Pre-Application Proposal to Natural Resources Wales for town-scale gravitational vortex hydro-electric plant at Llandysul

10th September 2014

1. Overview

A community group led by Llandysul and Pont-Tyweli Ymlaen are proposing to implement a gravitation water vortex hydro-electric power plant on the river Teifi at Llandysul.

This will produce 0.85GWh of electricity per year, which is sufficient for the average annual consumption of 256 households; sufficient to meet the power requirements of 60% of the town of Llandysul.

The scheme will improve the environment by reducing pollution and the amount of CO_2 produced burning fossil fuels by 380 tons per year for at least the next 100 years with no significant maintenance required. The CO_2 produced in the construction of the plant will be offset within the first 7 months of operation.

This project proposes the use of a Gravitation Water Vortex Power Plant (GWVPP) which has not been installed in the UK yet but has been used at several sites in Europe, and a major project to install 1,000 plants has just be launched in India (http://www.swissinfo.ch/eng/multimedia/swiss-hydro-technology-exported-to-india/40528326?rss=true).

The GWVPP is completely different to existing hydro-electric plants in place in the UK as it does not require any depleted reach, does not abstract or impound any water, and allows free passage of fish and aquatic life both up and down river through the plant, with no separate fish pass required. So we urge NRW to carefully consider the technology and the long term benefit to the environment rather than treat it is a standard hydro-electric system.

Llandysul and Pont-Tyweli generated hydro-electricity from the river Teifi until the 1940s when the national grid replaced the dependency on local power. Now, as energy consumption continues to increase and coal fired power stations are closing, the national grid is stretched to breaking point, so local energy security and independence once again is vital.

The energy produced by the GWVPP is equivalent to a 500kW wind turbine 77m tall. The advantages of the hydro-electric power plant over the wind turbines are:

1. Wind turbines produce intermittent power that has to be backed up by conventional fossil fuel power stations. While the power produced by the hydro-electric plant is steady and can be relied upon to produce a base supply into the national grid.

2. The peak power of the wind turbine would be 500kW to produce the same energy annually as the hydro-power system which produces a peak power of only 200kW. So the wind turbines would need a new large electricity pylon network to hold the 132kV power lines,

while the hydro-power system can connect to the existing 3-phase power lines near to the site.

3. Wind turbines and the associated electricity pylons required have a huge visual impact over tens of miles. While the hydro-electric power system has a very localised visual impact.

4. Wind turbines have an expected safe life of only 20 years due to mechanical fatigue. The GWVPP is likely to operate for over a hundred years (the generator and electrical components may need to be replaced before then, but these are relatively low power and a small proportion of the costs).

To empower the local population and make them feel part of the community and be responsible for their energy needs, local people will be given the opportunity to invest in the project with an expected return on investment of 8% per year, which will increase at least in line with inflation and probably higher as energy prices increase above inflation. Unlike a wind turbine, the return on investment will continue even after the feed in tariff period of 20 years expires.

Additionally a community fund of £30,000 per year will be made available for community projects, with priority given to projects that improve the environment further. This may fund further renewable energy projects to allow the entire town of Llandysul to have it electricity requirements provided by renewable energy.

Many of the UK's coal fired power plants are due to close over the next few years, leaving a gap in the electricity production, which the government are planning to fill by creating more nuclear power plants. These only have an operating life of 30 years and will produce nuclear waste which must be safely stored for tens of thousands of years, creating a huge impact on the environment. Additionally gas produced by the fracking process in the UK will be required which will severely impact on the environment.

Gravitation water vortex hydro-electric power plants do not need a large head, unlike other hydro-electric plants; they can operate on heads as low as 0.5m. The construction costs are relatively small. This makes them suitable on rivers across the UK, at tens of thousands of locations. This has the possibility of completely removing the need for any nuclear and gas power stations.

The installation at Llandysul can act as an exemplar station to prove that there is no negative environmental impact and to demonstrate the huge environmental benefit.

2. Scheme description

2.1 Introduction

Gravitation Water Vortex Power Plants (GWVPP) convert the potential energy of water with a powerful Gravitation Water Vortex in a rotation tank to kinetic energy. This kinetic energy is focused as rotational energy to the Zotlöterer-turbine in the centre of the Gravitation Water Vortex. The Zotlöterer-turbine converts the rotational energy of the Gravitation Water Vortex through a generator to green electricity.

From the photos you can see the principle is exactly the same as you would see water falling down a plug hole – it rotates as it exits the plug hole. As the water rotates it turns an electrical generator.

The exit is simply an open hole which is designed to be large enough for the largest fish found in the river to swim freely through it. Sediment and cobbles in the river can also pass freely through the hole so the hydromorphology of the river is unaffected.

The outer area of the Gravitation Water Vortex generates an ideal living environment for aquatic plants, for microbes and for fish. So the GWVPP takes the function of an ecological passable bioreactor and fish ladder, which produces green electricity.

All water from the river passes through the GWVPP so it produces the maximum possible power at all times. There is no separation of flow as there is in conventional hydro-electric plants, which means there is no negative impact on the river environment of reducing the flow at any stage; there is no depleted reach.

There is no abstraction or impoundment of the water. The water is simply rotated on the spot in a similar manner to its natural rotation at rapids which occur naturally along the river.

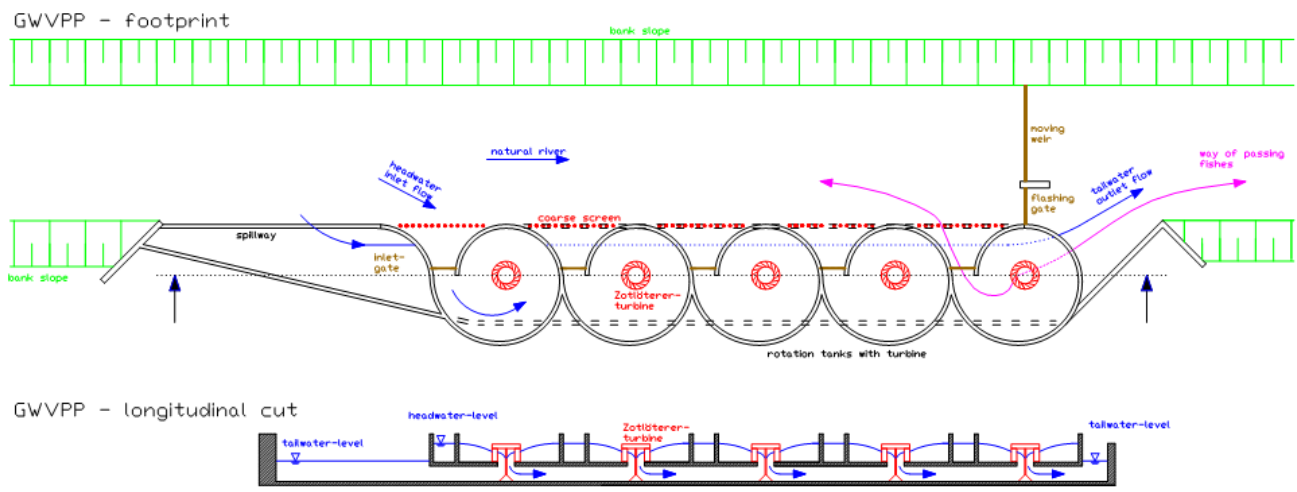
The GWVPP needs only a coarse screen to block large floating debris. Small pieces like apples, glass bottles etc. can pass the GWVPP without any problems.

GWVPPs comply with the EU Water Framework Directive and have been installed at sites in Austria, Italy, France, Switzerland, Germany, Latvia, Japan, Indonesia, Chile and India.

The size of the GWVPP is dependent on the head of water available. A suitable size for our site is a 6m diameter chamber, with a turbine speed of 30rpm. Each vortex can produce up to 10kW. A total of 20 chambers will make the 200kW peak power. These will be arranged down one bank of the river. A low weir will be installed across the river which will direct all flow through the GWVPP.

The chambers will pass up to 26m^3/s of water. The river only exceeds this flow for about 20% of the year. A low weir will be installed across the river which will direct all flow through the GWVPP until it reaches its maximum, then the remainder will flow freely over the top of the weir.

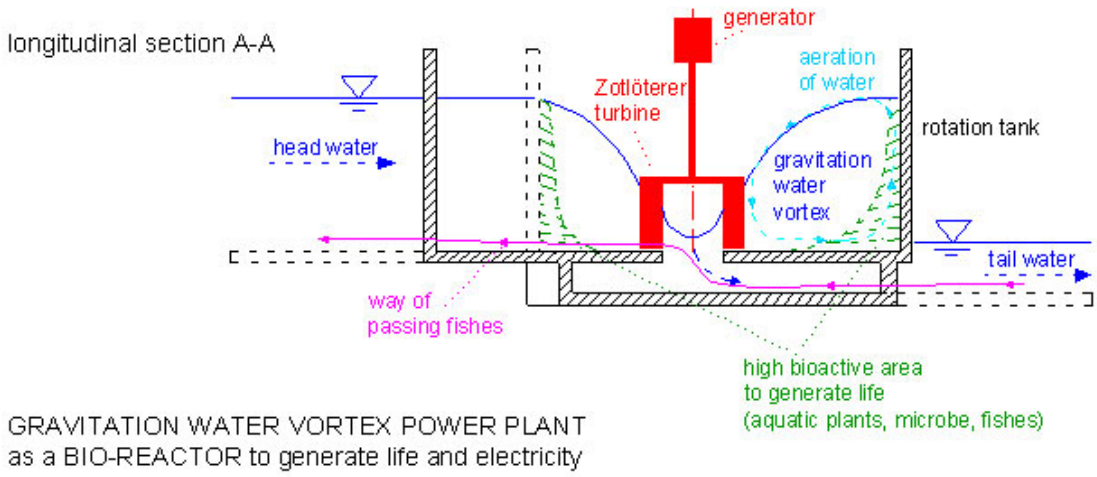
A diagram is shown below with only 5 chambers for clarity. The proposed plant will have 15 additional chambers along the bank.

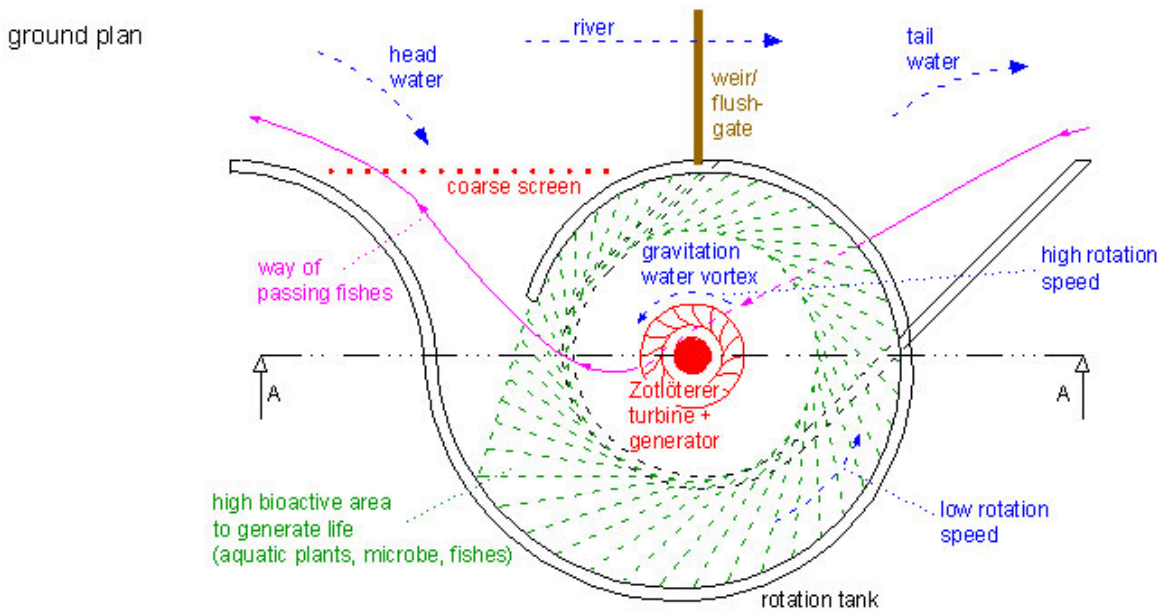


The weir will be hydraulically controlled so that it will automatically lower when the river reaches a pre-set level. Once lowered, the river channel and bed has the same profile as it would have had before the plant was installed. Hence, this project poses no additional risk to flooding.

The construction will require around 1,000m^3 of concrete which would release around 240 tonnes of CO_2. This will be offset by the savings produced by the plant in the first 7 months of operation.

Detailed views of vortex





More details are available at

http://www.zotloeterer.com/welcome/gravitation-water-vortex-power-plants/

The peak power produced by the plant is 200kW which can be connected to the national grid through the existing 3 phase overhead power lines that pass nearby.

The plant will produce 0.85GWh of electricity per year, which is sufficient for the average annual consumption of 256 households.

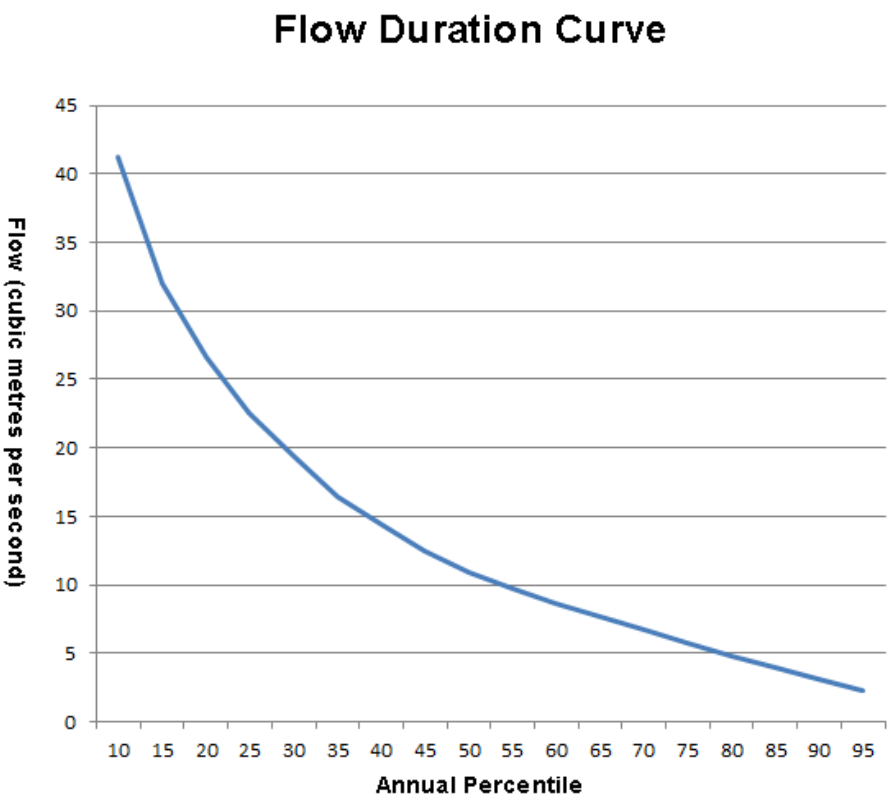
Note, a Swiss group also develop and distribute their own version of the Gravitational Water Vortex www.gwwk.ch.

2.2 Impact on river levels

The flow of the Teifi varies greatly over the year and from year to year. Accordingly, river levels along the stretch through Llandysul and Pont-Tyweli also vary greatly.

Estimated flow rates of the Teifi at the proposed site are given below. These are based on the NRFA gauging station on the Teifi at Llanfair and adjusted for additional down river flow by Mannpower Consulting up to the Llandysul parks then an approximation of 10% added to include the complete flow of the Tyweli which has no NRFA gauging data (based on a measurement of flow taken in the site location survey of 16/2/14).

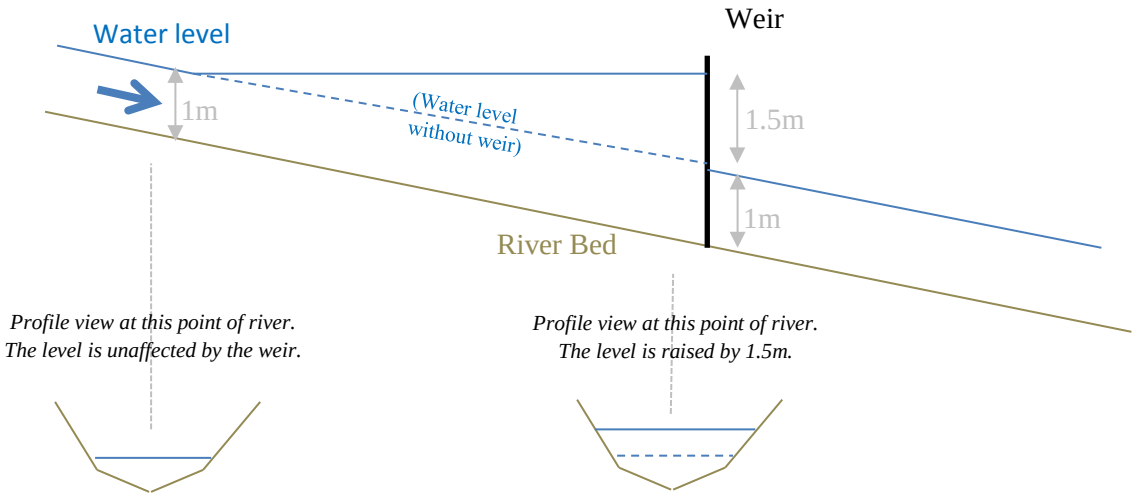
% of year	m^3/s
0	229.770
1	93.696
5	57.420
10	41.221
15	32.008
20	26.635
25	22.520
30	19.438
35	16.462
40	14.403
45	12.460
50	10.930
55	9.732
60	8.683
65	7.660
70	6.770
75	5.710
80	4.810
85	4.025
90	3.160
95	2.329
99	1.669
100	1.361
Mean flow	**17.826**



Each chamber passes up to $1.3m^3/s$. So the full flow of the river will flow through the GWVPP for 80% of the year. There will be no depleted reach. During this time, 100% of the flow will flow through the GWVPP, allowing fish to pass up and down river freely with no confusion as to which channel to take – they only have to pass through a single chamber. The remaining 20% of the year, the flow rates will be too high to be fully taken by the GWVPP and the remainder will spill over the top of the weir. This is not a problem for the fish as they have a large volume of water flowing through the GWVPP which they can navigate.

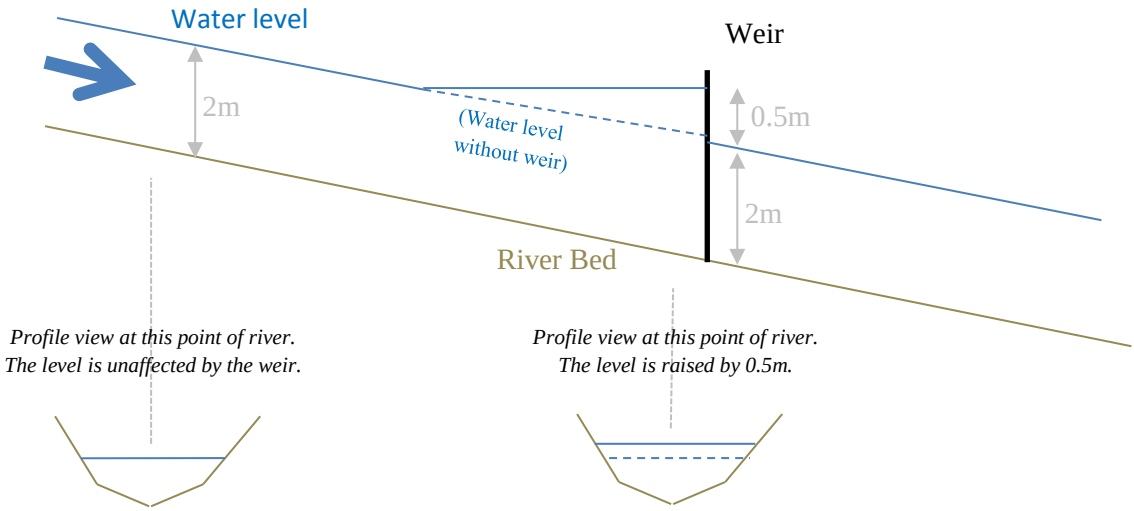
The GWVPP needs to have an ideal drop in head of 1.5m. This is achieved by putting in a weir. The river upstream of the weir will be raised in height by 1.5m. So we need a stretch of river where the banks can easily take another 1.5m of water height on top of the "average" level.

View along river showing water level with and without the weir. "AVERAGE" water flow.



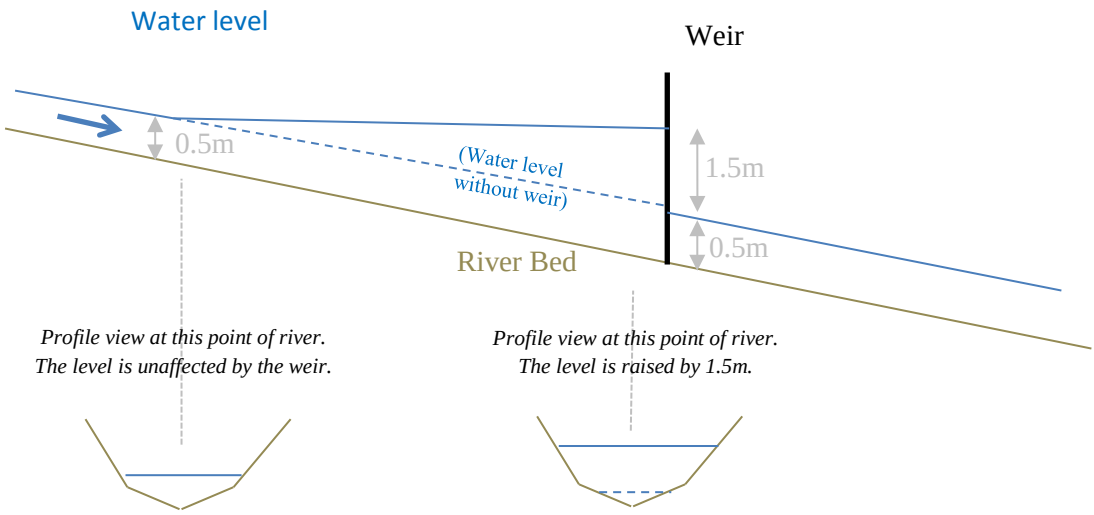
At times of high water flow the height difference at the weir will be reduced and the power generated reduced. To minimise this, the outlet side of the GWVPP needs a wide river bed so that the difference in depth varies little. Or the weir is built higher to increase the height differential.

View along river showing water level with and without the weir. "HIGH" water flow.



At times of low water flow the height difference at the weir will be maintained at 1.5m. The power generated will already be at the maximum so the power will not increase.

View along river showing water level with and without the weir. "LOW" water flow.



A map of the river that has water levels affected for the chosen site is given in section 2.4.

2.3 GWVPP Chamber Operation

To accommodate the wide range of flow of the Teifi, and to generate the maximum possible power at all times, the 20 chambers are automatically opened and closed as the flow changes. For example, for 1% of the year only a single chamber is open which will pass 1.3m^3/s of water, for 50% of the year at least 9 chambers will be open, passing at least 10.9 m^3/s of water, for 20% of the year 20 chambers will be open, passing 26 m^3/s of water.

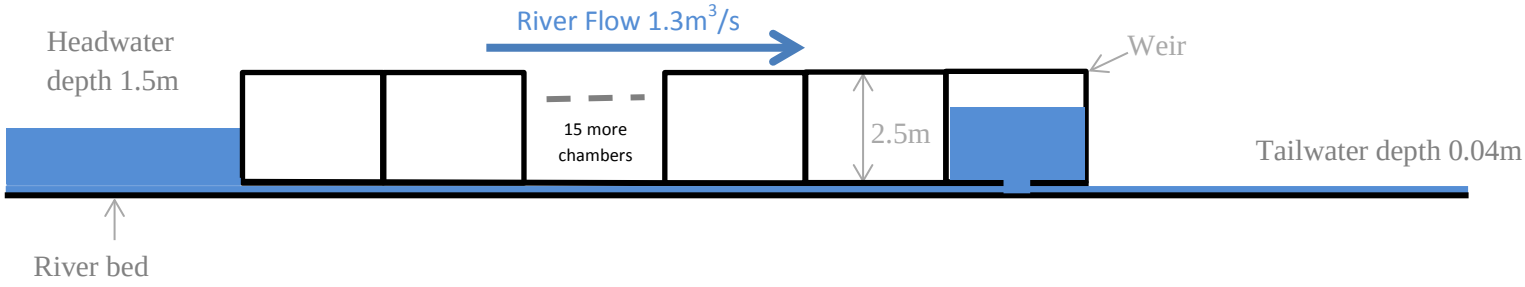
% of year	m^3/s	Number of chambers open	Approx. Power Generated kW	Approx. Energy Generated over year kWh
0	229.770	20		
1	93.696	20	100*	8,760
5	57.420	20	140*	49.056
10	41.221	20	180*	78,840
15	32.008	20	200	87,600
20	26.635	20	200	87,600
25	22.520	18	180	78,840
30	19.438	15	150	65,700
35	16.462	12	120	52,560
40	14.403	11	110	48,180
45	12.460	10	100	43,800
50	10.930	9	90	39,420
55	9.732	8	80	35,040
60	8.683	7	70	30,660
65	7.660	6	60	26,280
70	6.770	6	60	26,280
75	5.710	5	50	21,900
80	4.810	4	40	17,520
85	4.025	4	40	17,520
90	3.160	3	30	13,140
95	2.329	2	20	8,760
99	1.669	2	20	7,008
100	1.361	1	10	876
			TOTAL	**845,340**

*At high flow levels the tailwater depth rises and the ideal operating head of the GWVPP reduces from 1.5m so the power generated reduces.

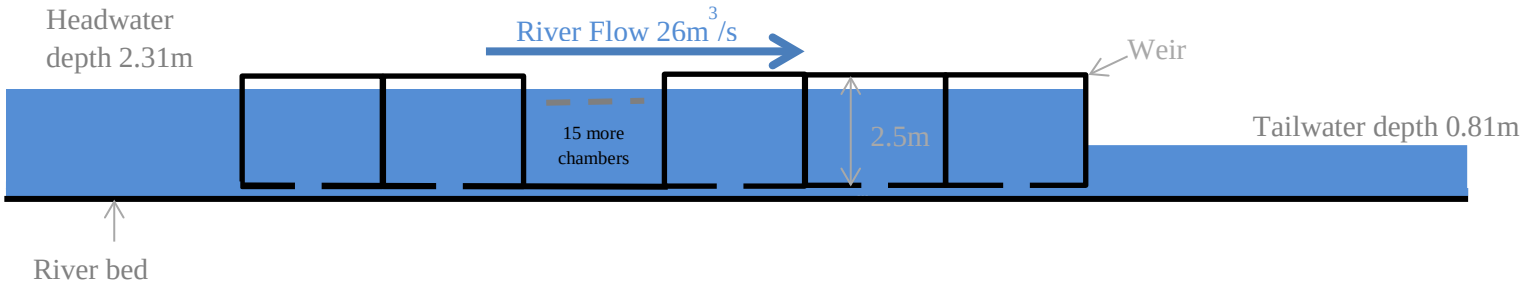
Some examples of flow and river depths are shown below

Width of original river channel is up to 40m in places so estimate tailwater depth based on that.
The exit speed of the GWVPP is designed to be 0.8m/s.
Flow = speed x area = 0.8m/s x 40m x depth -> If flow is 1.3m^3/s then tail water depth = 0.04m.

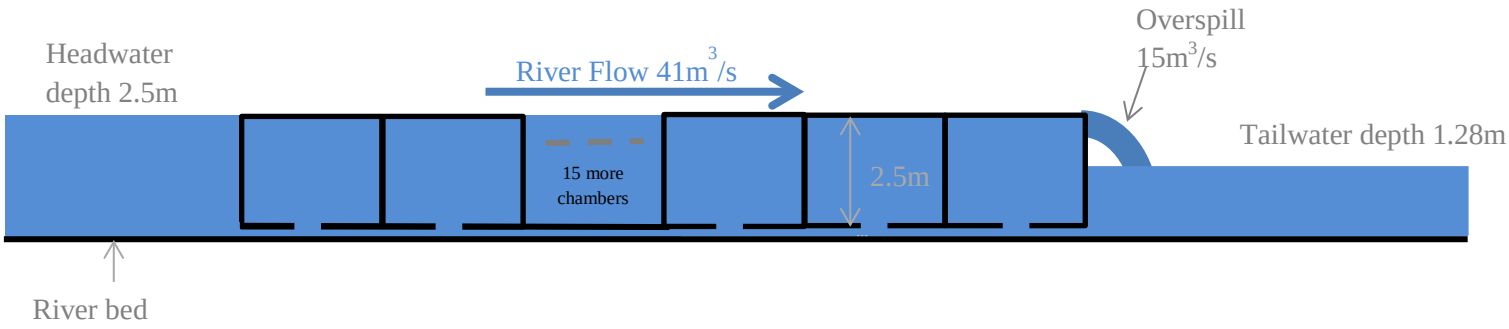
A. Longitudinal view – 1 chamber open – flow 1.3m^3/s – tailwater depth 0.04m
GWVPP operating height difference 1.5m – maximum efficiency



B. Longitudinal view – 20 chambers open – flow 26m^3/s – tailwater depth 0.81m
GWVPP operating height difference 1.5m – maximum efficiency



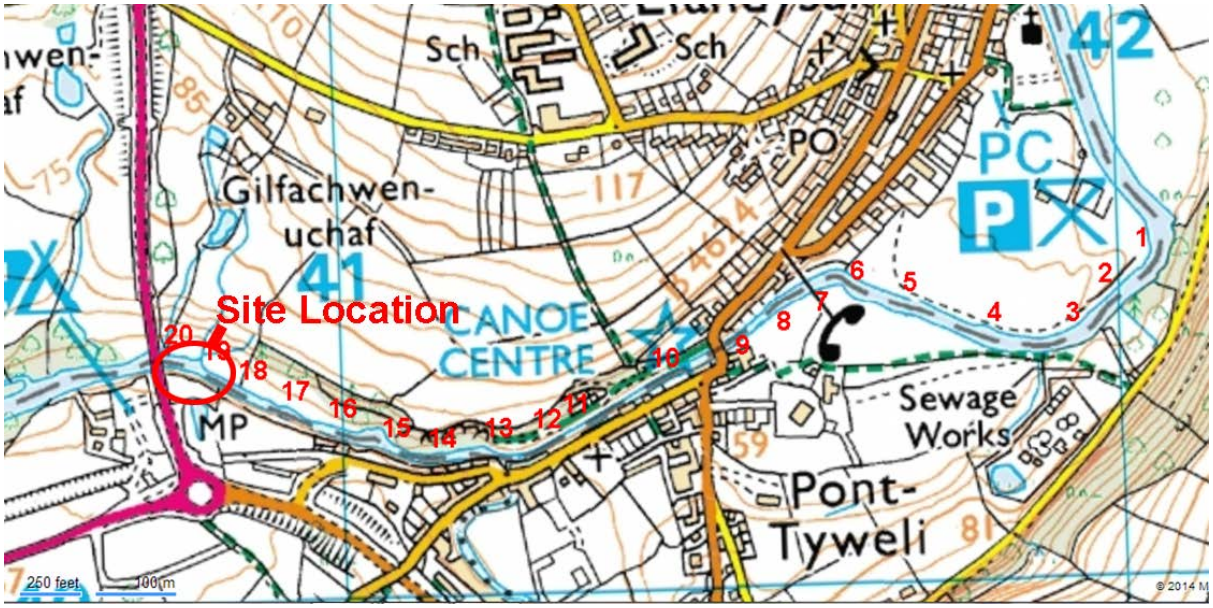
C. Longitudinal view – 20 chambers open – flow 41m^3/s – tailwater depth 1.28m
GWVPP operating height difference 1.22m – this is less than the maximum efficiency so power generated reduces.

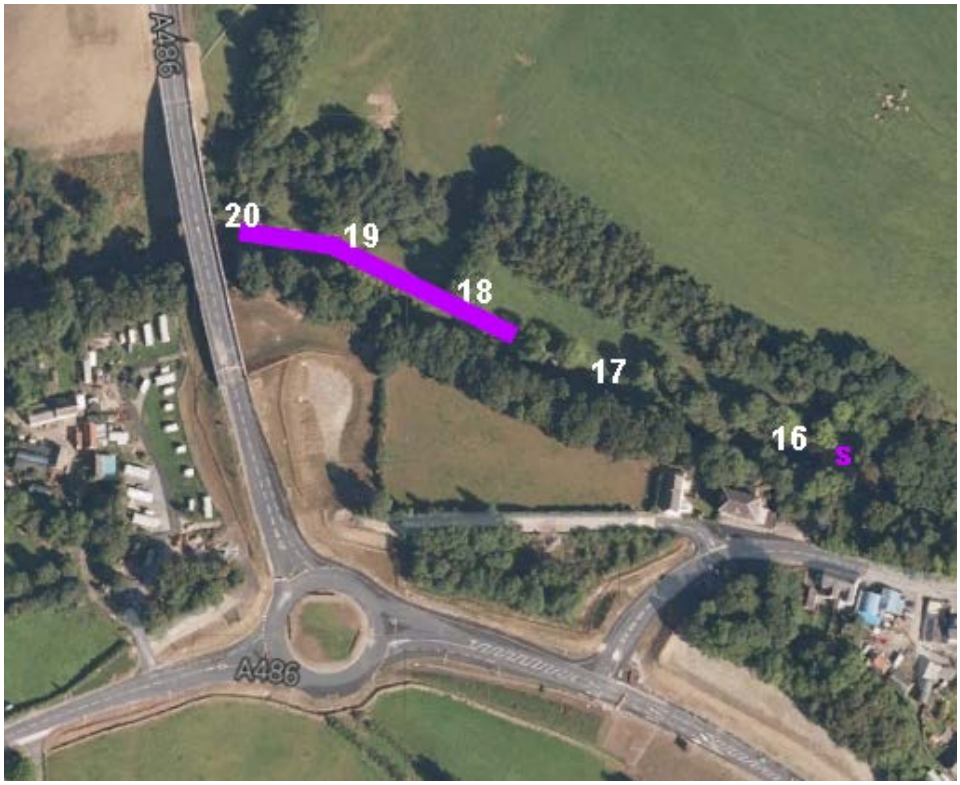


2.4 Site location

To identify the most suitable location for the GWVPP a survey was carried out over a 1 mile stretch of the Teifi from Llandysul park to the bypass and a for the Tyweli where it joins the Teifi, up river for half a mile. A comparison was made of potential sites based on criteria such as power generated, impact on river users and environmental impact. The full report is at www.llandysul-ponttyweli.co.uk/Hydro/SiteLocation.

The study showed that the most suitable site location is where the Llandysul bypass crosses the Teifi.





The GWVPP would be installed along the north bank covering a length of 120m – as shown by the purple line in the above photo.

View from bypass bridge (point 20) of proposed site.

The south side bank is steep and can easily take a rise in water level of 1.5m without losing land so chambers on the north side will work with no effect on the south side fishing (apart from the water levels increasing).

Access should be possible from the bypass, building a track down a not too steep slope.

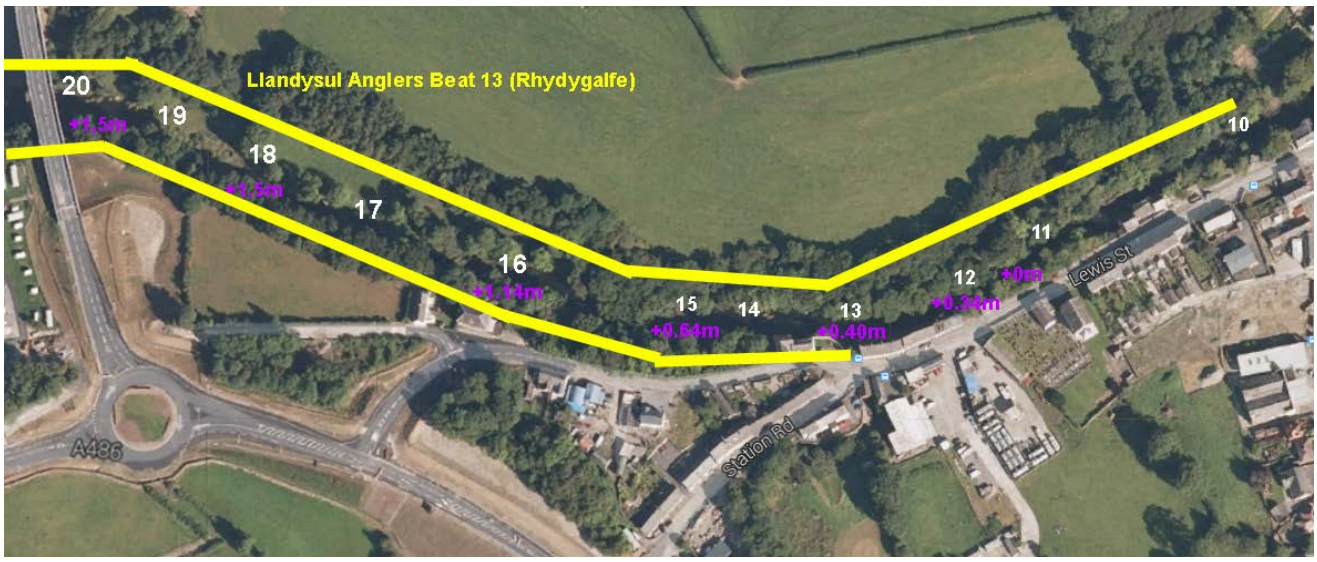
If the Highways Department does not grant access as it is off a high speed road then access would be possible from the south side, using the area that was used to store material for the bypass works, and installing a temporary bridge.

There as a wide low shelf in many places before the bank rises, meaning that there is a minimum amount of material to remove to install the vortex chambers.

The outlet from the vortex chambers will be at a very wide part of the river > 50m meaning large changes in flow rate will have little effect on the height of the river, minimising power losses due to loss in head and obviating concerns for change in flood risk.

The area has had recent major construction work in the building of the bypass so any additional construction work will have little additional environmental impact.

The height of the river will be raised between points 20 and 12 on the map below. The heights raised at times of "average" flow are given below in purple. As the height naturally varies, the difference between natural and changed heights will vary (decreasing to nothing at times of heavy flow and increasing at times of low flow).



Both sides of the river are part of a Llandysul Anglers' fishing beat.

3. Environmental Impact Analysis

The community group has already been in discussions with NRW about the proposed hydro-electric project. Initially we had investigated re-instating the original 1920s scheme, but using an Archimedes Screw as a more fish friendly option. However, the original proposal raised concerns by NRW. The concerns have now been fully addressed by this revised proposal using a GWVPP, and are discussed in the following sections.

The proposed scheme is within the Afon Teifi Special Area of Conservation (SAC), as designated under the Habitats Directive. It is also within the Afon Teifi Site of Special Scientific Interest (SSSI). The SAC and SSSI designations of the Afon Teifi afford the highest level of protection to the local environment. It is important that any activities do not have an unacceptable impact on the species, their habitats and the river system as a whole. The river Teifi, under its SAC designation, is recognised as an internationally important site for a range of species and habitats, including salmon and two migratory lamprey species.

3.1 Fish population

The location of this scheme is on the main river Teifi, with over 56% of the catchment upstream. This makes it very sensitive to any changes in river flow and structure. The proposal must not reduce the ease of fish passage, or otherwise detrimentally affect the movement and spawning success of fish and the overall ecology of the catchment.

In a typical hydro-electric scheme you would have a length of 'depleted reach' where some of the water is taken from the main flow, diverted through the plant and returned to the river downstream. This would reduce the typical flows along the depleted reach and may reduce the ability for fish to pass up river. However, in our proposal there is absolutely zero depleted reach, so there is no impact.

The water vortex is a large, slow moving body of water with no obstructions. The water exit at the bottom of the chamber is designed to be large enough that the largest fish found in the river can pass freely through it. This has been backed up by studies:

http://www.zotloeterer.com/welcome/gravitation-water-vortex-power-plants/fish-monitoring/

http://www.zotloeterer.com/welcome/gravitation-water-vortex-power-plants/ecology/

Additionally these water vortexes have been used as fish ladders side by side with existing hydro-electric plants. The advantages of using a water vortex over a traditional vertical slot fish ladder are:

1. Fish swim against the direction of current and so it is important to have a large flow rate out of any fish pass so that the fish can find the entry. With a separate fish pass, there are two main flows – one from the hydro plant and one from the fish pass and fish do not know which water flow to follow and can get exhausted by repeatedly trying the wrong pass into the hydro plant. With the GWVPP there is only one flow of water as all water passes through the GWVPP so the fish can easily find their way through. When there are multiple chambers open in the GWVPP the fish only have to pass through a single chamber and they can pass through any one they choose.

2. The GWVPP as a bio-reactor generates microbes which are food for fish. So the microbes lure fish in the rotation tank of the GWVPP and the fish can move in the head water.

3. The maximum speed of water on the way through a GWVPP is lower than 1m/s. On the other hand the maximum flow speed of a vertical slot fish ladder is between 1.5 and 1.8m/s.

4. The power density, which is generated by the Gravitation Water Vortex, is lower than 120W/m³. On the other hand the allowed maximum power density for a vertical slot fish ladder is between 120 to 150W/m³.

5. The entry water speed into the rotary Zotlöterer-turbine is below 0.4m/s. So there is no danger for fish at all.

6. Fish can pass the GWVPP in both directions upstream and downstream. A vertical slot fish ladder works only upstream.

7. At the GWVPP, fish have to pass only one doorway in a single rotation tank. At a vertical slot fish ladder fish have to pass 20 or more basins with their doorways (Vertical Slots).

8. The GWVPP needs no additional fish ladder and so there is no additional building in the river (no additional ecological footprint).

The water vortex also offers additional benefits:

1. Aeration of water.

2. The sides and base of the tank act as a bioactive environment for growth of small microbes, aquatic plants and river life. The photo below shows the population of aquatic plants with microbes on the wall and on the floor of a rotation tank.

This:

   a. Acts an additional food source for the larger fish in the river

   b. Cleans the water.

   c. The food lures migratory fish into the tank, helping them to navigate upstream through the vortex.

Zotlöterer, the company who designs and installs the GWVPP, won the Energy Globe Award in 2010 after several years of operation of the system, monitoring fish passing both up and downstream without problem. This was awarded by an international jury and signed by the chairwoman, the Austrian minister Dr. Reinhold Mitterlehner and the Indian minister Maneka Gandhi.

Fish Population Impact: Benefit

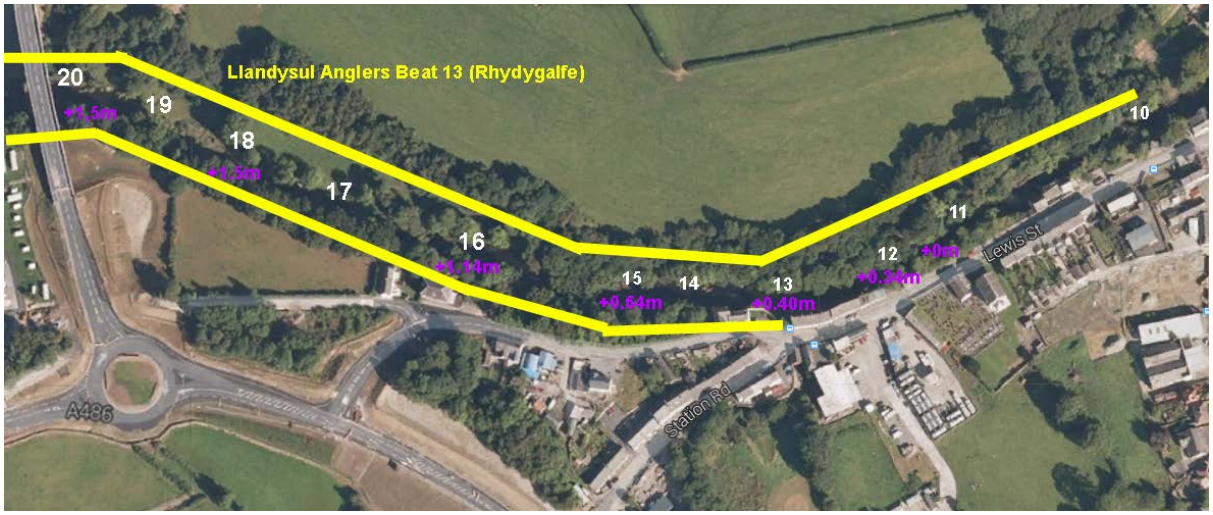
3.2 Dendrocryphaea lamyana

Dendrocryphaea lamyana is a rare multi-fruited river-moss found in the area. It is generally found above the standard water line in areas which are regularly flooded.

In a typical hydro-electric scheme the flow along the length of 'depleted reach' will be reduced which may mean that the moss is flooded less regularly. However, in our proposal there is absolutely zero depleted reach, so there is no impact of drying out the moss.

A length of the river shown below will have higher than natural water levels – between points 20 and 12, with the average increase in height shown in purple. This may cause more flooding to the moss, which may cause loss of some moss now below the standard water line, but should encourage more growth higher up.

However, in a meeting with NRW it was indicated that the surveys done showed the moss only in a stretch further upstream from point 10 on the map below which is not affected by the change in water level so there will be no impact.



Dendrocryphaea lamyana Impact: None

3.3 Flooding

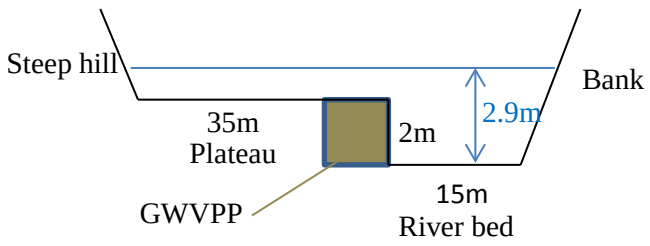
The river Teifi floods occasionally and there are a number of properties at risk of flooding in Llandysul and Pont-Tyweli.

The proposed project includes a moveable weir which is automatically lowered when the river level reaches a pre-set level. Once lowered, the river channel and bed has the same profile as it would have had before the plant was installed. Hence, this project poses no additional risk.

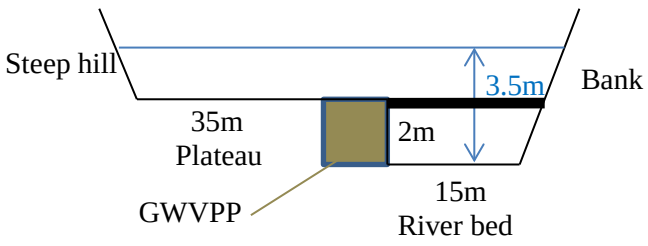
Even if the weir fails to open, it is only a low weir and water will freely flow over it and over the GWVPP chambers. The outlet of the GWVPP is in an extremely wide part of the river channel with a width of over 50m so there is plenty of area for flood water to spread out, considering some parts of the Teifi up river in Pont-Tyweli are less than 15m wide, and the Tyweli restricted to 3m wide in places.

The maximum flow that has ever been recorded at this part of the Teifi is 230m^3/s. Taking a conservative water speed of 3m/s at times of this flood, the water level at the GWVPP with the weir open would be 2.9m. If the weir was closed, the water level at the GWVPP would be 3.5m. A difference of 60cm. The river rises by 60cm from point 20 to 16 on the map (section 3.2). So the only affect is within this area. The banks throughout this area are much higher than this and there are no properties within range (the house seen away from the bank at point 16 is over 10m higher).

Weir Open



Weir Closed



Flooding Impact: None

3.4 Impact on other SSSI species and features

The GWVPP is on the same site as the Llandysul bypass which caused major disruption as it was built a few years ago. Environmental studies were done for the bypass and it was allowed. The area around it has recovered well. In terms of scale of construction the GWVPP is insignificant compared to the bypass.

The GWVPP will involve digging into the bank 6m wide and 120m long. The bank in this area is largely rock covered in grasses and few shrubs and few trees. The bank further up and down river is largely similar, so it is not a unique stretch of 120m, and only a very small percentage of the environment will be affected.

SSI Impact: Negligible

3.5 Hydromorphology

The channel at this site is hard bedrock so the scheme does not raise a concern of erosion or mobilisation of sediment within the river either in construction or operation.

Unlike most hydro-electric plants, sediment and small cobbles will pass through the GWVPP without problem as the GWVPP is simply an open channel, so there will be no effect on the morphology of the river further downstream.

Larger stones and debris carried down river at times of flood may be stopped at the weir. The weir is movable and can be periodically lowered to allow free transit of the larger material down river.

The exit from the GWVPP is at a straight part of the river, with a wide plateau of hard bedrock and banks. Additionally the exit speed of the GWVPP is designed to be a low 0.8m/s so there is no reason to expect a significant change in the pattern of erosion and movement of the river in the area compared to the GWVPP not being in place.

Hydromorphology Impact: None

3.6 Other water users

Anglers:

There is no depleted reach in the scheme so no length of the river will be affected for angling.

There is a small stretch of the river (see *section 2.4*) where the depth will be deeper than the natural depth in average flow conditions. This may improve conditions for the fish.

The GWVPP itself will take up 120m of bank on one side of the river. It would be possible to build platforms for fishing on top of the GWVPP or partially cover the tanks (some light must enter to encourage fish to pass through). However, it is likely that anglers would prefer to use an area away from the plant. Llandysul Anglers have fishing rights along 50km of banks of the Teifi so the 120m is an insignificant proportion.

We have explained in section 3.1 that fish are free to move up and down river through the GWVPP so there is no impact to the Anglers.

The fish population will benefit from aeration of water, additional food, and the improved environment of the planet which will help to preserve global migration patterns of the fish.

Additionally anglers can apply for some of the annual £30,000 community fund to run projects to further improve the environment along the rivers.

Canoeists:

The Llandysul Paddlers do not canoe past the GWVPP site so will not be affected by the weir. The owner of the Llandysul Paddlers has also said that the stretch of increased water height will not affect them negatively and may improve the canoeing at times that the river is too low to canoe at the moment. He is in support of the hydro-electric scheme.

Other Water Users Impact: Benefit

3.7 Abstraction & Impoundment Licence

The GWVPP does not abstract or impound any water – it simply rotates the river flow on the spot in the same manner that is it rotated at natural rapids further up and down river.

However, the moveable weir may be classed as an “impoundment” as it will raise the water level upstream by the amounts shown in section 2.4. However, it does not restrict the flow of the river at any time – the same flow rate through the channel occurs with the weir and GWVPP in place as would happen should the weir and GWVPP not be in place.

3.8 Weir installation

NRW Guidance Notes HGN 2 Hydropower Flow standards indicate that schemes building a new or improving an existing weir are unlikely to be licenced. This is based upon the weir interfering with the "movement of fish and sediment and altering the channel morphology". This is a valid argument for traditional hydro-electric schemes. However, for the GWVPP we have demonstrated that it will not affect the movement of fish (*section 3.1*) and will not affect the movement of sediment (*section 3.5*), so there is no reason to object to installation of the movable weir. Clearly the shape of the channel at the section of the weir is changed when the weir is raised, but the overall morphology of the stretch of river will be maintained (*section 3.5*).

3.9 Overall risk management

The risks can be monitored as the power plant is in use e.g. monitoring fish numbers passing through the vortex. Should there be any negative impact seen, the weir can be lowered, so that the profile of the river is exactly as it was before any works were started. Then results can be analysed in full and mitigation measures put in place before the plant is put online again.

4. Other Impact Analysis

4.1 Visual Impact

The plant is all contained a single location so poses an impact in one location only.

There are very few places which will have a view of the site, and those will be largely shrouded by trees and vegetation.

There is a view from the Llandysul bypass bridge, but few walkers choose to walk along a busy bypass and the impact is insignificant compared to the bypass and traffic itself.

The plant will generate as much energy annually as a 77m tall 500kW wind turbine which would be seen for tens of miles around. So the hydro project has clearly nothing like the visual impact of wind turbines.

Additionally 500kW of power would need large pylons to support the 132kV electricity cables that would be required to distribute the power, creating further visual impact for miles around. Conversely the hydro plant only produces a maximum of 200kW power which can be handled through the existing 3 phase power lines that pass nearby.

4.2 Tourism Impact

The GWVPP may increase tourism as people come to see the first (that we know of) such plant in the UK. Additionally they may wish to see how it was constructed and how that may be implemented in their own area. A small exhibition may be set up in the library giving details of this.

4.3 River navigation

The river is not considered to be navigable in the area as there are rapids nearby and many areas where a small canoe or coracle would have to be portaged. So there will be negligible impact if a coracler had to carry their coracle past the weir.

5. Water Framework Directive

This proposal has analysed the possible impacts raised by NRW and found them to be negligible to beneficial. However, despite this, Elizabeth James from NRW said, at a meeting with the community group in September 2013, that there is a blanket policy of no development in Special Areas of Conservation.

This is contrary to the EU Water Framework Directive Article 4.7 which NRW are committed to comply with.

This states that new physical modification is permitted even if it causes deterioration in status if:

1. *All practicable steps are taken to mitigate the adverse impact on the status of the body of water.*

   We have shown in section 3 that there will be no adverse impact on the status of the body of water. If any impact is noticed, the weir can be lowered to restore the river channel to its natural profile.

2. *The reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years.*

   Hydropower generation has been specifically set out in the River Basin Management Plan Western Wales River Basin District – Section 5 – Managing new physical modifications.

3. *The reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 17 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development.*

   The benefits of the project are of overriding public interest:

   Providing 100+ years energy security for the town of Llandysul.

   Providing income for the local community to support projects to further improve the environment and help the local society which is suffering from a lack of job opportunities, affordable housing and the high costs of energy.

   Setting an exemplar which can be taken up by other communities across the country to make a real impact to reduce our reliance on nuclear and fossil fuels, greatly reducing their impact on the environment. This would be a significant national and international environmental and social benefit.

4. *The beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.*

   All other methods of producing this amount of energy would have far more severe effects on the environment.

5. *Exemption for activities that prevent the future achievement of good status through restoration activities have been defined.*

   There is no need for future achievement of restoration as there has been no negative effect.

We have shown that our proposal does not cause deterioration in status, and even if it did, it would be permitted under Article 4.7.

6. Conclusion

The Gravitation Water Vortex Power Plant at Llandysul will:

1. Provide 100+ years energy security for the town of Llandysul.
2. Improve the environment by reducing pollution from fossil fuels and reducing CO_2 emissions by 380 tons per year.
3. Provide income for the local community to support projects to further improve the environment and help the local society which is suffering from a lack of job opportunities, affordable housing and the costs of energy.
4. Generate a focus for the local community to work together on a community project. Options for hydro-electric schemes have already been presented at a public meeting attended by more than 50 people who all offered positive support.
5. Create an exemplar which may be taken up by other communities across the country to make a real impact to reduce our reliance on nuclear and fossil fuels, greatly reducing their impact on the environment.

This project is being led by a small community group of volunteers to help the community and the environment. We do not have the money to spend on expensive speculative impact analyses. So we hope that the common sense analysis contained in this document is sufficient to obtain support from NRW. With that support we should be able to go out and encourage funding for the project as a whole. If there are any aspects we have not considered please do not hesitate to get in touch to discuss further.

The Gravitation Water Vortex Power Plant at Llandysul provides NRW with a unique opportunity to make a significant improvement to the national and global environment by encouraging the development of more plants which could potentially power most of the UK with no pollution and no adverse effect on the environment.

The Government has signed up to the EU requirement that 15% of all energy consumed in the UK should be from renewable sources – this includes *all* energy, including fuel and heating. In the light of the difficulties in providing significant elements of fuel and heating from renewables by 2020, the proportion of electricity supply that would have to come from renewables to balance this out would need to be raised substantially, to 30% or more. Currently the proportion is 5% so there needs to be

a radical increase in renewable energy supplies. This commitment is described in the National Renewable Energy Action Plan for the United Kingdom, July 2010 and has been made law under SI 243 – "Promotion of the Use of Energy from Renewable Sources Regulations" on 14th March 2011. This hydro project will set an example of how the target could be reached with no negative impact on other aspects of the environment.

Cutting down on the global CO_2 emission is the only way to minimise climate change. It is climate change that will have the biggest impact on the local environment of the river basins that NRW are charged with protecting. It will not take much climate change to affect water currents and food supplies in the Atlantic that migratory fish follow so no fish may return to the river Teifi. Nor will it take much climate change to affect rain fall patterns and river levels in the Teifi so that particular mosses are unable to survive.

Blocking this proposal will not help to protect the fish and mosses of the Teifi in the long term, but encouraging the UK to adopt more Gravitation Water Vortex Power Plants just might.

Llandysul a Phont Tyweli Ymlaen Cyf

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