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## **Application for Technical Variation to CAR Licence (CAR/L/1012323): Galloway Hydro-electric Scheme**

### **Consultation response from Ayrshire Rivers Trust**

Following discussion with stakeholders and persons who may be required to respond to the above application on behalf of government or non-governmental organisations it is clear that there is a need for information to balance the application document and the supporting MBEC Ecological Report supplied by Scottish Power (SP) (<http://www.sepa.org.uk/water/hydropower/regulation.aspx>). It is the opinion of Ayrshire Rivers Trust (ART) that a number of issues which have been promoted through the application process and subsequent press coverage would benefit from clarification. This report sets out to address these issues and to provide information so that the reader can form a balanced view.

This report should be regarded as a non-technical summary of the more detailed response that will be submitted by Ayrshire Rivers Trust (ART) prior to the close of the 28 day consultation period, which ends on the 17<sup>th</sup> Dec 2010. Further detail regarding any aspect of this summary can be provided if requested.

### **1. Introduction**

Ayrshire Rivers Trust (ART) is an independent charitable organisation which was established in 2000, employing its first biologist in 2002. ART currently employs 3.4 f.t.e. staff based in Ayrshire. The ART Mission Statement is:

*“To preserve a valuable part of our natural heritage for the enjoyment of current and future generations, through the conservation, enhancement and development of our freshwater habitats and the fisheries they support.”*

ART operates under the governing principle of primacy of interest in the collective welfare of all river catchments across Ayrshire. The specific remit of ART and depth of knowledge and understanding held by ART on all of Ayrshire’s rivers provides a unique position to comment objectively on the above application and its potential impacts on the River Doon.

ART holds a wealth of survey and monitoring data on the River Doon, including:

- habitat surveys
- electrofishing data
- fish counter data
- invertebrate surveys, including freshwater pearl mussels
- other ecology surveys and data
- fisheries data, both current and historic

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- historical data on many aspects of the river.

## 2. Context

The Water Environment and Water Services (Scotland) Act 2003 (WEWS) was introduced to enable the Scottish government to implement the European Water Framework Directive (WFD), a major piece of EU legislation which focuses on the integrated and sustainable management of the water environment. Prior to the implementation of the WFD and the new Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR), hydro power schemes such as the Galloway Hydro Scheme (GHS) operated under powers provided by parliamentary acts. Following the introduction of WEWS most existing consents were transcribed into CAR licenses. Reviews of the most significant CAR licenses are now underway by SEPA to ensure compliance with the WFD. Due to the scale of the impact of the GHS it was included in the first tranche of reviews.

It is important to stress that the review of the GHS was required by SEPA due to the impact of the GHS on the River Dee and Doon. The River Dee is heavily affected by the GHS with a succession of dams and power stations throughout its length. Compensation flows are inadequate, or in parts of the catchment, non-existent, and there are many barriers to fish migration. SP are required by SEPA to provide compensation flow or to increase compensation flows in specific parts of the River Dee (Kirkcudbrightshire). This means that SP are faced with a reduction in the water available for generation, and consequently a potential reduction in the output of the scheme. SP listed 17 options to replace this generation capacity, all of which they rejected in favour of reducing the long standing compensation flow in the River Doon (Mott MacDonald, 2010). This report will focus on the potential impact of the proposal on the Doon.

Details of the GHS are provided by SP in a series of leaflets which can be found at [http://www.spenergywholesale.com/pages/galloway\\_and\\_lanark\\_hydro\\_schemes.asp](http://www.spenergywholesale.com/pages/galloway_and_lanark_hydro_schemes.asp). The GHS included the construction of a dam at the natural outlet to Loch Doon and since 1935 the flow in the River Doon has been regulated.

## 3. Significant issues

### 3.1. Water resources

It is clear that SP seek to promote the concept that the Doon suffers from an unnaturally high flow, e.g. the statement made by Hugh Finlay, Scottish Power, BBC the 25<sup>th</sup> Nov 2010 (<http://www.bbc.co.uk/news/uk-scotland-glasgow-west-11831325>). This however ignores the fact that the Doon is not a natural river, and has not been since Loch Doon dam was built. Interim analysis hydrology undertaken by Envirocentre shows that the Doon is the most heavily abstracted river in Scotland. The mean flow from Loch Doon into the River Doon would naturally be 6.8m<sup>3</sup>/s (Envirocentre, 2010). The actual compensation flow released from Loch Doon is 2.37m<sup>3</sup>/s, equivalent to 34% of the natural flow.

In the application document (Appendix A) SP provide a calculation showing the water balance in Loch Doon. SP state that 3.09m<sup>3</sup>/s is abstracted from Loch Doon into the GHS. Taking the compensation flow into account this shows that 56% of the water resource in Loch Doon is abstracted by GHS. Some water is also taken from Loch Doon for the Ayrshire drinking water supply. The volume of water taken for the drinking water supply is not currently measured but it is thought to around 7.5mgd, or 10% of the total water abstracted from Loch Doon (James Storrie, SEPA pers comm.). These independent calculations both show that between half and two thirds of

the water that would naturally flow down the River Doon from Loch Doon is removed, the vast majority taken by SP for hydro generation, the largest cross-catchment net loss of water in Scotland.

The standard way of representing river flows is by a flow duration curve. Flow duration curves show river flow against the proportion of time when that flow would be exceeded. For example the normal low water flow in a river i.e. the low which occurs typically 18 days per year is known as the Q95 flow. This is the flow which is exceeded for 95% of the time, or conversely the low flow that occurs in a typical year for 5% of the time, or 18 days. At the moment the compensation flow in the River Doon at Loch Doon has been calculated as  $1.69\text{m}^3/\text{s}$ , equivalent to Q76 (Mott Macdonald, 2010).

The flow duration curve below shows the flow in the River Doon at Auchendrane in the lower river ([http://www.nwl.ac.uk/ih/nrfa/station\\_summaries/082/002.html](http://www.nwl.ac.uk/ih/nrfa/station_summaries/082/002.html)). The solid black curved line represents the annual flow duration curve. The Q76 flow has been highlighted by the blue horizontal line. This means that for 76% of the time, the flow in the Doon is lower than the natural flow (*missing flows highlighted in red in the graph below*). For the other 24% of the time the flow is slightly elevated (*highlighted in green*). It can be seen from the flow duration curve that the vertical scale is logarithmic and that the amount by which the low water flows are elevated (*green area*) above natural are relatively small compared to the large volume of water lost (*red area*) compared to natural flow pattern. The proposal from SP is to reduce the compensation flow to Q88, from Q76 (*effectively lowering the blue line in the graph below*), increasing the loss of water and halving the time during which flows are slightly elevated.

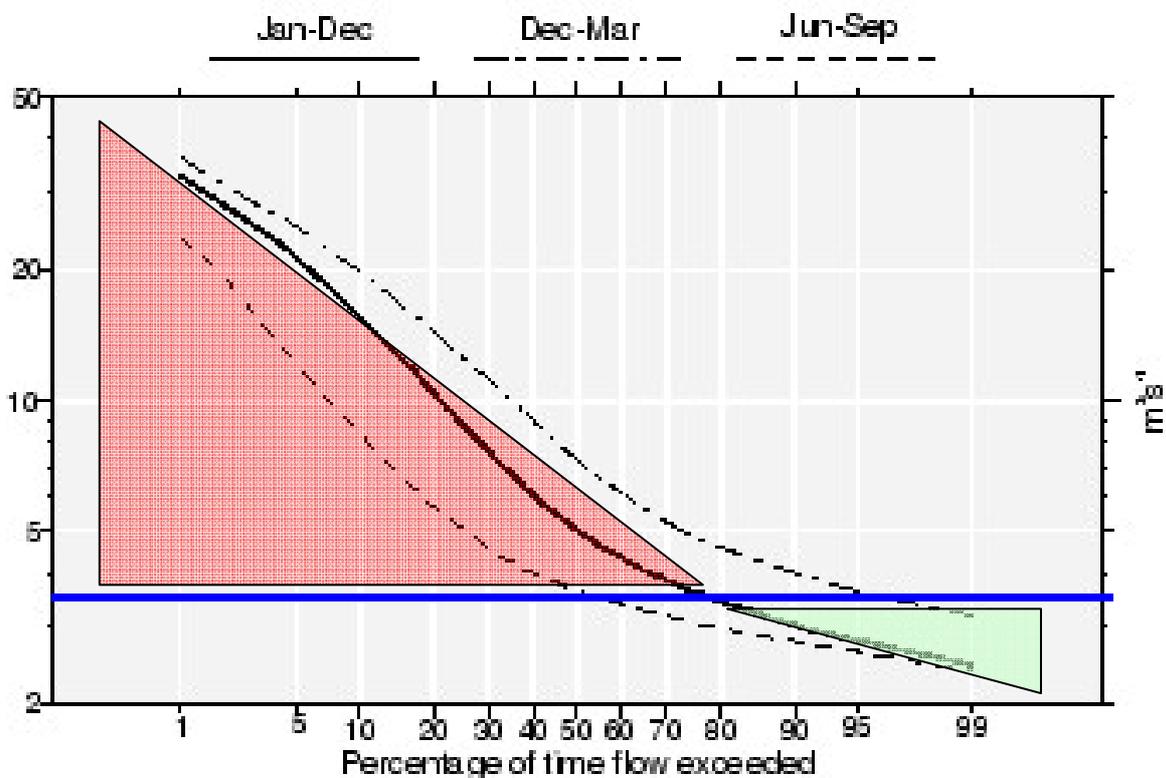


Figure 1: Flow duration curve for River Doon, Auchendrane

The flow duration curve shown above is for the lower River Doon but the general principles could be applied to almost any river flow curve including that for the outlet of Loch Doon.

Loch Doon is fed by many natural tributaries but also receives flow from the Water of Deugh and Bow Burn, Dee tributaries, via a tunnel. However the amount taken from the loch far exceeds the water contributed by the Deugh and Bow Burn. Therefore the claim that part of the compensation flow in the Doon is derived from outwith the natural catchment is highly misleading. The Deugh and Bow Burn provide 18% of the water abstracted from Loch Doon into the hydro scheme, but this is in addition to the lost 56-64% of natural Loch Doon water; water which is permanently lost from the Doon catchment (Mott Macdonald, 2010, Appendix A).

Appendix A in the SP application documents presents a calculation which concludes that 18% of the inflow into Loch Doon comes from outwith the natural catchment namely the Water of Deugh and Bow Burn, tributaries of the River Dee (Mott Macdonald, 2010). The implication given in Section 2.2.1.2 is that this water provides some of the compensation flow in the River Doon. Through mixing within Loch Doon some of this water may well end up flowing down the Doon but this should not be considered as additional water; there is a large net loss of the natural inflow into Loch Doon and the Deugh/Bow water is only transferred into Loch Doon for storage until required for hydro generation.

The compensation flow in the River Doon below Loch Doon is measured at the gauging weir downstream of Loch Doon. The measuring equipment was fitted in the 1930's when the dam was built. In June 2010 SP fitted a digital flow measuring device and recalibrated the flow. This recalibration exercise concluded that the actual compensation flow released had been 0.26m<sup>3</sup>/s or 5million/gallons/day (mgd) too high. Subsequently the compensation flow was cut to the newly calibrated 45mgd, resulting in a noticeable change in the flow in the river. It is not known when the gauging equipment went out of calibration, and no details of the new calibration certificate have been provided to date, but it is clear that Scottish Power have already gained 5mgd in additional water since mid summer 2010. It is also relevant to note that 2009 was a year of high output for the GHS with an 11% increase in generation compared to 2008

([http://www.spenergywholesale.com/pages/galloway\\_and\\_lanark\\_hydro\\_schemes.asp](http://www.spenergywholesale.com/pages/galloway_and_lanark_hydro_schemes.asp), Environmental Factsheet). The increased generation output in 2009 was achieved despite the loss of the additional 5mgd due to the poor calibration of the Doon compensation flow.

Following an inspection of Loch Doon dam under the Reservoir Act in 2004/5 the safe operating water level for Loch Doon was reduced to ensure that adequate storage was available to cope with forecast increased rainfall levels. The maximum operating water level of the Loch Doon reservoir was decreased and as a result extra water has had to be released from Loch Doon dam for an average of 10 days per annum in the last few years (Stuart Ferns, SP per comm.).

SEPA predict that rainfall amounts are set to increase throughout Scotland as a result of climate change and state that "*there are no rivers showing statistically significant declining trends in annual average flow*"

([http://www.sepa.org.uk/science\\_and\\_research/data\\_and\\_reports/water/scottish\\_river\\_water\\_quality.aspx#AverageFlow](http://www.sepa.org.uk/science_and_research/data_and_reports/water/scottish_river_water_quality.aspx#AverageFlow)). If this is the case then the quantity of water available to SP for generation will increase. Considering that the water level in Loch Doon is already reaching the maximum permissible level regularly, this is likely to happen more often and for a longer duration if rainfall levels do increase. If the compensation flow were to be reduced this situation would be exacerbated and for long periods during wet weather, water would have to be "dumped" down the Doon due to lack of capacity within the GHS. If rainfall levels do increase significantly there would be a case for reviewing the flow duration curve for all rivers potentially resulting in the requirement for increased compensation flow levels. It is clear that hydro operators in Scotland are set to benefit considerably from climate change driven increases in rainfall.

It should also be noted that the Doon catchment is relatively long and narrow and there are few tributaries of any significance downstream of Loch Doon Dam. Consequently the compensation flow from Loch Doon forms a relatively high proportion of the flow in the Doon during periods of dry weather.

### **3.2 Ecological status**

Throughout the application, ecological report and press coverage, the implication from Scottish Power is that there is a problem with the ecological status of the River Doon, a problem that could be resolved by reducing the compensation flow. This section will outline why ART consider this not to be the case.

The Doon supports a wide range of native biodiversity including Atlantic salmon, brown and sea trout, three species of lampreys, freshwater pearl mussels, saucer bugs, otters, kingfishers etc. ART holds a wealth of data on the River Doon which provides supporting evidence.

The official salmon catch from the River Doon is the highest of any river on the west coast of Scotland (*ten year average = 810*)(Marine Scotland, 2000 - 2009). This is a testament to the good health and management of the river. The excellent salmon population supports a notable rod and line salmon fishery which brings considerable social and economic benefits to Ayrshire. Salmon are an iconic species and are widely regarded as an indicator of good water quality; their mere presence in a river providing reassurance concerning its health and status. No assessment of the impact of reduced compensation flows on migratory fish passage over the many weirs on the river has been undertaken. Barriers to fish migration are an important factor in determining the overall status of rivers for WFD classification.

ART carry out annual electrofishing surveys of the River Doon (ART, 2005 – 2010). These show that salmon spawn throughout the main stem of the river. Salmon fry numbers in recent years have been increasing in the River Doon and in 2010 the mean salmon fry captured per minute in the Doon was 10.2, second in Ayrshire only to the results from the River Stinchar where the mean number was 11.6 per minute. Salmon hatcheries operate on all of the Ayrshire rivers but restocking is normally targeted at the tributaries and will have little impact on main stem where the numbers of natural spawning fish and egg deposition dwarf any hatchery output.

It should be noted that there is a historic provision for “freshets” to be released from Loch Doon, freshets being periods of increased flow released from the dam. The MBEC report wrongly states that these have been requested by the Doon District Salmon Fishery Board (DFSB) purely to provide enhanced angling opportunities on the river. This is far from being the case as the table of freshets provided in Appendix E of the application shows (Mott MacDonald, 2010). During the last three years all but one of the nine freshets requested were timed to assist with the downstream migration of salmon smolts during periods of low water rather than to provide better angling conditions.

The Doon was at one time noted for its pearl mussel fishery (Woodward, 1994), although they are of course now fully protected. ART have carried out a number of surveys to investigate the status of the Doon pearl mussel population in recent years. The findings were that pearl mussels can be found in low density throughout the lower river although there is no evidence of recent reproductive success. Water quality is considered to be the primary factor responsible for the lack of reproduction

(ART, 2009). Pearl mussels require very high water quality and any reduction in the flow of water from Loch Doon is likely to hasten their demise, a fact acknowledged in the MBEC report. Although generally considered to be a functionally extinct population the 2009 ART report recommended relocation trials to move mature pearl mussels into the upper river to assess survival and reproductive success in the part of the catchment where water quality remains highest.

The three species of lampreys found in Scotland are known to occur in the River Doon. Each year there is a run of spawning sea lampreys into the lower River Doon, the only river in Ayrshire where ART would have a realistic expectation of witnessing sea lamprey spawning on an annual basis.

The Doon also supports an abundant population of saucer bugs, one of only five or six rivers in Scotland to do so. Saucer bugs require high flows of clean water and are a further indication of the current good status of the River Doon.

Bogton Loch, which is located near Dalmellington, downstream of Loch Doon is an SSSI for its marginal vegetation. Changes to the compensation flow may affect the status of the SSSI.

It can be seen from the above that the Doon supports a diverse range of biodiversity, all of which is dependent on adequate volumes of high quality water. A reduction in the compensation flow will inevitably result in reduced water quality in the main stem of the River Doon, a fact that is acknowledged in the MBEC report, threatening the rich biodiversity found in and alongside the river.

There is not scope within this document to respond to the many statements within the MBEC report that need to be challenged. That will be provided in the formal and detailed response from ART. In the meantime ART welcomes requests for clarification regarding any aspect of the MBEC ecological report.

### **3.3 Water Quality**

It may seem obvious to state that for a river to function its entire catchment area must remain intact. In general terms the human population tend to live close to the coast with upland areas in Scotland being relatively sparsely populated. In that context the Doon is a typical catchment with few persons living upstream of Loch Doon dam. Consequently there are few pollution issues in the upper Doon (with the exception of acidification) and the water which flows from Loch Doon into the River Doon is of high quality; low in nutrients and sediment free. The water leaving Loch Doon tends to be acidic but the presence of the Southern Upland fault immediately downstream of Loch Doon means that pH levels rise rapidly and will almost always be neutral or alkaline by Patna.

This source of pollution free, high quality water is essential for the maintenance of water quality in the lower, populated, reaches of any river, including the Doon where there are many sources of pollution including sewage inputs, opencast mine effluent, rural diffuse pollution etc. Lowland tributaries in Ayrshire tend to be of much lower quality than found in more upland areas. ART could list many lowland tributaries of rivers in Ayrshire which are incapable of supporting even a poor population of salmonids, a typical example being the Water of Fail, which flows into the Ayr at Failford. The Water of Fail has no source of upland water and the entire catchment is heavily farmed and populated. No salmonids were found during four electrofishing surveys in the Water of Fail in 2010. The Doon has similarly affected tributaries, supporting poor populations of salmonids e.g. the Chapelton and Purclewan Burns.

If the supply of compensation flow from Loch Doon was removed completely all that would be left would be lowland tributaries discharging poor quality water into the river and eventually the sea. An extreme example perhaps but it does highlight the importance of water from upland areas.

“The Ecosystem Approach” is a ‘a strategy for the integrated management of land, water and living resources promotes conservation and sustainable use in an equitable way’ (<http://www.cbd.int/ecosystem>). The Ecosystem Approach would view the moors and hills of the upper Doon as being important for many reasons, including leisure activities, but particularly in this case, as a source of high quality, pollution free water capable of sustaining water quality throughout the lower reaches.

The Doon already suffers from a huge overall loss of water; this being offset by the provision of the compensation flow. Any reduction in that compensation flow in the Doon risks changing the current good water quality and ecological status.

Tourism is still one of Ayrshire’s main industries and Ayr beach is one of the most popular beaches in Scotland. Bathing water beaches are subject to regular microbial sampling and testing to ensure compliance with EU Bathing water standards ([http://www.sepa.org.uk/water/bathing\\_waters.aspx](http://www.sepa.org.uk/water/bathing_waters.aspx)). The Ayr Beaches (Heads of Ayr and Ayr South Beach) both failed compliance testing in 2010, and have done so regularly in recent years ([http://www.sepa.org.uk/water/bathing\\_waters/scottish\\_bathing\\_water\\_monitor/summary\\_of\\_last\\_season.aspx](http://www.sepa.org.uk/water/bathing_waters/scottish_bathing_water_monitor/summary_of_last_season.aspx)).

The sources of contamination responsible for the recorded failures of the Ayr bathing beaches are considered to be sewage and rural diffuse pollution ([http://www.sepa.org.uk/water/water\\_publications/bathing\\_water.aspx](http://www.sepa.org.uk/water/water_publications/bathing_water.aspx) ). The Rivers Ayr and Doon have been identified as diffuse pollution priority catchments by SEPA in the first planning cycle of the Water Framework Directive, two of only thirteen priority catchments in Scotland ([http://www.sepa.org.uk/water/river\\_basin\\_planning/dp\\_priority\\_catchments.aspx](http://www.sepa.org.uk/water/river_basin_planning/dp_priority_catchments.aspx) ). The Ayr and the Doon were prioritised as they discharge to the sea into bathing waters. SEPA are currently working intensively within all priority catchments to identify sources of point and diffuse pollution ([http://www.sepa.org.uk/water/bathing\\_waters/bathing\\_waters\\_symposium.aspx](http://www.sepa.org.uk/water/bathing_waters/bathing_waters_symposium.aspx) *presentation by Stephen Field*).

Considering the importance placed on rural diffuse pollution as a source of pollutants contributing to bathing water quality problems, the dismissal of the River Doon as a contributory factor in the bathing water quality problems in the Ayr beaches is a significant error in the MBEC Ecological report. Any reduction in the input of pollution free water from the upper catchment is likely to result in an increased concentration of pollutants, including those derived from diffuse pollution sources, within the lower river and ultimately the beaches of Ayr. New more stringent standards for bathing waters are due to be introduced by the EU in 2012, with the first report due in 2015. Continued failure bathing water standards in the Ayr beaches risks the loss of their designation as bathing waters.

### **3.4 Energy context**

The review of the GHS CAR licence was initiated by SEPA due to the impact of the hydro scheme on the River Dee. The Water Framework Directive requires that all watercourses are at good ecological status or good ecological potential by 2027. No deterioration in water quality status is permitted. The review of the GHS requires that additional water is released as compensation flow to

improve the ecology of the lower reaches of the River Dee. This represents a loss of water for generation capacity. At the present time almost the entire flow of the lower River Dee is diverted via a pipe to a power station on the Dee estuary upstream of Kirkcudbright, bypassing the natural river channel where there is a totally inadequate compensation flow. As a result SP are faced with a potential loss of generation capacity. The application documents state that this is equivalent to 6196MWh. The significance of this output needs to be placed in context.

The wind turbines which are currently being installed throughout Scotland are typically rated at 2.3MW. In commercial situations wind turbines are normally expected to operate at 30% efficiency. A 2.3MW turbine would therefore be expected to produce 6044MWh ( $2.3 \times 30\% \times 24\text{h} \times 365\text{days}$ ), virtually the same as the amount of hydro electricity potentially lost through this EU Water Framework Directive driven review. It can be seen then that this proposal, which potentially threatens the status and value of the River Doon, is all for the sake of the renewable energy that could be generated by a single wind turbine.

SP repeat consistently throughout the application document that they are not willing to accept any reduction in the scheme output; even though this may be required to fulfil an EU Directive. The Galloway Hydros Environmental Factsheet produced by SP ([http://www.spenergywholesale.com/pages/galloway\\_and\\_lanark\\_hydro\\_schemes.asp](http://www.spenergywholesale.com/pages/galloway_and_lanark_hydro_schemes.asp)) reports that the GHS generated 260GWh in 2009, up from 234GWh in 2008, highlighting that there is considerable variance in the scheme output from year to year. The 6.196GWh at stake under the current review is equivalent to 2.38% of the total output of the scheme in 2009. In scientific parlance an effect is not considered significant unless it is equal or greater than 5%.

This analysis shows that the potential loss of renewable energy from the GHS is not significant, is well within the scale of normal annual variance, and could be offset by the output from a single wind turbine.

#### **4. Summary**

This reports focuses on the current ecological status of the Doon and the potential impact of the proposed change in compensation flows. The intention has been to try and present factual, referenced, information to provide balance for those tasked with responding to the consultation.

The Doon is widely regarded as a healthy and diverse river, supporting a great range of natural biodiversity. Culturally, socially and economically the River Doon can be considered to be a great asset for Ayrshire. Ayrshire Rivers Trust consider that the proposal to reduce the compensation flow in the Doon will be harmful to the current good ecological status of the Doon and all the benefits that brings to Ayrshire for the following reasons:

- the Doon is the most heavily abstracted river of its size in Scotland, and currently flows lower than its natural level for 76% of the time, this being offset by the provision of the compensation flow
- river water quality is likely to decline
- changes to the current compensation flow regime threaten the rich biodiversity associated with the Doon
- the Doon's status as the most productive salmon river in the west coast of Scotland is threatened

- the ecology report provided to support the application falls considerably short of Environmental Statement standard, the level of report that ART would expect for a development of this magnitude
- the desire to promote renewable energy should be kept in perspective and balanced against the wider environmental and economic benefits to Ayrshire and Scotland

If clarification on any aspect of this report is required please contact ART.

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