Angling Trust
Position Paper: Run of River Hydropower

Clockwise from top left: perch sliced in half by hydro blades; hydro turbines on the River Mole in Surrey; salmon leaping over Hexham bridge footings; an artist's impression of Marlow weir with Archimedes screws installed.

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©Angling Trust
www.anglingtrust.net
admin@anglingtrust.net
0844 7700616

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1. A VISION FOR SUSTAINABLE HYDROPOWER

The Angling Trust believes that climate change is one of the greatest environmental challenges facing humankind. It will have far reaching consequences for our ability to grow crops, supply drinking water and maintain biodiversity. We must transfer our energy generation methods to low carbon alternatives urgently and reduce our use of unsustainable energy.

Generating electricity from river water flow could make a small contribution to that transfer, but most of this contribution will come from storage reservoir schemes. An almost negligible amount will come from run-of-river schemes (small dams, weirs and in-river turbines). This is because England is a relatively flat country, and despite our reputation, it is actually not very wet. There are also very substantial demands on water resources from abstraction for irrigation, industry and public water supply. Therefore river flows are not sufficient to generate any meaningful amounts of electricity for the vast majority of the time. The Government's own advisers confirm that low head schemes will produce insignificant amounts of power, contributing less than 0.5% of our total electricity demand, even if all the available sites were to be exploited. Many will not be exploited as they are not viable for other reasons, and therefore the actual contribution of run-of-river hydropower is likely to be in the region of 0.1 – 0.2% of current electricity demand.

We believe that run-of-river hydropower may be acceptable where electricity generation can be carried out in a way which doesn't unduly damage the river environment and where the investment might benefit fish passage over an otherwise impassable barrier which could not be removed. We have provided some case studies where this balance has successfully been achieved. There are also opportunities for hydropower generation on sewage outfalls and in the water distribution network where it will have no environmental impact and there is a predictable supply of water.

We believe that beneficial schemes on our rivers are the exception to the general rule that run-of-river hydropower causes great cumulative damage to the ecology and geomorphology of rivers and makes a very small contribution either to electricity supply or CO_2 emissions reduction. Because of this, we believe that permission to develop run-of-river hydropower should only be granted if the scheme can meet the **sustainable hydropower three stage test**:

1. if the development can be proved to have a very low impact on the ecology and other functions of the rivers both individually and cumulatively with other schemes and;
2. if it is installed on an existing weir and;
3. if that weir cannot be removed or eased for technical reasons or because it has some other legitimate and long standing function (such as navigation on heavily used rivers).

All schemes should also be considered in the context of other planned and potential developments on the same river and as part of an integrated energy strategy. We also

believe that subsidies, such as Feed-in Tariffs[1], should only be available to schemes which also benefit the river environment, which is already the case in some EU Countries such as Germany.

All energy generation has some environmental impact at some point either in the manufacture of the technology (e.g. solar panels), or in the generation of the power (e.g. CO_2 and other emissions from coal-fired power stations). Decisions about which sources of energy to use should be based on the balance between the amount of energy which is generated and the environmental impact of that process, throughout its lifetime.

2. CURRENT EXAMPLES OF BAD PRACTICE

1. The Good Practice Guidelines for hydropower developers have been found by the Environment Agency's own advisers to be "unfit for purpose" and were initially drafted only with the input of hydropower developers rather than any other interests. They are not written on a scientific evidence base, but are instead the result of negotiation with developers. They are now being reviewed following pressure from the Angling Trust.
2. The current strategy is based on an approach of "first come first served" rather than any strategic assessment of the viability of sites and their cumulative impact on ecology and river functions.
3. Some hydropower licences have included conditions which allow for up to 110 fish to be killed in each 24 hour period (up to 100 coarse fish and eels and up to 10 salmon or sea trout). One recent draft licence proposes an 'allowance' of a 20% deterioration in fish welfare and movement on a river already 'probably at risk' of failing its Salmon Conservation Target in 2014. This is completely unacceptable and seems to be impossible to enforce in any case.
4. The cost of applications for licences (£175) in no way reflects the vast costs incurred by the Environment Agency on regulating applications. For example, the Agency admitted that it had spent more than 8,000 man hours dealing with an application on Beasley weir (and has since spent many more). This scheme will generate a maximum of 85 Kw.
5. A draft community scheme has been developed on the River Lyn in North Devon to install a new concrete weir to generate hydropower. One of the last healthy salmon rivers in the country, this beautiful river is a Site of Special Scientific Interest. North Devon Council has wasted almost £150,000 on the development of plans for this scheme, which is now not going ahead.
6. If a licence application is rejected, the developer has the right to appeal. However, if a legitimate affected party objects and the development is still approved, the person affected has no right of appeal. He may have a right to judicially review the decision but there are too many hurdles to cross and taking such cases is often prohibitively expensive. This obviously favours developers over those who stand to be affected by the schemes.

[1] Feed-in Tariffs are a subsidy paid for every kW of energy produced, whether used locally or exported to the national grid, and guaranteed inflation-proof for 20 years.

7. There is no substantial monitoring of the impact of hydropower developments on the ecology and other functions of rivers being carried out despite hundreds of applications throughout the country.
8. No consideration is given to changes in future flows either because of increased abstraction or the effects of climate change itself.
9. Some hydropower schemes breach their licence and permit conditions and yet there is no enforcement from the Environment Agency as the breaches of each condition are not regarded as significant enough on the Compliance Classification Scheme to warrant action by the Agency. This means that a developer or operator could breach every single condition consistently is individually significant enough to cause damage to the environment (see example of Settle hydro below and detailed case study on page 4).

3. SCHEMES WHICH ARE CURRENTLY CAUSING, OR WILL CAUSE DAMAGE

1. On the River Mole in Surrey, overly large turbines at times reduce the upstream water level to below the level of the weir. The turbines then cut out, and there is then no water flowing over the weir until the upstream levels build up again. This results in large fluctuations of flows and levels which are visible at an EA gauging station several km downstream.
2. On the River Trent at Beeston, hydropower generation has caused great fluctuations in the flow which has apparently led to boats running aground. An excellent stretch of water for barbel fishing has been ruined.
3. At Settle Weir on the River Ribble, a community-funded turbine development was designed to produce a maximum of 49kW, has never achieved more than 39kW and up to mid-October 2011 has generated an average of 9.1kWh. It is regularly breaching its licence conditions, but no enforcement action is being taken by the Environment Agency because none of the multiple breaches of each of the conditions of the permit in themselves is regarded as severe or causing environmental damage. This renders the conditions meaningless as, following this example, developers can simply operate outside the parameters of the conditions [See case study in box overleaf]
4. Another community scheme on the River Goyt at Torrs Mill was designed to produce an average of 27kWh, but in its first 2 years of life only produced an average of 17kWh, enough to supply the average electricity demand to just 30 houses.
5. On the River Lugg in Herefordshire, a Site of Special Scientific Interest, a scheme proposed to leave only an amount of water equivalent to low summer flows passing through a 300m stretch, which will ruin vital spawning habitat and destroy the salmon fishing rights of the riparian owner.

4. DETAILED CASE STUDY: SETTLE HYDRO

By David Hinks, Chairman of the Ribble Fisheries Consultative Association

Introduction
Settle Hydro is on the River Ribble and is placed on an old mill leat adjacent to Settle fish pass. The fish pass requires sufficient flow passing through it to make it passable to fish. The Ribble is one of the top six rivers in England and Wales for both salmon and sea trout. The Ribble Fisheries Consultative Association opposed the building of the hydro since we feared it would impede runs of migratory fish. The hydro started operating in Jan 2010. Since then we have constantly objected to the EA about its working. Our main objections:

We believe the hydro impedes the run of salmon through the fish pass.
In 2010 there were 238 violations of the Hands Off Flow (HOF), which is the required amount of water that should be left in the main channel. These occurred when the hydro was still working and abstracting water when the flow had dropped below the HOF. This is water lost to the fish pass thus preventing fish from ascending.

Even when the gate is supposedly shut on the screw because the level is below the HOF water is still passing through the turbines thus denuding the fish pass of water and preventing migration. No fish have been seen to go through the fish pass when the hydro is working, but it is not clear why. This means at best a delay in migration and at worst the fish drop back down the river and do not spawn.

Environmental Assessment
The environmental assessment produced by Settle Hydro was not worth the paper it was written on, as it focussed on terrestrial ecology and did not analyse in any detail the impact on migratory fish. This seems to be a common feature of hydro schemes yet the EA nearly always accept these inadequate assessments when issuing licences.

The hydro is poorly managed
The first audit held in June 2011 showed up numerous faults. The transducer had not been correctly maintained thus leading to faulty operation. Staff gauges had not been installed. Markers on the fish pass were not maintained. Water abstracted was not recorded on a daily basis. There were missing periods of data which appear to have been lost! Plus of course the 238 violations for running and abstracting when the river was below the hands off flow.

The control point for abstraction does not conform to the Detailed Project Plan
According to the Plan the “existing sluice gate will be fitted with a mechanical actuator and position limit switches in order to allow it to be automatically operated by an electronic control system”. The document went on to give all the reasons for this. This was never done and the existing sluice gate (Point A on the plan) is a manual operation. This sluice gate is left in a semi open position therefore the inlet sluice is permanently filled with water thus providing a permanent start up flow on tap. We believe that a lot of the problems stem from this failure to electrify point A as specified.

Control point B has never worked
Point B is the entrance to the screw and is not water tight and allows water to run constantly through the screw even when not generating electricity. This is water which should be going down the fish pass and thus cuts into the window of opportunity for fish to ascend. This was the first time we had looked for this since previously we had been looking for pulsing (see below). Settle Hydro eventually got someone to look at it and then said it was fixed but the problem continued in total for almost 30 hours.

The hydro pulses
This is a condition where it will run for a very short time, sometimes as short as 30 seconds. The pulsing affects the fish pass with the water level changing rapidly and thus affecting the ability of fish to run. After the first audit we were assured it would not happen again but immediately it did.

Effect on the pool immediately above the weir.
The hydro effectively uses the pool above as its mill leat and draws water from this pool causing severe changes in height. The pulsing in this connection has a particularly deleterious effect. The habitat and environment of this pool is affected as is the fishing.

We still after 22 months do not know the exit flow volume from the outfall of the hydro
This is a crucial piece of information in terms of how the fish pass works. The principle here is that fish are attracted to the high volume of water and then easily find the more energetic flow from the fish pass. According to the terms of the abstraction licence the hydro outflow should not exceed 0.5m/s. We have asked the operating company and the EA for this information, but have still not received it. There are no screens to prevent fish entering the turbines from downstream.

Monitoring
No one monitors the performance of the hydro. Settle Hydro leave everything to the "instruments" and pick nothing up themselves so faults go totally undetected. Despite constant complaining by ourselves to the EA nothing was done until the first audit held June 2011, 17 months after the hydro started operating. This audit showed numerous problems and at least now the EA contact Settle Hydro when we report something. It is not our responsibility to monitor the working of Settle Hydro. It should be up to Settle Hydro to monitor its performance, something at which it has proved singularly inept.

Licence Breaches
Throughout the 22 months of working there have been numerous breaches of licence. The EA takes the view that they are minor thus giving the operator the impression they can do what they like and fish and fisheries do not matter.
We have questioned how many "minor" breaches it needs to take to add up to a major breach of the licence?

Environmental damage
We are constantly told by the EA that we need to prove environmental damage. We do not believe it is up to us to prove damage but that the hydro operator should prove that they are not causing damage and that they are operating within the terms of their licence.

5. CURRENT EXAMPLES OF GOOD PRACTICE

1. On the River Teign a completely unsatisfactory scheme at Sowton Mill, granted a new licence without proper fisheries protection by the Environment Agency, is to be replaced by a much-improved scheme as a result of negotiations between the owner and the Teign Fisheries Association.

2. On the Duke of Northumberland's stretch of the River Aln which contains three challenging weirs for migrating salmon that cannot be removed for heritage reasons, a hydropower scheme will be used to fund efficient modern fish passes.

3. A high weir on the River Monnow, a tributary of the River Wye, had been virtually impassable to migrating salmon for many years. A fish pass, funded by the Agency, has been installed adjacent to a new hydropower scheme, opening up the river for spawning salmon and many miles of juvenile habitat.

4. A hydropower scheme proposed by Gateshead Council on an impassable weir on the River Derwent, a tributary of the Tyne, will include a fish pass, opening up the river for migrating salmon and sea trout.

5. On the Dart, Totnes Weir at the head of tide, currently has an unsatisfactory fish pass. A new fish pass, complete with fish counter, is to be installed alongside an Archimedes Screw turbine. Funding of the fish pass and counter is coming from the developer who has worked closely with local fisheries interests.

These are exceptional cases – most hydropower developments have a negative impact on fisheries. If in doubt, weirs should be taken out!

6. HOW DOES HYDROPOWER DAMAGE RIVERS AND FISH?

Put simply, hydropower can have the following impacts on fish and other wildlife and river functions:

- By creating, or perpetuating, structures in rivers which prevent fish from completing their life cycle. Nearly all fish, from minnows to salmon, need to move up and down stream to breed and feed.
- By damaging and killing fish that pass through turbines either through poor screen design, or absence of screening.
- By trapping fish against screens.
- By reducing the amount of time that flows are suitable for migration of fish. Where there are several installations on a single river this can mean that fish are unable to reach their spawning or feeding grounds.
- By increasing the vulnerability of fish to predation from cormorants, otters and other fish by funnelling them through fish passes, or disorientating them by passing them through turbines.
- By depleting the flow of water in the stretch of river out of which water is taken to power the turbine. This has impacts on invertebrate life and the ability of fish to migrate through this depleted reach.
- By preventing the natural movement of sediment and gravel down the river.

The European Commission's Environment Directorate commissioned expert consultants to study the implications of low head hydropower on the potential for implementing the Water Framework Directive: *"Hydropower Generation in the context of the EU WFD. Project number 11418 | version 5 | 12-05-2011".* In the report, the consultants describe the impacts of hydropower on rivers.

"Impacts of hydropower schemes can be distinguished in hydromorphological, physico-chemical and biological impacts on rivers and can be considered within a framework of interconnected effects:

- First order impacts: Immediate abiotic effects that occur simultaneously with dam closure and influence the transfer of energy and material into and within the downstream river and connected ecosystems (e.g. changes in flow, water quality and sediment load).
- Second order impacts: Changes of channel and downstream ecosystem structure and primary production, which result from the modification of first order impacts by local conditions and depend upon the characteristics of the river prior to dam closure (e.g. changes in channel and floodplain morphology, changes in plankton, macrophytes and periphyton). These changes may take place over many years.
- Third order impacts: Long-term, biotic, changes resulting from the integrated effect of all the first and second order changes, including the impact on species close to the top of the food chain (e.g. changes in invertebrate communities and fish, birds and mammals)."

These impacts increase with the number of schemes on a particular river. They should also be considered in the context of the fact that low head hydropower will generate an almost negligible amount of renewable electricity on a national scale.

7. A 10 POINT PLAN FOR SUSTAINABLE HYDROPOWER

The Angling Trust is calling for the following changes to policy and practice:

1. The Government should set out a clear vision for an integrated sustainable energy generation strategy. The absence of this strategy is leading to the current piecemeal and haphazard development, which is costing the nation dearly in vast public subsidies, regulatory costs and environmental impact.
2. The Environment Agency should ensure that the Water Framework Directive is implemented. This requires our rivers to achieve Good Ecological Status and for none of them to deteriorate. In most cases low head hydropower is not compatible with these aims.
3. The Environment Agency should prioritise its various duties to protect the environment above and beyond its requirement to promote economic development. It should not be involved in promoting opportunities for hydropower schemes, but should focus entirely on the protection of the ecology and other functions of rivers. For example, instead of drawing up a map of all the possible opportunities for hydropower development (which it has done) it should have drawn up a map of all the weirs which should be removed to improve rivers and the costs of so doing (which it has not done).
4. The Government should only pay Feed In Tariffs (FITs), which are a subsidy to pay for renewable energy generation, to hydropower developers if the development passes the sustainable hydropower three stage test. These subsidies should only be spent on renewable energy generation which is not causing more problems than it is solving.
5. The precautionary principle should be applied and developers should have to prove that their scheme is not damaging, rather than objectors having to prove that it will be damaging, before they are granted a licence.
6. Operating licences must not permit the killing of any fish in turbines.
7. No Go areas must be identified and a decision about the number and location of all developments on each river system should be established before any developments go ahead.
8. There must be a right of appeal for objectors who are legitimately affected parties to developments which are approved without addressing their objections.
9. Abstractions for hydropower generation should no longer be regarded as non-consumptive. They should also be charged by volume.
10. All hydropower developments should be closely monitored to ensure that licence conditions are being met and if they are not, then electricity generation must cease immediately until remedial action has been taken. All breaches of permit or licence must be actively enforced.