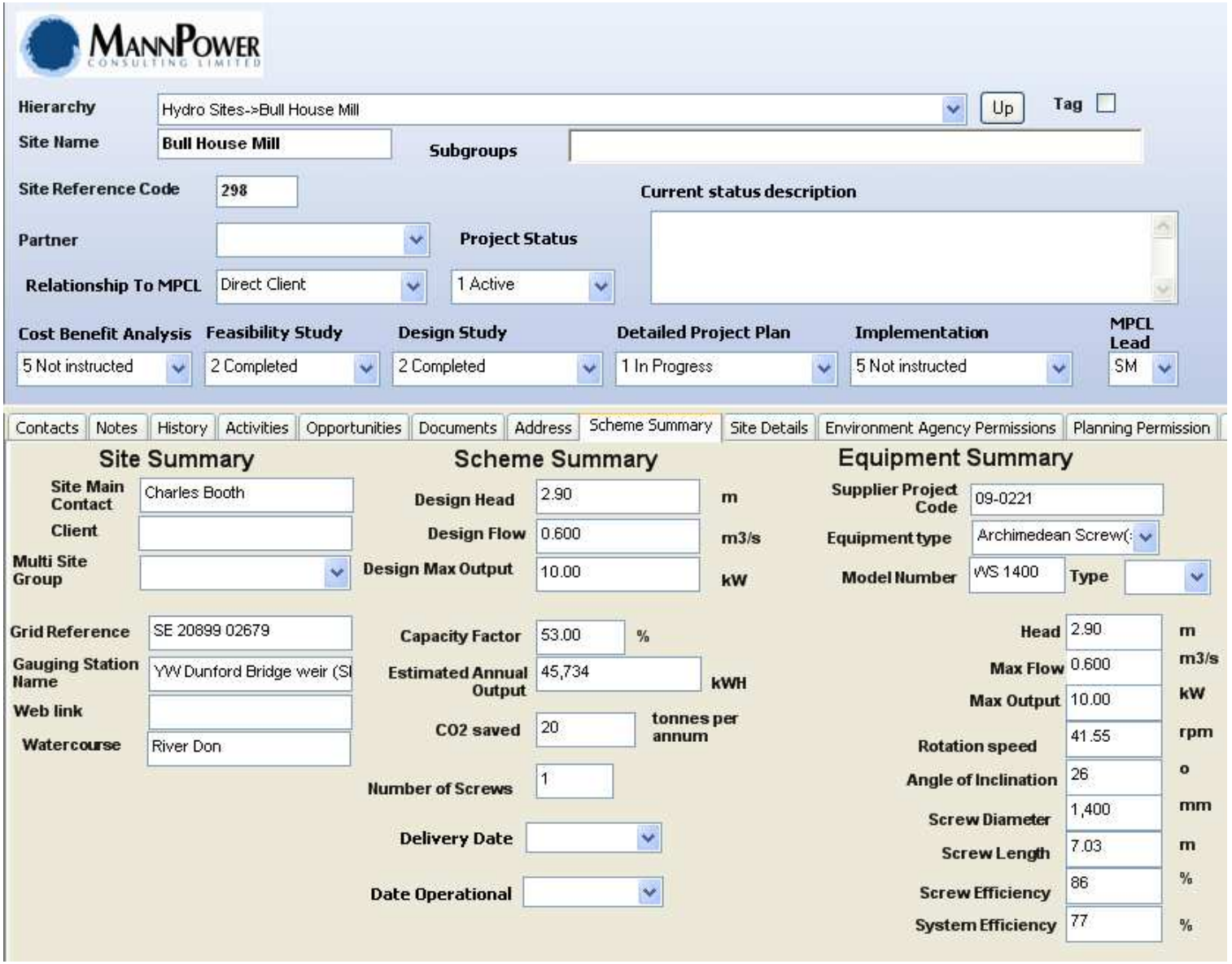
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This Detailed Project Plan relates to the scheme summarised overleaf.

The present release comprises the following documents:

- Design & Access Statement
- Hydrological Analysis
- Environmental Sustainability Assessment
- Construction Method Statement
- Principles of hydropower scheme layout
- Drawings
- Third-party ecology report
- Third-party fisheries impact assessment


MANNPOWER
CONSULTING LIMITED
Hierarchy
Hydro Sites->Bull House Mill
Up
Tag
Site Name
Bull House Mill
Subgroups
Site Reference Code
298
Current status description
Partner
Project Status
Relationship To MPCL
Direct Client
1 Active
Cost Benefit Analysis
Feasibility Study
Design Study
Detailed Project Plan
Implementation
MPCL Lead
5 Not instructed
2 Completed
2 Completed
1 In Progress
5 Not instructed
SM
Contacts
Notes
History
Activities
Opportunities
Documents
Address
Scheme Summary
Site Details
Environment Agency Permissions
Planning Permission
Site Summary
Site Main Contact
Charles Booth
Client
Multi Site Group
Grid Reference
SE 20899 02679
Gauging Station Name
YW Dunford Bridge weir (SI
Web link
Watercourse
River Don
Scheme Summary
Design Head
2.90
m
Design Flow
0.600
m3/s
Design Max Output
10.00
kW
Capacity Factor
53.00
%
Estimated Annual Output
45,734
kWH
CO2 saved
20
tonnes per annum
Number of Screws
1
Delivery Date
Date Operational
Equipment Summary
Supplier Project Code
09-0221
Equipment type
Archimedean Screw(
Model Number
WS 1400
Type
Head
2.90
m
Max Flow
0.600
m3/s
Max Output
10.00
kW
Rotation speed
41.55
rpm
Angle of Inclination
26
o
Screw Diameter
1,400
mm
Screw Length
7.03
m
Screw Efficiency
86
%
System Efficiency
77
%

Schedule of information requested in EA licensing pre-applications, May 2010

1. Site & applicant details

NGR (10-figure) of any existing impoundment(s) e.g. weir, sluice, hatch	SE 20941 02691
NGR (10-figure) of any existing or proposed water control structures e.g. lock, waterwheel, fish pass, canoe pass	n/a
Length of any deprived reach created (m)	n/a
Is it proposed to raise the level of an existing impoundment? If yes, by how much (mm)	No
Does the applicant have a right of access to any proposed abstraction point?	Yes

2. Scheme details

Turbine type	Archimedean screw
Maximum hourly turbine flow (m3/hour)	2160
Maximum daily turbine flow (m3/day)	51840
Maximum annual turbine flow (m3/year)	18921600
Maximum turbine start-up flow (l/s)	90 (+HOF)
How have the above quantities been calculated? In most cases the annual turbine quantity will not be 365 x the daily volume	Flows designed for an efficient scheme
Gross head calculation (m)	3.0
Net head calculation (m)	2.9
Estimated generating potential (kW)	10
Annual generating potential (kWhrs)	FAO client only
Please describe how the hydropower scheme will be operated; including the turbine(s) and any control structures used such as hatched, penstocks. Will the scheme be operated manually or be automated? (e.g. head level sensors, automated sluice gates, automated start and shut off, automated screen cleaners etc)	Automated intake sluice/level sensor; no fine screens
If a deprived reach and/or deprived weir or structure and/or fish pass forms part of the scheme, what is the proposed prescribed flow? (l/s)	130
How has any prescribed flow(s) been calculated?	Residual necessary for fish pass & weir

3. Fish screening (physical)

Intake screen size (mm)	100
Type (vertical bar, mesh, coanda, other)	Vertical bar
Screen dimensions (mm) (width x height)	1500 x 1500
Angle to main flow path (degrees)	45
Approach velocity calculation (m/s)	n/a – no exclusion
By-wash (location, type, operating flow)	n/a – via screw
NGR (10-figure) of intake fish screen	n/a – low risk
Outfall screen size (mm)	n/a – low risk
Type (vertical bar, mesh, other)	n/a – low risk
Screen dimensions (mm) (width x height)	n/a – low risk
NGR (10-figure) of outfall fish screen	n/a – low risk

4. Hydrology

Describe how the hydrology of the watercourse has been assessed. Include detail of any modelling package used and its limitations, gauging station data used and its limitations, period of dataset used, spot flow gaugings conducted, other relevant data e.g. significant abstraction licence and discharge consent details.	Historic gauged data from nearby gauging stations
Please provide a flow duration curve. Please include a [?] of the graph & data.	See report
Relevant calculated flow duration statistics: Q95, Q50, Q40, QMEAN	See report
Ratio of Q95:QMEAN	See report
What assessment has been made on the potential for the proposed scheme to impact in terms of flood risk? Has a Flood Risk Assessment been completed?	See report for preliminary FRA

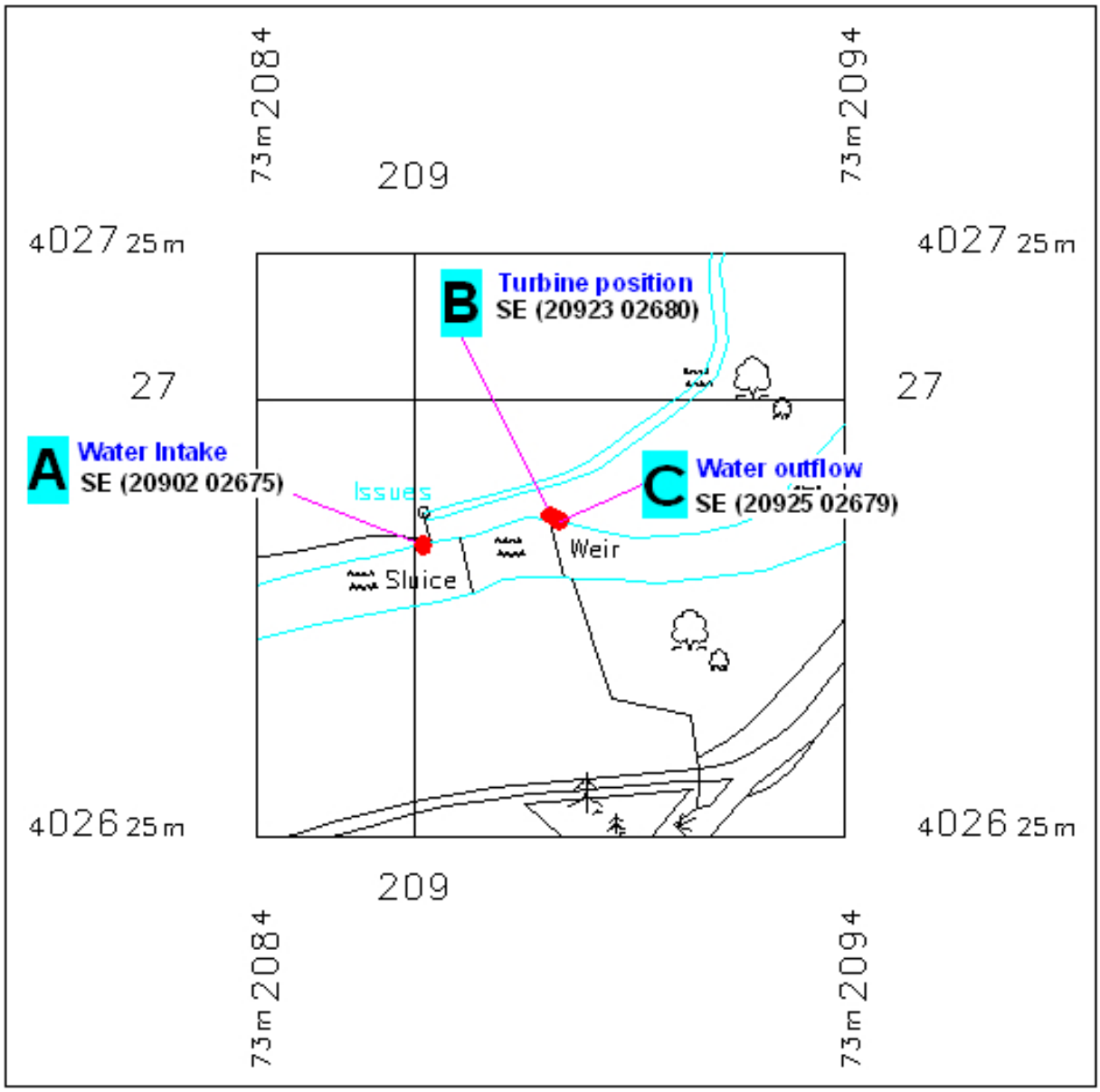
Please also provide two scaled and labelled OS maps or sketch plans of the proposed scheme:

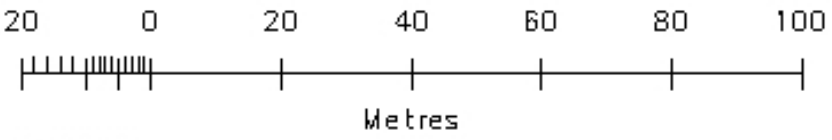
Map 1. Include the location of the abstraction/discharge/Impoundment points; the turbine(s); any penstock pipeline; existing water control structures; proposed water control structures; fish pass; fish screens etc	Attached with EA submission
Map 2. Include the different land ownerships or rights that exist. Who owns or has rights to the left and right banks upstream and downstream of the proposal, and within any deprived reach that is created. Who owns the watercourse and to what extent, e.g. the bank, middle of the watercourse. Who owns or has rights to operate any water control structures and any fishing or navigation rights that exist.	Site in sole ownership of the applicant

Map below shows points of interest A B and C, marking the approximate farthest extent of actual groundworks. For extent and for wider context, please refer to red-line plan submitted.

Ordnance Survey
OS Sitemap

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Serial Number: 00559702

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Bullhouse Mill

DESIGN & ACCESS STATEMENT

15 April 2011

Lead consultant: Stuart Moore

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FROM: STUART MOORE [MAILTO:STUART@MANNPOWER-HYDRO.CO.UK] SENT: 08 APRIL 2011 11:10 TO: WOODWARD , MATTHEW (PLANNING) CC: ADRIAN@MANNPOWER-HYDRO.CO.UK; 'DAVE MANN'; 'GREGORY NAU' SUBJECT: RE: PROPOSED HYDRO SCHEMES ON THE RIVER DON **24**

FROM: WOODWARD , MATTHEW (PLANNING) [MAILTO:MATTHEWWOODWARD@BARNSLEY.GOV.UK] SENT: 08 APRIL 2011 11:03 TO: 'STUART MOORE' CC: ADRIAN@MANNPOWER-HYDRO.CO.UK; 'DAVE MANN'; 'GREGORY NAU' SUBJECT: RE: PROPOSED HYDRO SCHEMES ON THE RIVER DON **25**

FROM: STUART MOORE [MAILTO:STUART@MANNPOWER-HYDRO.CO.UK] SENT: 08 APRIL 2011 10:58 TO: WOODWARD , MATTHEW (PLANNING) CC: ADRIAN@MANNPOWER-

HYDRO.CO.UK; 'DAVE MANN'; 'GREGORY NAU' SUBJECT: RE: PROPOSED HYDRO SCHEMES ON THE RIVER DON 25

FROM: WOODWARD , MATTHEW (PLANNING) [MAILTO:MATTHEWWOODWARD@BARNSLEY.GOV.UK] SENT: 08 APRIL 2011 10:13 TO: 'STUART MOORE' CC: ADRIAN@MANNPOWER-HYDRO.CO.UK; 'DAVE MANN'; 'GREGORY NAU' SUBJECT: RE: PROPOSED HYDRO SCHEMES ON THE RIVER DON 25

FROM: STUART MOORE [MAILTO:STUART@MANNPOWER-HYDRO.CO.UK] SENT: 08 APRIL 2011 09:47 TO: WOODWARD , MATTHEW (PLANNING) CC: ADRIAN@MANNPOWER-HYDRO.CO.UK; 'DAVE MANN'; 'GREGORY NAU' SUBJECT: FW: PROPOSED HYDRO SCHEMES ON THE RIVER DON IMPORTANCE: HIGH 25

FROM: WOODWARD , MATTHEW (PLANNING) [MAILTO:MATTHEWWOODWARD@BARNSLEY.GOV.UK] SENT: 10 MARCH 2011 13:56 TO: 'STUART MOORE' CC: 'ADRIAN CLAYTON'; PELL , KEITH; SMITH , MATTHEW SUBJECT: RE: PROPOSED HYDRO SCHEMES ON THE RIVER DON 27

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Introduction

In October 2008 a feasibility study was carried out by Mann Power Consulting Ltd which identified the potential for hydropower generation at Bullhouse Mill. A scheme design was then elaborated by Mann Power Consulting Ltd which forms the basis of this proposal.

Completion of this project will provide revenue from renewable electricity sales to the local supply network, and a connection has been agreed to supply green energy directly to the Bullhouse Mill Industrial Estate.

The present document serves as a Design & Access Statement, complemented by supporting material listed in the covering document, and containing the following information:

- Description of location
- Description of proposal
- Assessment of context
- Involvement
- Design
- Overview of the Archimedean screw turbine

Description of location

Bullhouse Mill is situated on the River Don, west of Penistone in South Yorkshire. The historic course of the mill lade can still be seen today, but the waterwheel and penstock are no longer evident. Parts of the original mill buildings still exist amongst a modern and thriving industrial complex.

The weir itself lies some 300m south of the former mill building. The water no longer leaves the River Don to pass into the mill lade, which is approximately 2m wide by 0.5m deep but so heavily silted up as to have become naturalised dry ground (Figures 1 and 3). Parts of the intake survive, though apparently infilled to exclude flood flows (Figure 1).

Access around the site is over private land and the area adjacent to the potential turbine location is open and clear of major obstructions. There are no existing public rights of way along this side of the riverbank, so provisions to maintain access were not considered.

O/S grid reference is SE 20899 02679.

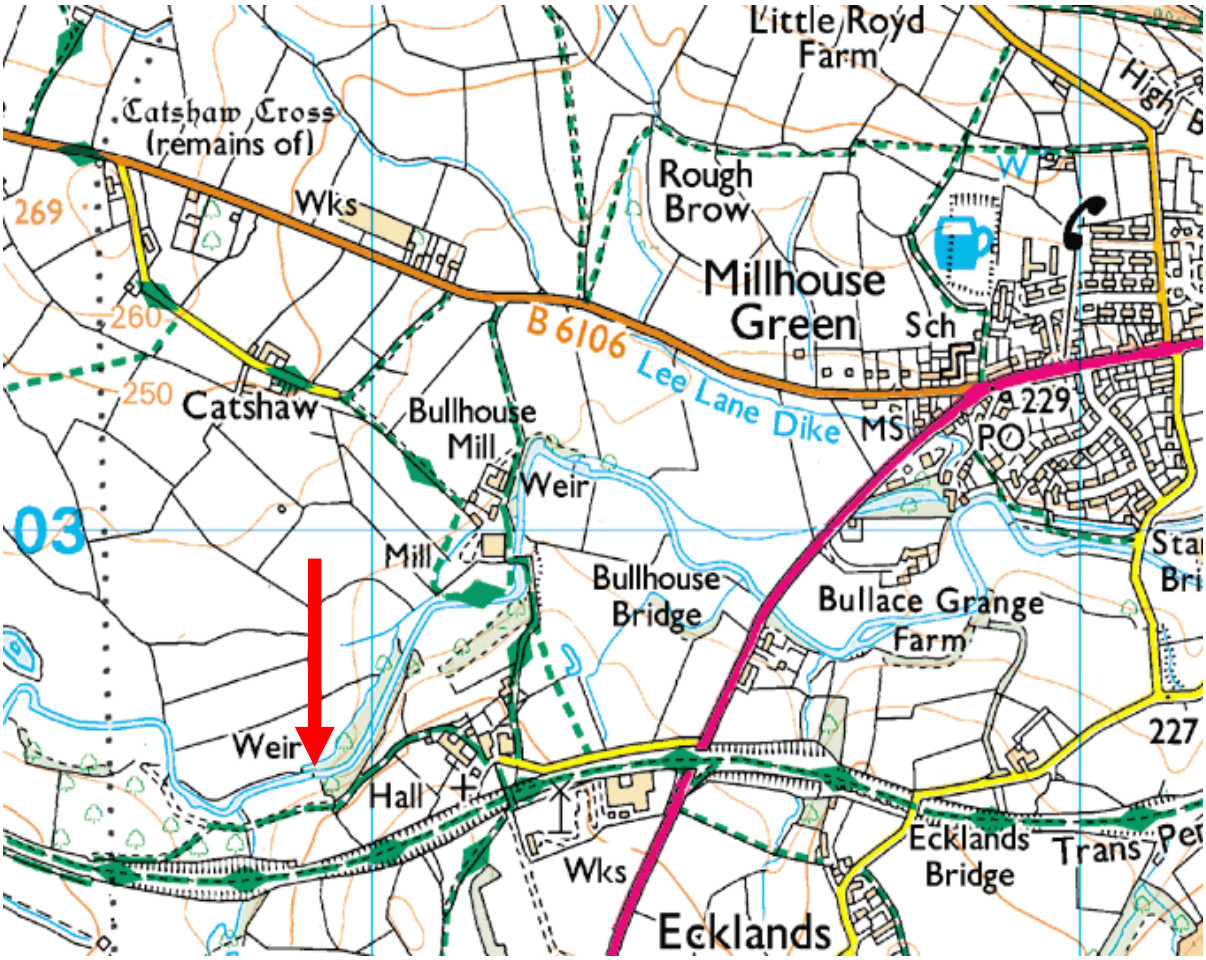




Figure 1: Path of proposed channel from bank intake alongside weir to turbine



Figure 2: Close-up of weir, indicating how site is screened by bluff on east bank



Figure 3: Reverse view - path of channel, showing applicant's grazing land to west



Figure 4: Lower end of site, where turbine returns down riverbank (see drawings)

Description of proposal

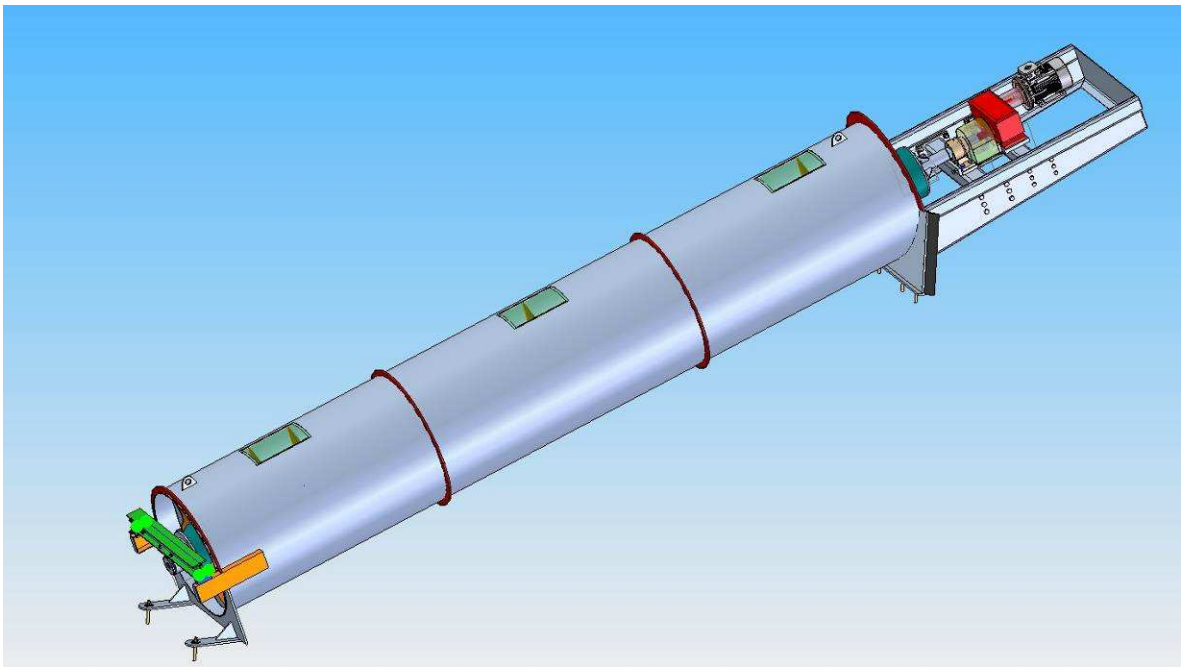


Figure 5: Proposed model of turbine (delivered in matt pale green or other paint)

Please refer to the drawings supplied with this document.

The Archimedean screw turbine is essentially a cylinder of spiral blades, here mounted inside a cylindrical tube, within which the screw rotates upon bearings at each end. The weight of the water passing down the screw will cause it to turn, thereby harnessing the energy within the falling water. This energy will be converted into electricity by the gearbox and generator at the upper end of the screw.

A concrete chamber is created as a solid base for the turbine and sluice (see drawings). The turbine is bolted into position at an inclination of 26 degrees between the upper water level and the river below. The model at Bullhouse Mill will be 7.03m long by 1.4m in diameter, extended at its upper end by a gearbox and generator to give a total length of some 9.03m (Figure 5). The latter are enclosed within a cabinet-like shroud, which can be given any exterior finish and contains soundproofing material adequate to control noise (Figures 6-7). Electrical controls must be housed within a robust enclosure nearby, which may be a small shed (as drawn) or steel utility cabinet according to aesthetic preferences.

The proposed location of the turbine is immediately adjacent to the weir itself, which lies some 300m south of the former mill building of Bullhouse Mill. The system will consist of a

single turbine installed close to the weir foot. The former intake and a short distance of the original lade will be re-used to deliver water to the turbine. Some of the water which currently passes over the weir will then be directed down this new channel, passing through the new turbine instead of over the weir, but returning to the same endpoint below.

An alternative might be to install the system at mill itself, closer to the site of the historic use of water power, making use of the full length of the former mill lade. While this would have the advantage of proximity to the electrical connnection point, reducing cabling costs and losses, it would not appreciably increase the output of the system. At the same time, the ecological disbenefit could be substantially greater, in that it would involve depriving the River Don of part of its flow of water for over 300m. Recreating the channel might also exacerbate flood risk at that site. This alternative was therefore not considered further.

Opting to install the system so as to abstract water just upstream of the weir and return it just below will minimise the depleted reach - a key aspect in minimising the impact of ecological changes whilst getting the most from the natural resource. The existing intake opening and the start of the lade would be re-used, requiring excavation of the latter and construction of a short section of new channel from the existing lade towards the top of the turbine (Figure 3). By reusing existing structures, this location will also avoid unnecessary excavation and construction in new ground. Locating the turbine as close to the downstream water level as possible also reduces the amount of excavation required, using the natural fall in the terrain at that point (see Figure 4) rather than creating a new slope.

A new vertical steel sluice will be installed immediately upstream of the turbine to control the intake of water, with a galvanized screen of vertical bars at 100mm spacing agreed as being suitable to exclude debris and larger mammals. Visual aspects of the proposal are covered in more detail below. Please refer to drawings for dimensions.

A lower support foundation will need to be provided to support the lower end of the screw. This will be formed from reinforced concrete within excavation in the bank slope, a design enhancement which avoids laying concrete in the riverbed. A small amount of excavation of the riverbed immediately around the lower end of the turbine will also be required to ensure that the discharge velocities at the outflow are ecologically acceptable.

The scheme is designed to provide an installed capacity of 10kW and represents a potential saving of 20 tonnes of CO_2 per year. The electricity produced will be used to

offset demand on the premises of the applicant who is a significant local consumer of electricity. Any excess at times of low demand will be exported to the local supply network.

Water from the river above the weir will enter the turbine and will return to the river below the weir, close to where it does at present. The quantity of this diverted flow, and the retention of an adequate flow in the existing channels, has been sanctioned by the granting of abstraction licence NE/027/0005/007 by the Environment Agency (EA). Adherence to the flows prescribed in the licence is a central condition of the licence, and therefore of the operation of the scheme. Provision of passage for fish has been a key concern of the EA, and a fish pass has been designed which will be installed onto the face of the weir as part of the scheme (see separate file of drawings). To ensure correct operation of this pass, the EA has agreed that the damaged weir crest may be repaired to a uniform height by replacement of wooden boards, some of which have become dislodged.

During its licensing process, the EA consults widely on the implications of such proposals. As the EA has been duly satisfied in these respects, it is therefore not proposed to duplicate details of this process in the present document, beyond alluding to the case made in the accompanying Hydrology and Environmental Sustainability Assessments. Commencement of the proposed works is also conditional upon gaining further EA consent for the proposed works in the river at the time in question.

Excavation of the works will yield a small amount of spoil. This material is alluvial silt and riverbank soil deriving from the same formation as the adjacent meadow. This spoil is considered unlikely to raise contamination issues, and will be appropriately redistributed within the applicant's property on adjacent land of similar composition. Part of the spoil will be used to block the adjacent stretch of redundant lade, which is of identical composition.

Remediation of the site, at any point in the future when the applicant might wish to cease operation, will be a straightforward process. The electrical and mechanical components can all be detached and removed for reclamation. The channel can be backfilled and the concrete elements buried to restore a surface landform similar to that seen today. An alteration which is likely not to be reversed is the new fish pass, whose continued presence is likely to be desirable for the purposes of optimising fish movement in the Don.



Figure 6: Example generator shroud (no exterior finish) in a residential context



Figure 7: Detail of engineering-grade sound insulation (Coustifoam or similar)

Electrical connection

The electricity generated will be connected into a local 3-phase supply within Bullhouse Mill, together with the appropriate metering. Connection therefore involves running a 3-phase cable from the generator to the closest connection point, ensuring the provision of a suitable transformer and the necessary metering and safety protection equipment. The cable will be buried across private grassland fully within the applicant's property.

Systems of this scale (producing 11kW and below) would normally be connected under the G83 regulations, which require only that the applicant notifies the electrical District Network Operator (DNO). However, at Bullhouse Mill, the new system will take the existing connection above this threshold. It therefore appears more likely that the system must be connected under the more rigorous G59 regulations. This would require the applicant to obtain formal approval from the DNO, YEDL, with whom discussions have been opened.

System operation

The amount of water to be abstracted from the river must be controlled to comply with the conditions set out in EA licences and consents to ensure that ecological, fisheries, and other water interests are not compromised. See Environmental Sustainability Assessment.

This is achieved by fitting a level sensor close to the weir, which will measure the precise water depth upstream of the screw. This level will be used together with the dimensions and profile of the existing channel to calculate the flow passing through at any time, so that the automatic sluice gate can be closed if the flow falls below the minimum level.

The automatic sluice gate will be located in the intake chamber just before the screw. This gate will be operated through an actuator controlled directly by an electronic control system which fulfils a number of functions:

1. Automatic system startup and G59-certified mains connection.
2. Automatic control of upstream water level.
3. Maximises the system output with the available water.
4. Automatic shutdown in the event of mains failure, system failure, or low water level.
5. System monitoring and reporting.

The water leaving the turbine will be directed smoothly back into the river, at a velocity of less than 1m/s. A cross-sectional area in the outflow channel of at least 1.7 square metres is available to achieve this.

Assessment of context

Renewable energy as a planning consideration

Clearly this installation is primarily aimed at the generation of green energy and sits firmly within the context of policy at national, formerly at regional, and increasingly at local levels.

National Policy

Climate Change Act 2008: This Act puts into statute the UK's targets to reduce carbon dioxide emissions through domestic and international action by at least 80 per cent by 2050 and 26-32 per cent by 2020, against a 1990 baseline. (Information from DEFRA)

Planning Policy Statement 22: Renewable Energy (2004). This sets the framework for Regional Spatial Strategies (upheld to 2011 at least) and local development documents. This document stresses that renewable energy amongst other things will form a vital part of achieving the national emissions targets. The intent of PPS22 informs PPS1, which sets out the importance of supplying energy from renewable sources as part of the compelling need to mitigate against and adapt to climate change. Planning authorities are expected to take a positive stance on inclusion of renewables in developments.

DECC Renewable Energy Strategy 2009. This clearly expresses the potential contribution which central government expects small hydropower to make to national renewable energy expansion.

Indicators from recent Regional Policy

While regional-level plans are in the process of being revoked, until alternative targets are set, the research which went into regional plans continues to provide an indicative guideline as to the scale of renewable energy development in this region which will be required to meet national commitments. Government Office for Yorkshire and the Humber (GOYH) Spatial Strategy Targets for renewable energy (which may be upheld to 2011 at least) set the following targets for installed capacity for renewable energy.

Regional target	2010	This scheme =	2021	This scheme =
All technologies	674 MW		1850 MW	
Hydro	4 MW	0.25%	4 MW	0.25%

South Yorkshire target	2010	This scheme =	2021	This scheme =
All technologies	47 MW		272 MW	
Hydro	0.25 MW	4%	0.25 MW	4%

Barnsley target	2010	This scheme =	2021	This scheme =
All technologies	15 MW		34 MW	
Hydro	0 MW	above expectation	0 MW	above expectation

At 10 kW, the proposed scheme would provide 4% of the South Yorkshire hydro target. However even a small scheme such as this one makes Barnsley Council a net positive contributor to county and regional targets, as the above report concluded "There are not believed to be any significant opportunities for hydro development within the district".

Local Policy

Barnsley UDP Policy Aim B12 has intended to "encourage new forms of energy generation... subject to environment, amenity and transport policies" in pursuit of its Goal B "to conserve and improve the physical environment". Barnsley's Local Development Framework Core Strategy is currently undergoing examination.[1] Subject to its adoption, policy CSP6 (Development that Produces Renewable Energy) "will allow development that produces renewable energy [if] there is no significantly harmful effect on:

> the character of the landscape and appearance of the area…
> biodiversity, geodiversity and water quality…
> heritage assets, their settings and cultural features and areas"

This policy intent is clarified in Core Strategy Objective 8 (protecting and improving the countryside) which explicitly foresees "supporting renewable energy facilities to increase the amount of renewable energy produced in the borough". Again, promotion of renewables where appropriate is a key element underpinning policy CSP1 (Climate Change), which requires developments to improve environmental impacts, carbon emissions, local resilience to climate change, efficient resource use, and use of renewable energy. Planners will expect developments to "mitigate climate change, and to withstand its effects [to] ensure that buildings and spaces endure" while the policy accepts that "making the best use of the natural features of a site… can make an important contribution complementing new technologies." Here the Archimedean screw turbine is a prime example of a best-in-class technology for its combination of good efficiency with environmental mitigation.

Any renewables development must of course be reconciled with other planning commitments, as detailed below.

[1] Core Strategy, submitted Sept 2010: http://www.barnsley.gov.uk/0xac16000b_0x0047cb39

Losses and benefits

The installation will return the weir site to a productive use which is analogous to its historic prior use for water power. The proposal uses machinery which is an efficient contemporary equivalent of the waterwheel equipment which must formerly have been present at Bullhouse Mill and fed by this weir. The benefit is renewable energy, as described above.

Alongside supporting renewable energy, Barnsley Core Strategy Objective 8 expresses an intent to protect landscape, biodiversity and heritage and preserve green infrastructure. This is in harmony with the present project, which improves both the river and green landscape context at this former waterpower site, by putting it to work in a proportionate and appropriate way respectful of its character, with net benefit to its wildlife (fish mobility).

The site lies within the Green Belt and Area of Borough Landscape Value. On green belt, Barnsley CSP34 defers to national PPG2, allowing that proposals may be acceptable for the development of “essential facilities… which preserve the openness of the Green Belt and which do not conflict with the purposes of including land in it”, including engineering activities; provided that they are not “visually detrimental by reason of their siting, materials or design”; a very similar approach is found in recent UDP Policies GS7 and GS8. Similarly, while the proposal occupies the river corridor, it does not impact the protection of open space such as to detract from the Don Valley Corridor as Green Infrastructure under CSP33, and supports the economic and climate change justifications of that policy. The proposal poses no impact to Green Spaces under CSP35, in that public access is here inapplicable and that wildlife impacts are designed to be nil or positive.

Again the proposed scheme must prove itself acceptable to planners under CSP37 (Landscape Character) on the basis that the site’s prior use was for water power, resumed here in a contemporary form, and its public visibility is limited. The authority is referred to the submitted documents, the drawings which characterise the unobtrusive physical appearance of the proposed structures, and the secluded river-channel landscape context. Recent UDP Policy PE5 has explained the purpose of the Area of Borough Landscape Value as “to avoid coalescence of the urban area and to protect the individual character of each settlement”, areas in which, under policy GS13, “conservation and enhancement of the landscape will be extremely important considerations”. Development may however be permitted if there is no loss of valuable features and overall character and appearance are conserved, which is submitted to the case in the present instance.

The proposal occupies a small footprint of riverbank grazing within private land, distant from rights of way, and therefore has minimal impact in terms of reserving space from other uses. The site is not publicly accessible, and is not thought to be visible in views from public rights of way. Employment and other social impacts are neutral.

CSP21 (Rural Economy) supports development in rural areas, if that development supports the sustainability and diversification of the rural economy and/or existing businesses. Subject to the protections above against adverse impacts on other policies, the present proposal augments the rural industrial facilities operated by the present applicant, in keeping with CSP21.

On the question of site remediation, as above, the proposal consists largely of a channel which can be backfilled and a machine which can be removed and recycled. Concrete elements too are largely subsurface and can be buried. Construction and operation should create no contamination, and the profile of the site can easily be restored if the scheme were to cease operation in future. A planning condition requiring this would be acceptable.

Impacts upon living conditions, highways, infrastructure and radar are not implicated in this micro-hydropower proposal. While undulating landscapes in the west of the Borough are recognised in the Core Strategy as posing problems for the acceptable siting of wind power, it is precisely such topography which allows a small-scale hydropower installation to be discreetly incorporated into the landscape at an appropriate fall in the land.

Natural environment aspects have been treated at length in gaining the necessary abstraction licence from the EA (supported by documents similar to those presently submitted). The proposal supports policy CSP36 (Biodiversity and Geodiversity) in promoting the passage of fish, as recognized by the EA in its grant of a licence. This constitutes ecological enhancement measures as have been preferred under UDP Policy GS15, while the proposed scheme's benefits outweigh any special ecological interest at this site (GS16). As per the submitted ecological survey, the proposal will not be detrimental to habitats or wildlife in its construction or operation. Likewise the small-scale earthworks proposed do not threaten geological assets. The ecological report and the MAGIC database indicate no specific habitat or wildlife designations at this site. For full details of the specific consideration which has already been given to aquatic and bankside habitat in receiving approval from the EA, please refer to the reports submitted herewith.

Furthermore, as a significant local riparian landowner, the applicant is a principal contributor to managing and maintaining this part of the green river corridor. His investment in the present proposal allows the landscape to contribute economically to its own management, and thus supports the sustainable maintenance of the managed landscape in the future.

In summary, it is submitted that the proposal may be viewed favourably, as being a proportionate use of the natural resource in the landscape at one of the most appropriate points where that resource may be exploited, without diminishing the public amenity of the landscape in terms of visible appearance, character, or valuable features, and therefore without conflicting with the intent of the designations. Indeed, by improving passage for fish, opportunities for angling as a public benefit of this rural landscape will be enhanced.

(For further details, refer to submitted Environmental Sustainability Assessment, ecological survey, fisheries survey and Construction Method Statement.)

Evaluation

Design & Access Statement methodology seeks in part to ensure that developments are responses to their context, rather than impositions of pre-defined design. However it must be recognised that the construction of a renewable energy generating facility must be driven in the first instance by identifying a potential site which possesses sufficient natural resource to justify such a project. This is particularly the case with low-head hydropower, where such resource exists only at points where a fall in the river can be harnessed.

Evaluation, in the terms of the present development, subsists therefore in having identified that this location is particularly suited to hydropower. At the same time, the nature of this site within the river means that it is suited to no competing use which is more appropriate, more preferable, or incompatible with the hydropower proposal.

Through a process of appropriate consultation and responsive detailing, as described below, the present design has been elaborated to realise the site's potential, balancing the maximum benefit with minimum of adverse impact. Design of a hydropower installation to suit this site is therefore a clear response to context. (For generic considerations of hydropower siting and layout, see the appended "Principles of hydropower layout".)

Involvement

The present Design & Access Statement reflects the outcome of discussions to date.

Consultation with the Environment Agency (EA)

Consultation on factors affecting the water environment and its riverbank context has been undertaken with the EA, and an abstraction licence obtained (see below). Environmental impacts of the scheme will be constrained by the conditions attached to the permissions on that licence. The EA licensing process was satisfied by the applicant's assessment of ecological issues and Flood Risk as set out in the accompanying Environmental Sustainability Assessment. The following paragraphs describe the EA's involvement.

Division of regulation between Planning Authorities and the EA

Hydropower schemes vary greatly in their size and their implications for development control. Low-head micro-hydropower schemes may be at the lower end of the size range, but their typical situation is the lowland river environment where the proposed location may be considered visually or ecologically sensitive.

Environmental considerations receive detailed attention during the process of obtaining an abstraction and/or impoundment licence, which is a legal prerequisite to almost all schemes. The EA approaches statutory consultees including Natural England and is a competent authority to undertake Appropriate Assessment under the Habitats Regulations. The EA considers flood risk, water resource, fisheries, recreation, ecology and biodiversity. The EA issues consents for works in rivers and for any identified flood defence or land drainage impacts of new schemes. Principal legislation includes Water Resources Act 1991, Water Act 2003, and subsequent amendments.

The EA as a consultee to planning

The EA also has a role as a statutory consultee to the planning process in these matters. It is usual for the EA to require planning conditions which *inter alia* prevent the operation of the scheme unless the appropriate abstraction and/or impoundment licence has been issued (see licences, below).

In late 2010, the EA undertook to streamline its processes to facilitate "parallel tracking" of licensing with planning, and to appoint an account manager for the proposed scheme as a

single point of contact in the EA. In the interests of avoiding unnecessary duplication and delay, it is therefore advisable that the planning authority should seek early contact with the relevant EA account manager, to maintain an awareness of the EA's timescales, points of input, preferred ownership of joint regulatory activities, and the status of work already done to address mutual concerns. Where no EA account manager was appointed, e.g. for transitional applications such as this one, the relevant EA permitting officer will be most familiar with the proposal (here, Stephen Smith: EA, Manley House, Kestrel Way, Exeter, Devon, EX2 7LQ. 01392 352425. stephen.smith@environment-agency.gov.uk).

The EA's latest internal guidance to its planning liaison officers is that work should not be duplicated between EA regulatory activities and the planning process, but that how these considerations will be allocated will be determined by the EA on a case-by-case basis. The EA aims in principle to return no objection at planning after having adequately addressed regulatory concerns under the grant of appropriate EA licences and consents.

The EA works to a statutory 4-month timescale for licensing, and to a 2-month timescale for the additional consents described. Any parallel processing must take this into account.

While the EA favours this parallel approach, it must be borne in mind that a developer will wish to establish that scheme design is acceptable to the EA (at least in principle) before submitting a planning application. This is because the parameters of the scheme design which are influenced by EA preferences during the licensing process (hydrology, fisheries screening requirements) are more crucial to the technical viability of the scheme than other aspects regulated primarily via the planning process. The logical progression is from tentative investigation, to agreeing appropriate mitigation, to establishing viability, to confirming finalised design. Due consultation is required at each stage. Each of these stages gives a developer confidence to commit additional investment to the development.

Abstraction licence

Application was made to the EA for an abstraction licence to remove water from the watercourse under Water Resources Act 1991 and amendments. The licence was granted as valid until the common end date for the local catchment (2029 for the EA's Don & Rother area. When the licence reaches that date, there is a presumption of renewal if three tests are met: continued need, efficient water use, and environmental sustainability. The EA has further deemed that an impoundment licence is not required in this case.

EA licences attach a number of conditions to the development (namely the protection of other water users' rights in the river as well as environmental issues discussed in the Environmental Sustainability Assessment). When determining the licence, the EA makes a decision whether the scheme context justifies advertising the application in the local press.

Fish pass approval

Any fish pass must be type-approved by the EA prior to operation. Typically (as here) the approval process follows the grant of the licence, which is issued with a condition requiring the fish pass to be approved and installed before the licence is used. Discussions are ongoing at present to refine the exact technical details of the fish pass which will be installed, though the location and physical form are already agreed, and the submitted drawings are closely indicative of the form and position of the proposed pass structure.

Works-in-river consents

Also referred to as Flood Defence consent (in main rivers) and Land Drainage consent (in ordinary watercourses), one or more consents of this type will be required from the EA for the hydro project, as for all works to be carried out within 8 metres of a watercourse. EA consents consider the temporary impacts on the river of all construction works to be carried out for the scheme, for example by the potential release of concrete or oils during construction; and also the permanent impacts of the operation of the scheme.

The consent application requires describing the fine detail and timings of the scheme's construction, and it is therefore often most appropriate to postpone this until the planning decision has been made (when final design and timings have been agreed). The consent will be considered by the EA's local area team for Development Control & Flood Risk (ADFR), which has already been fully engaged and consulted during the abstraction licensing process and responds also as a statutory consultee to the planning process. EA ADFR therefore has already been satisfied with discussion of flood-related aspects of the scheme via the licensing process, and will have further opportunity to express its opinion.

Consultation with National Trust and English Heritage

The site does not contain scheduled monuments, listed buildings or other recorded heritage assets. The proposal does not threaten to remove or significantly modify historic structures of importance. Therefore these bodies have not been approached.

Consultation with Natural England

No statutory designations apply to the present site. River ecology considerations have already been considered by the EA. Otherwise the site's context is unimproved grazing of no notable ecological importance. The EA's licensing process includes statutory consultation of Natural England where the latter has an interest in the site, either within or outside the river. Therefore no direct consultation with Natural England has been made.

Other work undertaken in relation to ecological considerations

A Phase 1 Habitat Survey was commissioned from Martin Hammond in September 2010. A detailed Fisheries Impact Assessment was commissioned from Fishtek Ltd earlier in 2010. These are appended to the planning application.

Listed Building Consent

No LBC considerations apply at this site.

Community involvement

The site is entirely within private land and the generation project is part of a commercial undertaking. It does not entail negative impacts upon the wider community, therefore consultation has not taken place. Output from this resource is too small and too distant for benefit sharing to be viable. However, the common benefit to the community's river users in terms of angling is at the forefront of the EA's concerns when considering abstraction licence applications. In granting a licence, the EA has recognised that the scheme confers a net benefit upon the angling public by promoting the movement of fish in the Don.

Consultation with the local planning authority

A pre-application site meeting took place on Sept 3rd 2009 and was attended by Matthew Woodward of Barnsley Planning, who subsequently responded as follows. The present updated document should form the basis of further consideration by the authority.

From: Stuart Moore [mailto:stuart@mannpower-hydro.co.uk]
Sent: 08 April 2011 11:58
To: 'Woodward , Matthew (Planning)'
Cc: 'adrian@mannpower-hydro.co.uk'; 'Dave Mann'; 'Gregory Nau'
Subject: RE: Proposed hydro schemes on the River Don

Matthew,

The nearest tree to the works is 5m away and well outside the tree canopy and therefore the root splay (see page 3 of the previous PDF containing scheme design). The only elements which still fall within the latter are now the support posts for the wooden access deck. This is not an essential part of the hydro scheme, and can be omitted if that is absolutely required. This structure should not require any obtrusive works, as it will be four posts in the ground, hence a small footprint.

Once we have reviewed our design and access statement you can expect us to put in the application via the planning portal early next week,

Thanks for your time, any questions or queries please get in touch.

Kind Regards,

Stuart Moore
Hydro Engineer

From: Woodward , Matthew (Planning) [mailto:MatthewWoodward@barnsley.gov.uk]
Sent: 08 April 2011 11:25
To: 'Stuart Moore'
Cc: adrian@mannpower-hydro.co.uk; 'Dave Mann'; 'Gregory Nau'
Subject: RE: Proposed hydro schemes on the River Don

Thank Stuart,

If that is the case then you may submit an application without a tree survey. However, if it is suspected that trees may be affected when the application is received then we may ask for a tree survey.

Kind Regards

Matthew Woodward
Planning Officer
Development Management
Barnsley Metropolitan Borough Council

From: Stuart Moore [mailto:stuart@mannpower-hydro.co.uk]
Sent: 08 April 2011 11:10
To: Woodward , Matthew (Planning)
Cc: adrian@mannpower-hydro.co.uk; 'Dave Mann'; 'Gregory Nau'
Subject: RE: Proposed hydro schemes on the River Don

Matthew,

The current proposal provides the minimum disturbance to trees in the general area and no trees will be affected by the current proposals.

Kind Regards,

Stuart Moore
Hydro Engineer

From: Woodward , Matthew (Planning) [mailto:MatthewWoodward@barnsley.gov.uk]
Sent: 08 April 2011 11:03
To: 'Stuart Moore'
Cc: adrian@mannpower-hydro.co.uk; 'Dave Mann'; 'Gregory Nau'
Subject: RE: Proposed hydro schemes on the River Don

If any trees are to be affected then we would require a tree survey to be submitted with the application. It is difficult to comment because I am not altogether clear where the site is so if you could submit a location plan then it would be appreciated.

Kind Regards

Matthew Woodward
Planning Officer
Development Management
Barnsley Metropolitan Borough Council

From: Stuart Moore [mailto:stuart@mannpower-hydro.co.uk]
Sent: 08 April 2011 10:58
To: Woodward , Matthew (Planning)
Cc: adrian@mannpower-hydro.co.uk; 'Dave Mann'; 'Gregory Nau'
Subject: RE: Proposed hydro schemes on the River Don

Matthew,

There has been an ecological report, which included an appraisal of the trees, but taking into account the comments below, do you still require that we undertake a formal appraisal of the trees only?

Kind Regards,

Stuart Moore
Hydro Engineer

From: Woodward , Matthew (Planning) [mailto:MatthewWoodward@barnsley.gov.uk]
Sent: 08 April 2011 10:13
To: 'Stuart Moore'
Cc: adrian@mannpower-hydro.co.uk; 'Dave Mann'; 'Gregory Nau'
Subject: RE: Proposed hydro schemes on the River Don

Dear Stuart,

Have you carried out a tree survey?

Matthew Woodward
Planning Officer
Development Management
Barnsley Metropolitan Borough Council

From: Stuart Moore [mailto:stuart@mannpower-hydro.co.uk]
Sent: 08 April 2011 09:47
To: Woodward , Matthew (Planning)
Cc: adrian@mannpower-hydro.co.uk; 'Dave Mann'; 'Gregory Nau'
Subject: FW: Proposed hydro schemes on the River Don
Importance: High

Matthew,

Since our meeting there have been many discussions and minor tweaks to the design to improve the overall finished design.

a) The Millhouse site, which involved the biggest ecological impact

"*At Mill House Weir, reinstatement of the feeder channel and creation of the turbine channel may require removal of a small number of small- and mid-sized trees to allow access for machinery but this impact would be trivial in relation to the area of riparian woodland/tree cover on this section of the River Don."*

was moved to the semi-improved grassland on the opposite bank, to avoid any disturbance to the riparian habitat, despite the findings of the ecology report, which summarised:

"*This section of the River Don contains extensive areas of wooded bankside habitat, so the effect of any small-scale, localised tree removal necessary for the two hydro projects will be trivial in terms of the habitat resource*"

However, due to economic pressures of a hydro scheme, the client has decided to concentrate on a single scheme only, and has therefore shelved the proposal at Millhouse Green with a view to progressing it in the future.

b) The client therefore wishes to progress the scheme at Bullhouse Mill only. Here, the ecologist concluded:

"The footprint of the proposed Archimedean Screw turbines and associated infrastructure would be small and would require little disturbance or loss of semi-natural habitats. At Bullhouse Weir the impact would be negligible."

While progressing the design, and in view of your concerns, the scheme at Bullhouse Mill has been re-designed to avoid conflict with trees as much as possible. The client has also informed us that as part of his ongoing land management programme he has undertaken removal of some dead/diseased trees and those whose removal was necessary to protect the integrity of the walls adjacent to the weir. I have attached the most up to date design sketches, which indicate the position of surrounding trees in relation to the proposed scheme. Only one tree is implicated in the works (the nearest in a group of alders), and the concrete works have now been repositioned at 5m from this, to place the structures well outside the tree canopy and therefore the root splay. The only elements which still fall within the latter are now the support posts for the wooden access deck. This is not an essential part of the hydro scheme, and can be omitted if that is absolutely required. We would hope that this does not constitute a problem and, should a root be discovered, that steps can be taken to avoid damage during construction. In view of the fact that an ecological survey has been undertaken, which highlighted that this is one among many similar trees locally present, and as the risk to this tree is limited as described above, we would submit that a formal tree survey is not necessary in this case.

We have drawn up the maps and completed most of the documentation, and plan to be uploading many of these items to the planning portal and are looking to submit the application formally soon.

If you have any further concerns please can you highlight these as soon as possible so we can try to address these before we make our first submission.

Many thanks.

Kind Regards,

Stuart Moore
Hydro Engineer

From: Woodward , Matthew (Planning) [mailto:MatthewWoodward@barnsley.gov.uk]
Sent: 10 March 2011 13:56
To: 'Stuart Moore'
Cc: 'Adrian Clayton'; Pell , Keith; Smith , Matthew
Subject: RE: Proposed hydro schemes on the River Don

Dear Sir,

Thank you for your e-mail.

You may recall I wrote to you on 22nd September 2009. I appreciate this is some time ago so I have attached the advice I gave to you below. I am assuming that the scheme hereby proposed is identical to the original proposal.

Can you please advise me on the tree issue as outlined in my e-mail below as I would like to consult the Council's tree officer on the scheme, preferably before the submission of an application.

Kind Regards

Matthew Woodward
Planning Officer
Development Management
Barnsley Metropolitan Borough Council

From: Woodward , Matthew (Planning) [mailto:MatthewWoodward@barnsley.gov.uk]
Sent: 22 September 2009 16:27
To: 'Stuart Moore'
Subject: RE: Proposed hydro schemes on the River Don

Dear Sir,

Firstly, I attach a copy of the applications forms which are relevant for this type of proposal.

You may recall that the site meeting was split generally into two distinct areas. The following précis should provide general guidance:

The first area was a distance due south west of Bullhouse Mill, generally in a clearing adjacent to the river. In accepting that the scheme adheres to the thrust of Planning Policy Statement 22 (Renewable Energy) by providing a contribution towards Carbon reduction, and owing to the seemingly camouflaged and integrated design of the proposal, I do not have any immediate concerns. However, you should note that the site is located in the Green Belt, and the proposal would also need assessing against this policy (Planning Policy Guidance 2). It is vital that the scheme attempts to maintain the openness of the Green Belt, and to assimilate with its surrounding in order to make it potentially acceptable. Furthermore, I did note a number of trees on site and it follows that an appropriate survey would need to be carried out. Whilst the scheme may not involve taking out any trees, the excavation works have the potential to damage the roots.

[***A second potential site, not considered further in this planning application]*** was located approximately north east. On this particular site, I do have some concerns primarily regarding the impact the proposal would have on the existing vegetation and trees. In the absence of a tree survey and an indicative drawing showing the route, I am not clear what impact the proposal would have on the trees. However, I would prefer that the impact on the trees was minimised as much as possible and, at this stage, I am not clear a) on the value of the trees b) how much damage the works would do to the trees vegetation c) in the absence of the aforementioned, I am unable to advise as to whether any potential damage to the trees would be acceptable.]

On a general note, the river and bank are likely to be rich in biodiversity and it follows that a full ecological survey and associated mitigation measures should be submitted. I am sure this is something that the EA would require as part of their process.

Whilst I have attached the planning forms, I would be grateful if you would give me a call to discuss these issues and the planning requirements in more detail.

Kind regards

Matthew Woodward
Planning Officer
Development Control
Barnsley Metropolitan Borough Council

Tel - 01226 772587

Please note – The advice in this e-mail is based on limited information and a site visit. It does not imply a favourable recommendation on any subsequent planning application which would be assessed against national, regional and local policies and in respect of any other relevant material considerations.

Design

Description of the design should be read in conjunction with drawings and plans provided.

Use

The development will allow the comparison of modern water-power technology with local historic uses, echoing the site's historic use as a control structure for water power at the adjacent mill. This provides a visual example of progressive engineering to complement the economic activities of Bullhouse Mill and the business community which it supports.

Clearly, however, the installation is primarily aimed at the generation of green energy, and sits firmly within the context of policy at national, formerly at regional, and increasingly at local levels, promoting the development of decentralised low-carbon energy production.

The installation's electrical output will be concentrated in periods when there is an average or higher flow in the river, and will continue round the clock in such periods. There will be no output when the river flow is too low. The system therefore responds to the challenge of sustainable decentralised generation in a manner proportionate and appropriate to the natural resource at this site, while at the same time improving passage for fish in the Don via measures approved by EA Fisheries and in keeping with the EA's aspirations.

Amount

Barnsley LDF Core Strategy Objective 4 seeks "efficient use of land and infrastructure", including the reutilization of previously-used structures as is proposed here. Objective 6 pursues sustainable development by "embracing the principles of sustainable design including measures to prepare for, adapt to and reduce impact on climate change", which is inherent to this proposal.

The proposal does not support occupancy, and has no implications for occupation density, nor does it risk opportunistic conversion to other uses.

While as a private installation the facility itself is not open to the public, the scheme may foreseeably prompt occasional uninvited visits to Bullhouse Mill by those motivated to view the installation; but any increase in traffic or car parking arising from this eventuality will be negligible within what is already a multi-unit commercial and light industrial site.

The system is designed to supply electricity to the National Grid and to do so in a way which makes most efficient use of the available water resource having regard to environmental concerns which are controlled by the EA abstraction licence. On balance, the scheme is efficient and proportionate to the need to generate renewable electricity at a site where natural resources are available to do so (here, water flow and a fall in the land).

Layout

Water power was the original *raison d'être* of this former mill weir. Water power is reinstated by the proposed scheme, in a manner and to an extent in keeping with the site's present condition and status.

The defining characteristics of the proposed site are the presence of significant flow in the Don and the head available in terms of the descent at the weir. This site is one where the viable amount of head can be exploited on the spot where the water is abstracted without having to lead the water out of the watercourse over any great distance. This prioritises returning the water to the river as soon as possible, minimising the 'depleted reach' of watercourse so that only the weir itself is deprived of water. The sizing and layout of the turbines has been designed with the intention of making the most efficient and viable use of the available water resource and fall in the land.

A coarse screen will exclude only massive debris, assisting this to remain the river and be dispersed by onward river flow as at present. The sizing of the intake, screen and channel are all directly dictated by the amount of flow being taken, a technical necessity for efficient design of the scheme to use the water resource available at the site.

Flood risk to, and arising from, the proposed development is dealt with more fully elsewhere in addressing the specific requirements of the Environment Agency (see Environmental Sustainability Assessment for responses to EA Flood Risk Assessment questions). All elements of the hydropower scheme relate to the routing of water within the river, and common sense confirms that they must therefore lie within the flood corridor. Thus the scheme constitutes an exception to non-development in the flood plain as infrastructure development whose location there is essential to its operation. In short, it is a technical necessity for the system to be located within the flood corridor and indeed partly within the river. It must logically be categorised as water-compatible development.

In layout terms, design is dictated by the functional purpose of the hydropower installation as in-river structure. The positioning of the generating equipment (above the screw) and the control equipment (within the powerhouse) places it at an appropriate height to escape submersion during predicted high flood flows, while the rest of the system is designed for submersion. The sluice gate design includes automatic failsafe shutdown of the system at excessive flows, allowing flood flow to continue to pass beneath the system. At moderate flows, when the system is operating, the turbines act as new paths to flow, but only locally between the sections of the flood corridor immediately above and below the weir. There are no third parties in this small area and the changes pose no third party detriment.

A compact Archimedean screw turbine will be used, which requires support only at the top of the system and at some distance from the bottom. A new sluice gate would be installed as part of the turbine assembly, inserted immediately upstream. These new elements are relatively superficial to the landscape and are removable at decommissioning in future.

These requirements contrast favourably with alternative scheme designs for such a site, using competing types of turbine such as Kaplan or siphon types. These could involve visible pipework or deeper excavation and pressure tubes formed within massive concrete.

G59 electrical connection will involve insulated cable buried and routed discreetly along the track across the fields to back Bullhouse Mill.

The shrouding structure at the top of each screw incorporates sound-proofing material which is designed to ensure that each generator can operate without any risk of public nuisance in terms of machinery noise. It secures, protects, and creates an aesthetically plain envelope around what would otherwise be an exposed piece of machinery.

Among low-head micro-hydro options, the Environment Agency most frequently cites the Archimedean screw as an example of potentially environmentally-sustainable technology. The Environment Agency's requirements for the scheme to be considered sustainable include incorporating a fish pass which must satisfy the specifications of the EA in improving the opportunities for fish to ascend the river. Through this development, migrating fish of all species will be able to pass upstream of this site more easily than is currently the case, aided to find the upstream pass by the attraction flow from the screws.

Scale

The overall footprint will be some 200m^2. More than 80% of this will be in creation and modification of open water channels, with the power generation equipment itself occupying approximately 25m^2. Only the upper part of the generation equipment and the adjacent intake will protrude above the surrounding ground level. Here the visible elements of the control structures and the top end of the turbine will be some 2.5m x 8m x 2.5m high (see drawings for exact dimensions). These elements are contemporary engineering structures, but we submit that these are not of such a scale as to detract significantly from the setting.

The turbine's presence in terms of shape and size is driven by technical considerations – it is the direct result of designing to optimise efficient use of the natural resource in the proposed location. The Archimedean screw turbine represents technical optimisation of an ancient technology, resulting in a more than corresponding increase in efficiency and output. And, while screw turbines are larger in size than other turbines which might compete technically at such a site, this is in fact a positive choice in terms of ecology, because their size is in direct proportion to their lower ecological impact. Fish can pass unharmed through the spacious slowly-rotating chambers of the screw. The proposed system is therefore proportionate to its context.

Landscaping

The proposed site is an engineered stretch of riverbank, with the river to the south and the leat curving away to the north, adjacent to grazing. The site is screened from public view. The project will retain the apparently nineteenth-century industrial stonework surfacing of the banks and intake. Installation of the new equipment at the bank top will clearly create an alteration to this landscape, but is argued to be proportionate in its context.

Though the context now appears tranquil, it must be remembered that the weir and intake structures are an industrial or post-industrial assemblage which came into being as a result of harnessing the power of the river. They formerly served to create a head of water and divert flow into Bullhouse Mill to provide power to its waterwheels.

A habitat survey has found the bankside site to be of no special ecological importance. The works proposed cause little loss of ground area outside the watercourse. After works, opportunist species will continue their colonisation of the bank as at present.

Impacts on the river environment were addressed in discussion with the Environment Agency in the process of obtaining the necessary licence. Pre-eminent in these discussions was the benefit to be obtained from the development in terms of the installation of an efficient fish pass, vouchsafing a reliable upstream passage for fish past the weir and the new turbine. The fish pass will change the appearance of the watercourse in this well-screened spot, but the EA has agreed this to be of net ecological benefit.

While improved fish passage is an important ecological benefit of the project, the generation of energy by a renewable low-carbon method is in itself a benefit to the environment and in turn to the landscape, in terms of emissions avoided and combustion activities displaced. The hydropower proposal represents one of the least impact uses of the landscape - in that the behaviour of natural systems remains unaffected - except at the site itself where water is now simply made to bypass the weir.

As has been addressed elsewhere, and in the submission accepted by the Environment Agency when granting the abstraction licence, flood risk is not increased by the proposal.

In sum, there does not seem to be justification for landscaping mitigation at this site.

Appearance

The turbine system and structures necessary to its mounting and operation will not be easily visible from viewpoints outside the applicant's property. Much of the turbine will sit below the level of the riverbank, and from outside the property, much of the installation will lie below the horizon due to local topography.

The screw turbine at this site is of a scale which will be enclosed within a steel tube. This confers safety and vandalism protection, and obstructs the view of the rotating blades. All steelwork elements will be either galvanised or painted steel (green or another colour by common agreement), to provide a finish best harmonising with the surrounding context.

Proposed Materials

Element	Material
Archimedean screw turbine	Mild steel, painted green or other; rubber extrusions
Generator shroud	Mild steel, painted green or other
Turbine mounting blocks	Rubber anti-vibration mounts (below water level)
Lower supports for turbine	Poured concrete in steel piling (below water level)
Grouting of components to channel base & sides	Poured concrete (at or below water level)
Upright supports for sluice, screen and stop boards	Mild steel, painted green or other (at water level)
Sluice, new	Galvanized mild steel (at water level)
Coarse screen	Galvanized mild steel (at water level)
Stop boards	Treated timber (below water level)
Deck of maintenance platform	Galvanized steel treadplate
Railings of maintenance platform	Galvanized steel tubing
Larinier fish pass channel	Galvanized mild steel (below water level)
Larinier fish pass baffle plates	Aluminium sheet (at water level)
Naturalistic fishway	Wood, stone, or recyclate baffles in a channel with concrete walls and base down the weir (TBC)
Cabling	Black waterproof plastic-sheathed copper cable

Paint specifications for all elements are subject to agreement.

Access

Exceptionally, as the considerations are atypical, access considerations are dealt with here under a separate heading.

As an engineering infrastructure installation, the proposed development requires no ingress except for periodic maintenance inspection and engineering access. For these purposes the present access route via track from Bullhouse Mill is adequate.

The scheme's utility and benefits to the local area, community, and wider society lie not in direct public access to or use of its structures, but principally in its contribution to renewable generation targets and concomitant benefits to fish migration.

Maintenance access to the vicinity of the hydropower installation will be by the applicant within his own property. The installation will permit continued access to the riverbank/weir by EA personnel by arrangement with the landowner as at present.

There is no public right of way to access the site, which lies amidst grazing land to the rear of Bullhouse Mill.

Construction Access

Please refer to submitted map showing the footprint of the proposed development as a red line.

During construction, it is proposed to maintain to make use of the Bullhouse Mill industrial complex for the purpose of construction storage and contractors' welfare. Additional vehicle movements in relation to the development should not exceed c.10 per day at peak.

Construction within the red line on the plan will also include a sequence of dewatering operations. While heavy equipment is being used during the construction phase, no unauthorised persons will be permitted into the marked area. Notices will be posted to reflect this and unauthorised access will be monitored.

Flood Risk Assessment

Barnsley policy CSP4 (Flood Risk) seeks to prevent development which "would be at an unacceptable risk of flooding or would give rise to flooding elsewhere". (This succeeds the former UDP policy ES4 on preventing risk arising to or from washland areas.) While this policy requires developers in Flood Zones 2 and 3 to provide evidence of the sequential test and exception test "where appropriate", the present proposal is a case where this is not necessary, in that run-of-river hydropower developments must and can only be situated within the watercourse.

The scheme therefore constitutes water-compatible development. Its location is a matter of technical functionality. (While it also fulfils an infrastructure function as a power generation facility, capable of passing sequential test, PPS25 Practice Guide (Dec 2009) 4.39 clarifies PPS22 to the effect that LPAs "should not use a sequential approach" for renewables infrastructure.)

While the proposal is therefore indeed in a location likely to be affected by current and future flooding, nonetheless in fact it creates low risk in relation to flooding. This is due firstly to the proposed zero net reduction in flood plain capacity, secondly to the small area in which the proposal modifies the flow path, thirdly to the absence (within that small area) of any properties, structures or other interests which might experience third party detriment, and fourthly to the flood-resilient design of the installation itself.

Full details of this case are presented in the submitted Environmental Sustainability Assessment, and those observations should satisfy the policy's requirement in the present case for site-specific Flood Risk Assessment (FRA) as a proposal in Flood Zone 3. The scheme has already satisfied EA Water Resources and their internal consultees in EA Flood Defence, and will be reviewed again by the local EA Flood defence team when the applicant seeks to gain EA works consents which are mandatory prior to construction.

The proposal creates no surface water or other drainage requirements.

Environmental Assessment

At the proposed scale, EIA regulations are not invoked unless on grounds of special site sensitivity (EIA Regs 1999 Schedule 2), therefore no formal Environmental Statement is required. For a micro-hydropower development of this limited scale, using Archimedean screw technology which is acceptable to the Environment Agency, the Environmental Sustainability Assessment submitted with the present document is typically accepted as adequately fulfilling an equivalent function. Furthermore, the scheme is regulated in terms of its potential impacts on the natural environment by having been subject to EA licensing.

Archaeological Statement

For the vicinity of Bullhouse Mill, record search via Heritage Gateway online shows no records held by South Yorkshire Sites and Monuments Record or others, except for the listed and other buildings of Bullhouse Manor and Chapel some 150m to the southeast of the proposed site. These form a distinct area of settlement, separated from the proposed site by the river itself and a steep bluff.

The project seeks to remodel the remains of the drystone former intake. This is a now isolated outlying component of the former mill assemblage whose other parts have now been lost or incorporated into modern buildings. It is submitted that the partial remnant of this intake of probable nineteenth-century date does not represent archaeological remains of local importance needful of protection under Barnsley's CSP30 (Historic Environment). It is therefore submitted that it need not be protected when "weighed against other factors including the need for the proposed development" (as former UDP policies BE3 and BE4).

Tree Assessment

No trees are implicated in the area of works. The final design has been amended to reposition the concrete works at least 5m from the nearest tree in a group of alders, placing the structures outside the tree canopy and therefore the root splay. The only elements, which still fall within the latter are now the support posts for the wooden access deck. The deck is not an essential part of the hydro scheme and could be omitted if that were absolutely to be required. We would hope that this does not constitute a problem, and that should a root be discovered, steps can be taken to avoid damage during construction. In view of the fact that this is one among many similar trees locally present,

and that the risk to this tree is limited as described above, we would submit that a formal tree survey is not necessary.

Biodiversity Statement

The planning application takes account of the fact that local authorities may call for submission of a biodiversity statement. The present paragraph therefore stands as a statement, stating response to generic questions as follows:

“Extent and location of habitats and features that could be affected"
- River Don fisheries; this development confers net benefit, as below

"Likely impacts to designations/priority habitat"
- no designations here

"How alternative designs and locations have been considered"
- designer has been commissioned as supplier of best environmental option; applicant is making application for this specific site as the less potentially-disruptive of two potential sites in the area

"How adverse impacts will be avoided"
- see attached Environmental Sustainability Assessment for design principles which have satisfied the ecological requirements of the Environmental Agency and other consultees

"How any unavoidable impacts will be mitigated or reduced"
- ditto

"How impacts that cannot be avoided or mitigated will be compensated"
- ditto, for enhancement re fisheries

"Any proposals for enhancements of biodiversity (this is particularly relevant and desired for Major Developments and other large developments)"
- this development is of a small scale, but again enhancement re fisheries

"Any Protected Species statements required as indicated by section 2A/B should be integrated within the biodiversity statement"
- n/a

"These reports may form part of a wider Environmental Impact Assessment"
- this development is of a small scale which does not require full-scale EIA under the regulations

"Reports may not be required where applicants are able to provide pre-application correspondence from Natural England which confirms that they are satisfied that the proposal will not have an adverse impact on any SAC, SPA, SSSI OR RAMSAR"
- n/a at this site

For further detail, the reader is referred to the attached document entitled Environmental Sustainability Assessment and the ecological consultant’s site report.

Overview of the Archimedean screw turbine

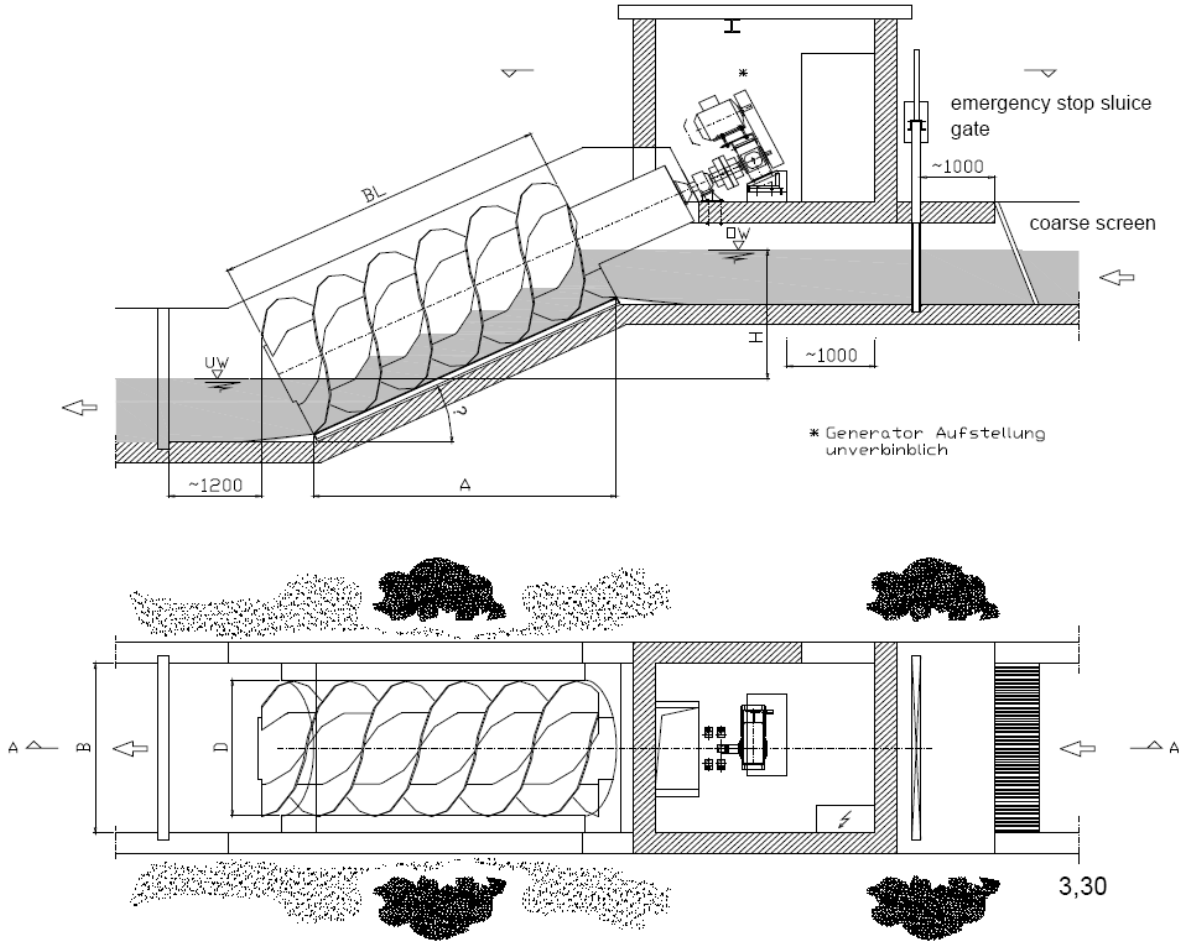


Figure 8: Archimedean screw hydropower system layout sketch

The concept of the Archimedean screw has been known since ancient times, when it was first used as a water pump, with the screw rotating to lift water uphill. The potential of inverting this process has now been realised, by allowing water to fall by gravity into the chambers of the screw. The system then rotates, allowing potential energy to be extracted from the water and fed through a gearbox to power a generator to export electricity.

The turbine structure is similar to an extremely large hardware screw, which commonly consists of a single blade rotating round a central core (single helix). The modern hydrodynamic turbine consists of a triple or quadruple helix, combining large open water chambers with a slow speed of rotation, which avoids any pressure change in the water. Fish can therefore simply enter the screw at the top, and pass through the screw unharmed at the bottom. Extensive testing has been carried out to prove just how fish-

friendly the machine is, with over 1000 successful passages of live fish of various species and sizes. These tests were carried out and fully documented by independent experts Fishtek Consulting Ltd.[1]. As there is no need to exclude fish, only a very coarse screen is required, which allows leaves, sticks and other debris to pass through without causing blockages and the subsequent loss of output that other turbines would suffer.



Figure 9: Archimedean screw turbine in use – here a larger model not within a tube

The top of the screw is connected via a flexible coupling to a gearbox, to increase the speed to close to 1500rpm, and then through a final drive to the generator. An electrical control system controls the flow of water to the screw via a sluice gate, monitors the output of the generator, and ensures that the correct frequency and voltage are maintained at all times.

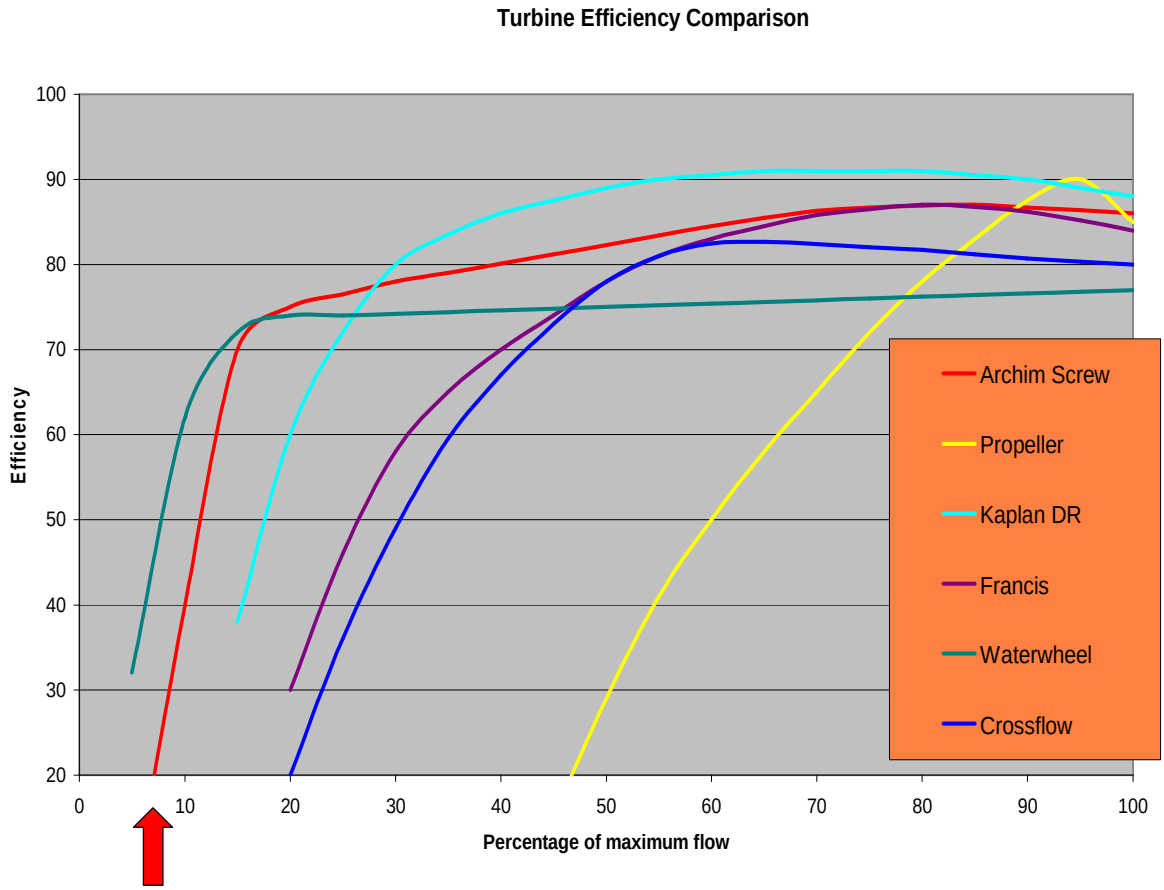
Efficiency comparison

The Archimedean screw is recognised not only for its potentially fish-friendly design, but for its performance among competing designs as increasing flow affects efficiency (below).

The Archimedean screw reaches efficiencies of up to 86%, providing a comparable electrical output to alternative systems, but with a lower capital cost and maintenance overhead. The omission of fine screening, together with a low water velocity and low pressure throughout the system, means that the net head available for generation is very close to the gross head at the site. In addition, full flow capacity is maintained through the

screw even when the gross head is reduced during times of high water. These factors can all have a significant impact on the actual annual generation possible from a particular site. A thorough assessment of the actual performance of an operating system was carried out by independent consultants Nick Bard Hydro Systems[2], which proved that the performance matched that predicted by the manufacturer.

When estimating the energy delivered over the course of the year, it is most important to consider the effect of changing head and flow on efficiency. Favourable performance of the screw in this respect is reflected in the energy capture calculations provided to the client.



References

1 Archimedean Screw Fish Passage Test Results, Fishtek, Sept 2007 et seq. http://www.mannpower-hydro.co.uk/research.php

2 River Dart Hydro Performance Assessment, Nick Bard Hydro Services, June 2007. http://www.mannpower-hydro.co.uk/research.php