Calculation Checklist

This checklist shall be used to record the site data and calculate the Hydro Abstraction Factor for the site (HAF_{site}) to allow conversion of electrical output to quantities abstracted. The HAF_{site} is the amount of water used in m^3 per kWhr generated for any period.

Site Data	
Site name	Cynwyd Hydro
Address	Waterfall Road, Cynwyd. LL21 0LH
Licence serial No.	24/67/3/0023/V003
Contact name	Jamie Needle
Contact telephone	0845 680 2942
Contact email	jamie.needle@derwent-hydro.co.uk
Turbine manufacturer	Gugler
Turbine type	Pelton
Turbine serial no.	None
Number of jets (where relevant)	3

Performance Data		
Parameter	**Value**	**How was the parameter determined?**
Net operating head of the system at maximum power output ($H_{n\ (Pmax)}$) in metres	85m	Operational site data
Turbine/water wheel efficiency at maximum power output ($e_{turbine/water\ wheel\ (Pmax)}$)	90.6%	Manufacturer's data
Transmission system efficiency at maximum power output ($e_{transmission\ (Pmax)}$)	100%	Direct Drive: No transmission system
Generator efficiency at maximum power output ($e_{generator\ (Pmax)}$)	95%	Manufacturer's data

Calculation of overall system efficiency of the rotating parts of the hydro system, at maximum power output ($e_{system\ (Pmax)}$)

$e_{system\ (Pmax)}$ = $e_{turbine/water\ wheel\ (Pmax)}$ x $e_{transmission\ (Pmax)}$ x $e_{generator\ (Pmax)}$

= 0.906 x 1.00 x 0.95

$e_{system\ (Pmax)}$ = 0.86

Calculation of HAF_{site}

HAF_{site} = Hydro Abstraction Factor for the site in question

= 366.972 / ($H_{n\ (Pmax)}$ x $e_{system\ (Pmax)}$)

= 366.972 / (85 x 0.86)

= 5.02 **(m3/kWh)**

Where:

$H_{n\ (Pmax)}$ = net head at max. power.

366.972 = a constant in order to bring the final HAF into the correct unit of m3/kWhr (it is arrived at by dividing the number of seconds in an hour (3600) by gravity (9.81 m/s^2)

The volume of water abstracted for any period (**V_{period}**) can then be calculated by simply multiplying the HAF_{site} by the number of kiloWatt hours generated thus:

V_{period} (m3) = kWh_{period} (kWh) x HAF_{site} (m3/kWh)

See example overleaf:

(*kWh is a measure of energy, whilst kW is a measure of power: at full efficiency, a 50 kW turbine will produce 50 kWh of energy in one hour, 100 kWh in two hours, 150 kWhrs in three hours etc.).*