



## **Lammas Tir-y-Gafel Settlement**

### **Supplementary Report:**

**(Appendix 11)**

## **Implications of Abstraction Licensing on the Usage of the Existing Hydroelectric System**

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Introduction  
Possible Abstraction Regimes  
Implications for use  
Implications for Power Generation  
Supplying Extra Power  
Conclusion

## **Introduction**

A number of discussions with the Environment Agency (EA) have indicated that the existing leat and hydroelectric system at Tir-y-Gafel has Riparian Rights (pre-dating the Environment Agency), and that as such, no abstraction licence exists and none would be required as long as no changes or alterations are made to the leat, weir and inlet. James Slowgrave of the Environment Agency Wales confirmed this on The 15th February 2008.

Mr Slowgrave has since retracted this statement and advised both Lammas and PCC Planning Dept that the EA may require the system to be licensed. This document is a response to this change and explains the implications that abstraction licensing would have on the proposed settlement.

## **Possible Abstraction Regimes**

The hydroelectric report included in Lammas' planning application resubmission (March 2008) was based on a 50% residual flow abstraction regime. Under this regime a maximum of 50% of the available water in the river would be abstracted through the leat and turbine. In the wettest 25% of the year abstraction would be considerably less as the turbine reached its capacity.

The residual flow required by Environment Agency abstraction licensing would be decided at the time of licensing. Dulas' previous study of this system (*Cymdeithas Cwm Arian Renewable Energy Feasibility Study Report , March 2006*) considered the following possible abstraction regimes to be a representative range:

**Q95 + 25% residual flow** - A generous regime. Q95 refers to the flow rate exceeded by the river for 95% of the year. This flow must be left in the river at all times. 75% of all flow over and above the Q95 flow could be abstracted.

**Q95 + 50% residual flow** - An intermediate regime. As per the previous hydroelectric report but with the Q95 flow protected.

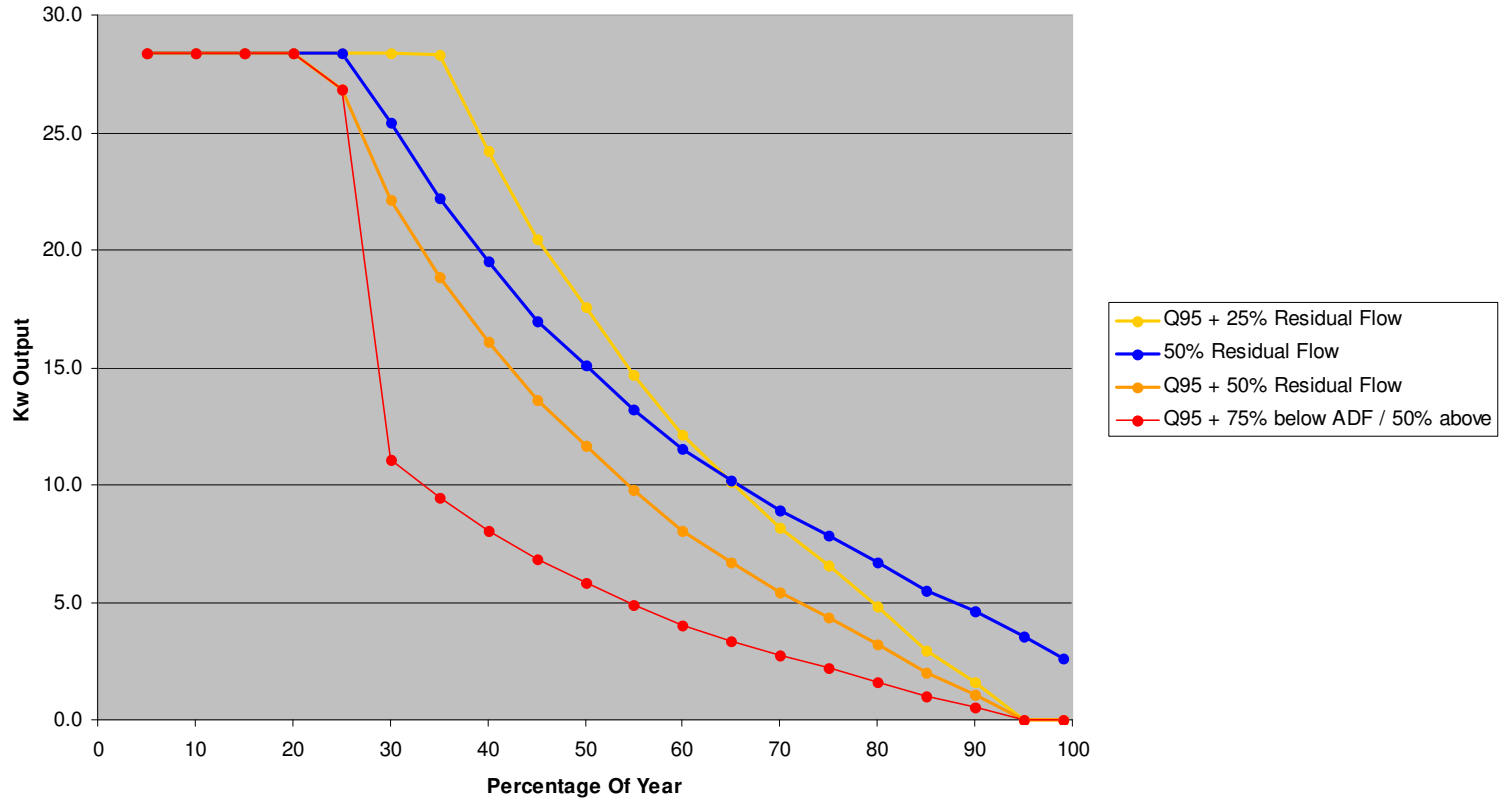
**Q95 + 75% residual flow below ADF, %50% above** - A restrictive regime. ADF is the average daily flow. Below this flow rate 25% of all flow over and above the Q95 flow could be abstracted. Above it 50% abstraction would be allowed.

*"The [third] regime is the typical conservative response suggested by the EA during the early stages of a proposal. The second is a regime that could possibly be negotiated after carrying out more studies and discussions. The [first] regime is possible but less likely to be agreed..." (Smith / Dulas 2006)*

## **Implications for Power Generation**

The graph below shows the power generation under Dulas' three abstraction cases as well as that under the 50% residual flow assumption of the previous Lammas report

**Comparison of Power Generation under Different Abstraction Regimes**



		Abstraction Regime			
		50%	Q95 + 75% / 50%	Q95 + 50%	Q95 + 25%
Total generation expected per year	MWh	138.4	88.5	115.5	141.0
Annual availability per phase		46.1	29.5	38.5	47.0
<b>Annual availability per plot*</b>		<b>11.5</b>	<b>7.4</b>	<b>9.6</b>	<b>11.8</b>
<b>Average expected consumption per plot</b>		<b>1.8</b>			
Maximum expected consumption per plot		4.5			

\* based on 4 plots sharing a phase and all running at maximum consumption / no surplus sharing (see main report)

**Under all considered abstraction regimes the annual generation is by many times higher than the expected consumption.** Under the most restrictive regime the available power would be 64% higher than the maximum expected consumption (that of a plowholder who's livelihood requires the use of heavy workshop machinery).

Under all Q95 regimes, generation would cease for 5% of the year or 18 days.

### ***Implications for use***

In the **worst case scenario** that the most restrictive regime was applied and the weather was such that all of the driest days of the year came together, the backup batteries would provide power through this period of 18 days. Their capacity is 30kWh, or 170Wh per building each day. This amount of power is sufficient to run 4 low energy light bulbs and a radio for 5 hours every day in all 9 dwellings and the community hub. Within 3 days of generation restarting (even at the lowest level) the batteries would be recharging and consumption could increase.

### ***Supplying Extra Power***

If this amount of power is considered insufficient by the residents, extra generating capacity would be added as a central solar PV array at the hub. This would use all of the same storage and distribution hardware and be an ideal compliment for the driest days of the year.

Under these conditions it is safe to assume that the array would produce an equivalent of 4h/day at maximum capacity. It is likely that each building on the site would wish to have the guaranteed usage described above as well as an additional low energy freezer in each dwelling as well as computer and food processing use in the hub. These should all be able to be used in this **worst case scenario**. This would require 1.4kW central solar pv array of approximate size of 5.5m<sup>2</sup> and cost of £4,000.

### ***Other Implications for Infrastructure and Budget***

If the scheme is deemed to require an abstraction license, it would be necessary to measure and log the abstracted and residual flows. This would require the replacement of the existing boulder weir with a new concrete measuring weir fitted with electronic measurement and data logging equipment. The works would involve temporary diversion of the river which the EA have previously suggested should be avoided due to its potential environmental impact.

The approximate costs of these modifications are estimated based on the costs given by Dulas.

<b><u>Additional Costs of Modifications Required for Abstraction Licensing</u></b>			
<b>Item</b>	<b>Dulas Cost</b>	<b>Approximate Proportion Associated With Abstraction License Conditions</b>	<b>Additional costs</b>
Development Fees (Planning, abstraction, ecological surveys)	£5,000	50%	£2,500
Intake refurbishment, flow measurement	£17,400	100%	£17,400
Control system, cabling and fittings	£15,600	50%	£7,800
SCADA	£4,800	100%	£4,800
Design, Specify and Project Manage	£9,200	25%	£2,300
Electro-mechanical installation and commissioning, O&M manuals, training, travel and subsistence	£19,253	25%	£4,813
<b>Total</b>			<b>£39,613</b>

The scheme is expected to be paid for by 90% grant funding. The additional £4,400 would be added on to the leasehold price at a cost of £490 per leasehold.

### ***Conclusion***

If an abstraction license is required for the leat the amount of power generated annually will still be many times in excess of that required for all expected uses. Q95 flow protection has the potential to cause generation to cease for periods up to 2 or 3 weeks under unusually unfavourable weather conditions. The existing system design would provide for adequate lighting during such a period. To maintain freezers and hub functionality would require the addition of a centrally connected, modest scale, solar PV array.