Pat ONeill

Subject: RE: DesignPro Ltd - File ref. FS 006821

From: David Higgins [mailto:dhiggins@designproautomation.com]
Sent: 12 June 2018 10:44
To: Pat ONeill
Cc: Paul Collins; Sheila Downes (SDownes@clarecoco.ie)
Subject: RE: DesignPro Ltd - File ref. FS 006821

Hi Pat,

Please see our response to the public submissions No. 1 and No. 2 below. Response No. 3 is attached.

No. 1
DesignPro would like to thank Marine Ireland and Dr. White for their support of this foreshore application. We also believe the project can have a positive and sustainable impact on the community and industry into the future.

No.2
DesignPro would like to thank Mr. Stephens and the Limerick Clare Energy Agency for their continued support of this project.

Kind regards,

David Higgins
BUSINESS DEVELOPMENT ASSOCIATE

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Response to Submission 3

The following submission is in response to the submission received after the closing of the public review period on May 28th 2018. To start DesignPro would like to thank all parties for their submissions and will aim to respond to the best possible standard.

Submission 3

1.1

DesignPro would like to reiterate that the purpose of this foreshore application is to secure a location to test and demonstrate a 60kW hydrokinetic turbine that is currently being developed as part of a Horizon 2020 research, development and commercialisation project. If granted the foreshore area will be solely used by DesignPro to test their device and not for commercial export of electricity for use.

1.2

As stated in Section 1.2 of DesignPro's foreshore application 'the unit will be tested in order to validate the power production performance, and ability to withstand the marine environment'. The purpose of this chosen site is to allow for the extensive testing of the device and its design concept in an ideal natural environment. As we are undergoing testing it is not our aim at this location and this stage of the project to export electricity to the grid.

In reference to fish movement around the turbines, a number of studies (Broadhurst, Barr, & Orme, 2014; Copping, Grear, Jepsen, Chartrand, & Gorton, 2017; Keenan, Sparling, Williams, & Fortune, 2011) have shown that the possibility of fish becoming entrained in hydrokinetic devices is very low. This coupled with the outward rotation of the turbines and the pitch control system increases the mitigation measures taken by DesignPro for the protection of fish and marine life.

1.3

To clarify the start date of the licence is September 30th 2018.

1.4

The proposed site is to be a 12-month demonstration site only.

1.5

The proposed site is to be used for the private use of DesignPro Ltd only.

1.6

As can be seen in Attachment 3.4 and on closer view in Figure 1 below, the designated foreshore area central to this application does not preclude the island user from access to their quay or landing place.

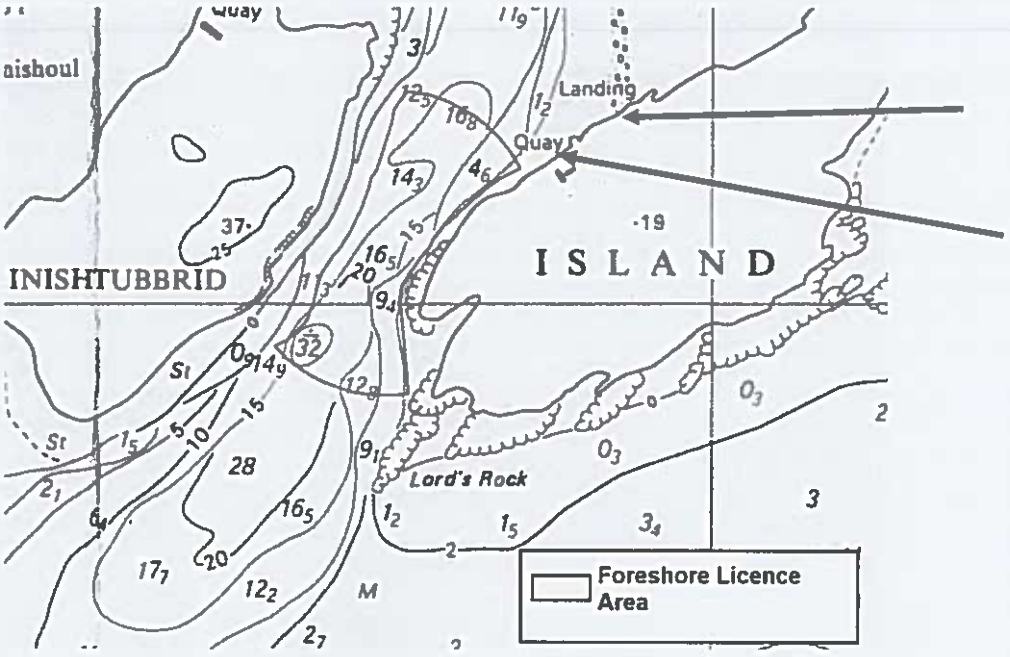

Figure 1:Propsed foreshore licence area with no overlap on quay or landing area

In the event that the proposed foreshore area does preclude the navigational access to this landing place DesignPro will be, subject to adequate health and safety training and in compliance with insurance policies, open to permitting the passage of island owners through the proposed licence area during the 12 months of its licence.

1.11

The proposed development of necessary testing infrastructure, device installation, operation and removal at this site will cost 200,000 euro.

2.4

An area of 11.47ha is required to ensure there is a safe distance between the device and other channel users during all positions and stages of its operation.

4.1

Contrary to the statement under this section as outlined under section 5.6 of the foreshore licence application form and as is also highlighted in both the EIA Screening and the Natura Impact Statement Design Pro are in fact undertaking a programme of Static Acoustic Monitoring.

Extract from Section 5.6 of the Foreshore Licence Application as submitted

A number of mitigation/best practise measures are recommended to ensure minimal impact from the test site.

Static Acoustic Monitoring (SAM) before, during and after the deployment of the device to assess the sites use by dolphins and to ensure there is no displacement. The CPOD can be deployed from the mooring system that will be in place. This is in the knowledge that based on the unique design of the device, the location outside of identified critical areas that there will be no impact on marine mammals. However, the collation of such baseline information for this location associated with a tidal energy device provides an opportunity within the Shannon Estuary to acquire critical environmental data in a

low impact scenario which is not normally possible. The CPOD was deployed on the 5th of April to commence pre deployment monitoring and will continue until such time as a decision is reached on the foreshore application.

In relation to the point raised by the submission stating there is an area specifically designated for this type of enterprise nearby which the submission indicates was raised by NPWS this is not the case. NPWS correctly raised a query in relation to the location of the test site and the applicability of one of the Areas of Opportunity arising from the SIFP for the Shannon Estuary in their pre-application consultation response. Contrary to the submission DesignPro did indeed respond and provide a satisfactory explanation in relation to the chosen location and its consistency with the SIFP for the Shannon Estuary on the 21/02/2018. This response was made by Dr. Caroline Roche of Aquafact Ltd on behalf of Design Pro and is contained in the Consultation Responses as uploaded to the Foreshore Application web-site and available for public viewing. Any further issues raised by Dr. David Lyons of NPWS in his response were addressed in the Natura Impact Statement.

4.4

A number of valuable issues and concerns were highlighted to DesignPro by the local community. Many concerns relating to the possible effect on channel navigation throughout the 12 month licence period were addressed and it was confirmed that navigation through the channel would remain possible throughout the duration of the project. Open dialogue was encouraged and it was the aim that any concerns regarding the proposed deployment could be discussed fairly and openly. As this application relates to research and developmental testing, DesignPro do not see concerns around the technological proof of concept as relevant issues in relation to the approval/non approval of this foreshore licence application as the proposed sites' sole purpose is to facilitate this type of testing.

4.5

DesignPro have engaged with adjacent island owners on a number of occasions and assured them that every effort has/will be made so that no adverse impacts occur to their property as a result of the proposed development.

5.5

DesignPro refers to the AA and EIA for assessment of Environmental Impacts of the proposed development.

5.6

The antifoul paint system to be used is provided by Jotun Paints and is of the highest certified marine standard. Please see spec sheet attached.

5.9

Please see Noise and Vibration section below for detailed noise levels of the site and device.

6.0

As stated in SFPC's consultation response Shannon Foynes Port Company have conducted a navigation assessment of the proposed site and has determined that it will NOT interfere with commercial navigation. As Attachment 3.3 (b) Preliminary Mooring Calculations shows, initial calculations have already been made regarding mooring requirements for this type of development. If granted, and

during site design, the mooring and navigation markers will be design in accordance with industry best practice under the supervision of the Local Lighthouse Authority SFPC.

Consultation Responses

PDF3 of 18

The submission refers to the letter by Dr. Caroline Roche of Aquafact to the Development Applications Unit. This letter was submitted early in the consultation process prior to the evolution of the project and the final design, therefore areas and references may differ from the final details as submitted in the application form. However, the applicant felt for the sake of completeness that all consultation information should be made available for public scrutiny. The applicant is fully aware of the distinction between the Fergus Estuary and the Shannon Estuary however at times it is necessary to use the term "Shannon Estuary" where data has been collated as part of a wider study of the Shannon Estuary. All scientific data which has been utilised in the assessment of this application has been done so in an appropriate and effective manner at the relevant scale and does not warrant reappraisal to aid the decision of this application. The term "revised" has been added to the title of the Natura Impact Statement by the Foreshore Unit in response to a minor typo which was picked up by the applicant upon submission which necessitated the reloading of the document to the website. In relation to the point raised on the location of the testing within an Area of Opportunity please see the response to 4.1 above.

PDF16 of 18

The submission indicates that there is no response to address the issues raised by Dr. David Lyons at the consultation meeting held on the 21st March 2018 and that the application documentation does not contain the proof that the testing of the device will not lead to adverse effects. Contrary to this statement all of the concerns raised by Dr. Lyons are addressed in the Natura Impact Statement which is the appropriate location for addressing these concerns and proving beyond scientific doubt that the proposed testing of the tidal energy device will not lead to significant adverse effects on any European Site as is required by the Habitats Directive.

Farming Implications

Please see response under Noise and Vibrations. The proposed licence area does not encroach on the farmland to which the submission references, the licence applies to the foreshore area only.

EIA Screening Report

2.1.1 PDF4 of 22, paragraph 5

The submission raises a question in relation to the temporary nature of the test site based on the inclusion of a line of statement in relation to proximity to the electricity grid infrastructure. The foreshore licence application is solely for, a temporary installation of a tidal test device over a maximum period of 12 months. There is no requirement for a grid connection and the source funding under which this testing is being carried out (Horizon2020) relates to this short term testing also. There is no intention by the applicant to progress with a long-term permanent full scale installation at this site.

PDF13 of 22

The submission questions the validity of the response at this point in relation to impact on listed or scenic views or protected landscapes as outlined in the County Development Plan. The Clare County Development Plan (CDP) 2017-2023 was interrogated in relation to this question and while controls are in place and contained within the CDP relating to one off housing within such areas there are no such controls or restrictions relating to the subject of this application. It is acknowledged that the islands surrounding the proposed deployment location are within a Heritage Landscape as per Map C of Volume 2 of the CDP however, any restrictions relate to the landward side and not the seaward element. In addition, given the temporary nature of the installation coupled with the overall design of the device there is no potential for either direct or in-direct impacts on listed, scenic views or protected landscapes from the proposed application.

PDF16 of 22

There will be no impact on protected structures or archaeological features as has been assessed through the application process (Please see Section 5.10 of the application form for a detailed assessment). The temporary testing over a 12-month period of such a hydrokinetic device will not negatively impact on any feature of cultural heritage located on Canon Island.

PDF7 of 22

As is outlined in the EIA Screening Report the GKinetic design is based on the use of a Hydrokinetic Turbine.

Population and Human Health:

As presented in the NIS, there is a high detail of data provided on the 25kW machine including an assessment of the possibility of impact of recorded noise levels on the surrounding environment. Studies will be carried out during the testing of the 25kW device in France which will provide DesignPro with data on noise outputs emitted from above and below the waterline of the 25kW device during operation.

These results will then be utilised in the design of the 60kW machine to ensure that all necessary measures are taken to remove the potential for noise emissions to result in harm to the marine and terrestrial environment. DesignPro can state with confidence that the gear motors to be used on the 60kW device will have the same high level of protective and sealed housing as the 25kW device and equipment used will fall well within IEC 60034-9 standards. In accordance with these standards the gear motors will emitted noise in the maximum range of 80 dB to 100 dB (Nistor, Scutaru, Câmpeanu, & Cernat, 2015). These figures represent worst case scenarios as they apply to gear motors that are fully exposed and not encased in sealed housings which will not be the case for the 60kW device. Considering DesignPro will put in place all mitigation measures possible the risk of noise impact on the human population is low as noise levels will only be slightly above ambient for a short period of time (max 12months).

Noise and sound pressure impacts on the marine environment will also remain well within recommended root-mean-square (rms) sound pressure level (SPL) of 140 dB re µPa in the 100Hz band in line with the industry best practice and standards outlined in previous studies (see figure 1 below) (Elsaesser, Coffin, Hood, & Starzmann, 2015; Halvorsen, Carlson, & Copping, 2011; Matthews, 2012).

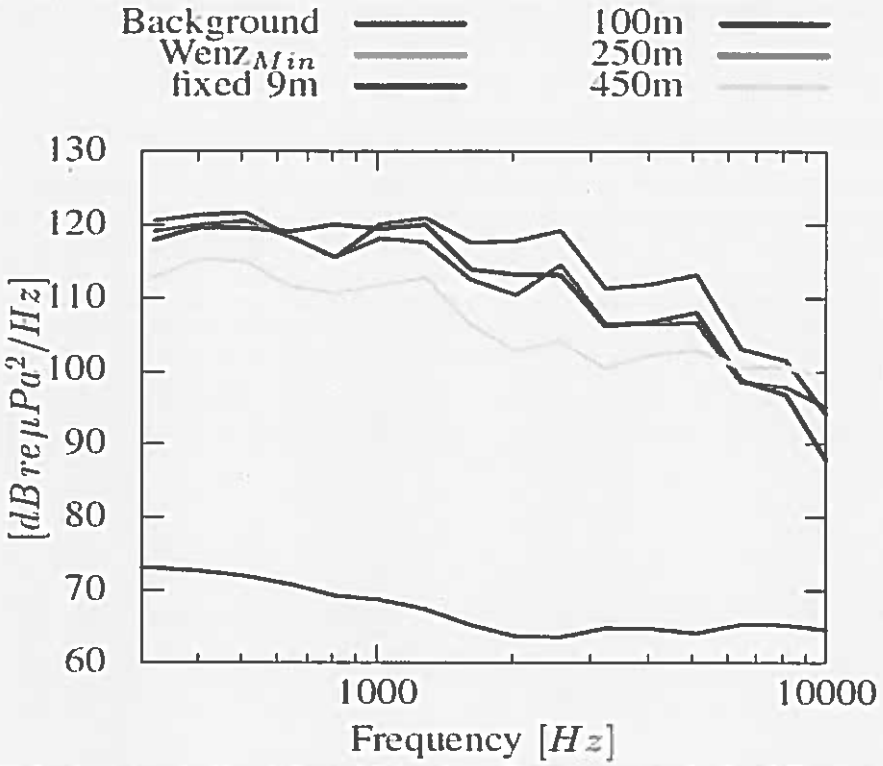

Figure 2: Third-octave spectral levels for turbine noise adjusted to a standardised distance of 1m from the source, compared to the 20-minute ambient noise sample (Elsaesser et al., 2015).

Biodiversity:

An approved anti-fouling paint system specified by "Jotun Paints" will be applied to the required standards. This is a pre-treatment to the device prior to deployment and will not lead to any negative effects on the natural environment.

Noise and Vibration:

Attention is drawn to this extract from the NIS

Noise sources during the installation works will be confined to that generated by the installation vessels. Vessel noise is a combination of tonal sounds at specific frequencies (e.g. propeller blade rotational frequency and its harmonics) and broadband noise (Vella et al., 2001). Propeller cavitation noise is the primary source of sound from underway vessels, whilst noise from propulsion machinery originates inside a vessel and reaches the water via the vessel hull. Noise from shipping is roughly related to vessel size, larger ships have larger, slower rotating propellers, which produce louder, lower frequency sounds (SMRU, 2001).

Overall, vessel noise covers a wide range of frequencies from 10Hz to 10kHz. Source levels and dominant frequencies range from 152 dB re 1 µPa@1m at 6300Hz for a 5m Zodiac with an outboard motor, through 162dB re1µPa@1m at 630Hz for a tug/barge travelling at 18km/hr, through to a large tanker with source level around 177dB re 1 µPa@1m in the 100Hz third octave band (Richardson et al., 1995). The use of bow thrusters increases broadband sound levels. There is a high level of diversity in hearing structures among fish, resulting in different auditory capabilities across species. Many fish

species hear in the range of about 30Hz to 1kHz (1000Hz); however, some investigations have demonstrated species specific hearing capabilities in the infrasonic range of less than 20Hz (Karlsen, 1992; Knudsen et al., 1997; Sand & Karlsen, 2000) and in the ultrasonic range of over 20kHz (Mann et al. 1998, 2001; Popper et al., 2004). Shipping exhibits major energy below 1,000Hz and is therefore within the frequency range of hearing of most fish species (Richardson et al., 1995; Popper et al., 2003). Fish and shellfish species may be disturbed by the noise from the maintenance vessels. Diving birds could also be affected by shipping noise causing them to become disorientated and affecting their foraging success (AECOM Ltd., 2010). Effects on surface feeding birds are likely to take the form of disturbance effects. This could cause birds to temporarily avoid the immediate area which may have implications for foraging and breeding success, stress on individuals and energy budgets. Marine mammals use acoustics to navigate, locate prey and maintain social contact and as a result they are very sensitive to anthropogenic noise. Underwater hearing sensitivity in harbour seals indicates a fairly flat frequency response between 1kHz and about 50 kHz, with hearing threshold between 60 and 85 dB re 1 µPa (Richardson et al., 1995).

Toothed whales are most sensitive to sounds above about 10 kHz and below this sensitivity deteriorates. Harbour porpoises exhibit a very wide hearing range with relatively high hearing thresholds of 92 –115 dBrms re 1 µPa below 1 kHz, good hearing with thresholds of 60 –80 dBrms re 1µPa between 1 and 8 kHz, and excellent hearing abilities with thresholds of 32 –46 dBrms re 1 µPa from 16 –140 kHz (Kastelein et al., 2002). Behavioural audiograms for the bottlenose dolphin (Johnson, 1967; Ljungblad et al., 1982; Au, 1993) indicate that hearing ranges from approximately 75Hz to 150kHz with the best sensitivity between 10kHz to 60kHz.In essence, cetaceans have the ability to detect ship noise andit may elicit a temporary avoidance behaviour for some of the more sensitive species (larger baleen whales) whereas many toothed whales appeared to be tolerant of vessel noise and are regularly observed in areas where there is heavy traffic (Thomsen et al., 2006). Disturbance of otters could also occur should maintenance works occur close to the coastal areas where they are present (AECOM Ltd., 2010).

The Shannon Estuary is one of Europe's premier deep water berths catering to shops up to 200,000 deadweight tonnage (O'Brien *et al.*, 2016). It has six main terminals and handles up to 1,000 ships carrying 12 million tons of cargo per annum. Additionally, a car and passenger ferry operates year-round between Killimor, Co. Clare and Tarbert, Co. Kerry and the estuary has two licensed dolphin-watching vessel operating between April and October. Fishing activity, most notably potting also occurs in the estuary. There are also an additional number of pleasure crafts year round. As a result, this is an area exposed to high levels of anthropogenic noise from a range of vessel activity. Noise monitoring results from the Shannon Estuary show that the estuary is a noisy place (O'Brien *et al.*, 2016). All results were broadband (5Hz to 20kHz) rms (root mean square) values. The mean noise level for the Shannon Estuary was calculated at 100 ± 7.5dB.

In addition to the noise levels in the Shannon from shipping, tidal streams targeted for exploitation by renewable energy converters are by their nature highly energetic environments often with high ambient sound levels (Marmo, 2017).

Lampreys are considered to be the most "primitive" of extant vertebrates and may represent the most primitive conditions in many aspects of their biology (Popper, 2005). While there have been some physiological studies of the vestibular response of the lamprey ear (Lowenstein & Osborne, 1964; Lowenstein *et al.*, 1968; Lowenstein, 1970), there have been no studies to determine the responses of the ear to sound or whether lampreys respond to sound behaviourally. While it might be argued that lamprey, as other vertebrates, may use the "auditory scene" to learn about their environment,

their behavioural repertoire is generally rather limited, and so it may be possible that sound is not relevant to them at all.

Although Popper (2005) report that there is no data on hearing in lamprey, their ear is relatively simple and there is nothing within the structure of the ear or associated structures to suggest any specialisations that would make them into anything but a hearing generalist, with maximum hearing to no more than several hundred Hz. Figure 5.1 shows an audiogram for a variety of fish species (Popper, 2005).

Of the species shown here, best hearing is the goldfish, followed by silver perch. The poorest hearing is in the plaice, a flatfish, a species that does not have a swim bladder. Both silver perch and goldfish are considered to be hearing "specialists" since they have adaptations that enhance the acoustic coupling between the swim bladder and inner ear. The other species do not have such enhancements and are considered to be hearing "generalists" or "non-specialists." (Data from Fay, 1988; Ramcharitar & Popper 2004; Ramcharitar *et al.*,

2004). As lamprey are also considered hearing generalists, the audiograms for these other species have been used to represent the lamprey.

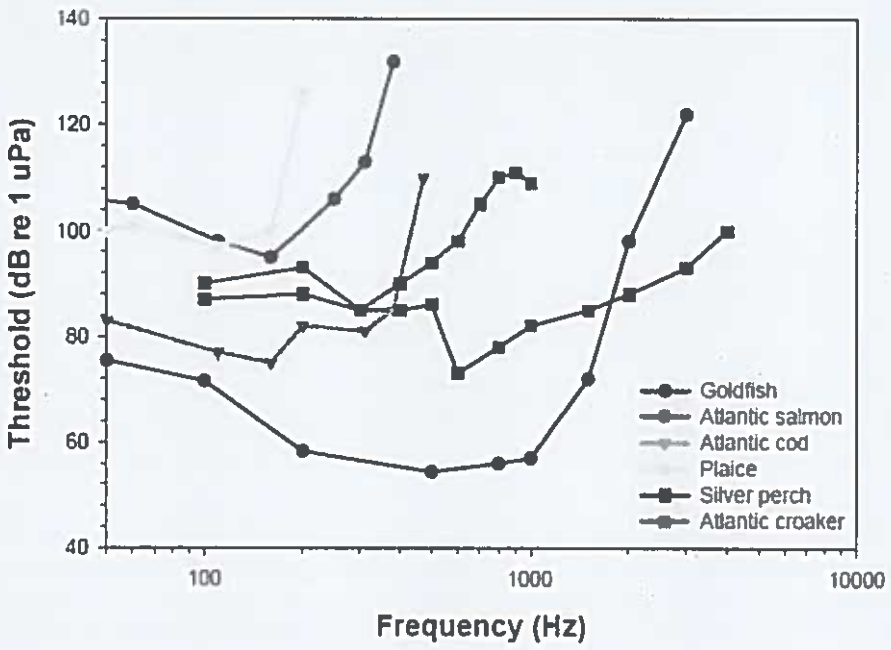

Figure 5.1: Fish species audiogram (Popper, 2005).

While no data is available on underwater noise levels from the 60kW device, airborne noise levels at 1m distance from the fully exposed motors (which are above the water line) of the 25kW device range from 33dB to 63dB with a frequencies ranging from 0.1 to 6.4 kHz (see Figure 5.2). In reality, these are worst-case noise levels as the motors on the 60kW will be fully sealed and housed. As there is no mechanical or electrical sound sources located below the waterline, the underwater noise level will be significantly lower than the airborne levels, which are significantly lower than mean background

noise levels in the Shannon. The noise levels generated by the 60kW device in the <500Hz range are below the possible audible levels of lamprey.

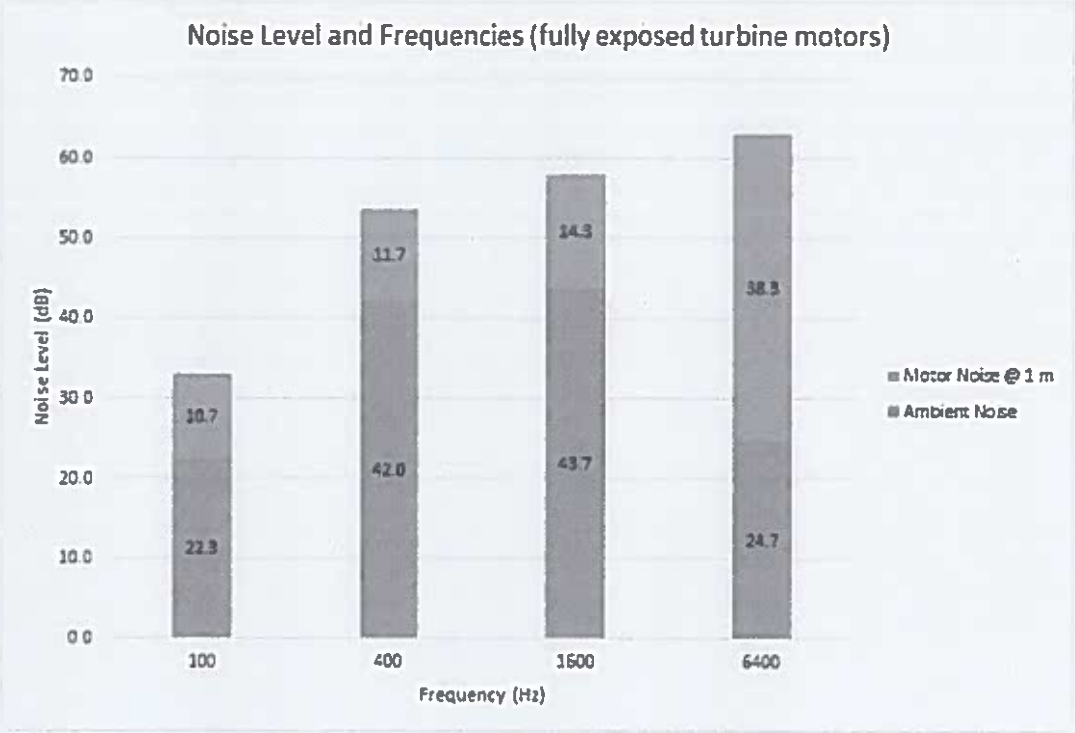

Figure 5.2: Airborne noise levels from 25kW device (fully exposed motors)

The noise levels from the installation and maintenance vessels will be similar to those generated by the existing volumes of shipping traffic in the estuary. The noise from two additional vessels will not significantly impact on lamprey in the estuary.

Noise: Likelihood = Unlikely; Consequence = Negligible; Impact = Low

Landscape

There will be no significant impacts on the landscape. Visually the device will have a very small footprint (see image below) and will not be visible from the landward side of the estuary given its proposed deployment location just west of Canon Island. Inishtubbrid Island will serve to screen the device further from view during the stage of testing. In relation to Canon Island, there is one derelict farmhouse on the island which is over 200 years old. The house on the island has not been habituated in a number of years. Given the orientation and location of the farmhouse on the island coupled with the screening which is provided through the presence of mature trees there is no potential for visual impacts arising from the temporary placement of the device within the channel between Inishturbid and Canon Island. (Please see Appendix 1 for Plates 1 & 2 and Figure 2 Location of Farmhouse with respect to tidal device). The 2013 Business and Tourism Feasibility Study on the Shannon Fergus Islands also highlighted that "*much of Canon Island is heavily overgrown with shrub and woodland and is currently very difficult to access*". This further emphasises the screening

provided to the tidal device. The location of Canon Island must be taken in the context of its location within the Shannon Estuary in terms of visual impacts within a highly industrialised environment. Canon Island is located within close proximity and visual impact of Aughinish Alumina and Foynes Port. Visually both of these industrial facilities represent a significant impact from Canon Island which far out weight any impact from such a small temporary tidal device.

In addition to above, a computer generated image of the minimal visual impact which the 60kW device will have at the proposed site can be seen below.

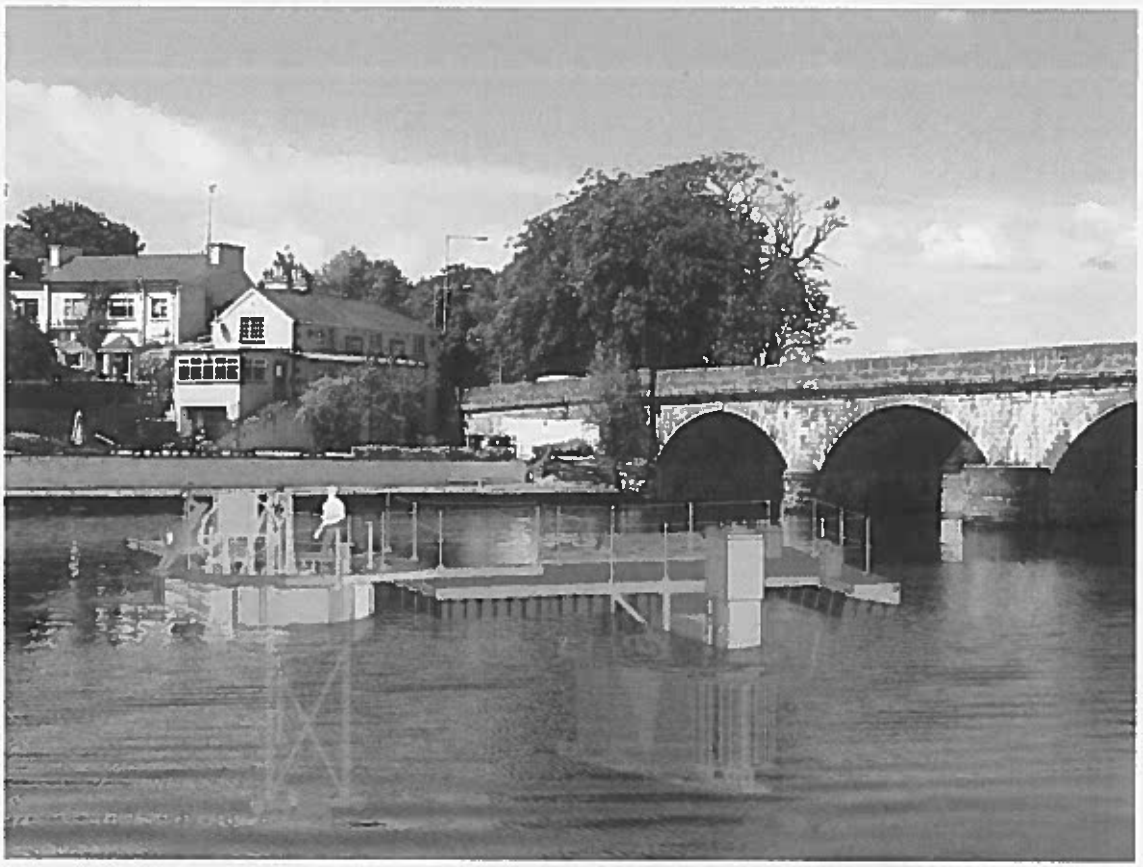

Figure 3: Visual representation of 60kW device in the water. Note the limited visible section of device above the waterline.

References

Broadhurst, M., Barr, S., & Orme, C. D. L. (2014). In-situ ecological interactions with a deployed tidal energy device; an observational pilot study. *Ocean and Coastal Management*, *99*(C), 31–38. https://doi.org/10.1016/j.ocecoaman.2014.06.008

Copping, A., Grear, M., Jepsen, R., Chartrand, C., & Gorton, A. (2017). Understanding the potential risk to marine mammals from collision with tidal turbines. *International Journal of Marine Energy*, *19*, 110–123. https://doi.org/10.1016/j.ijome.2017.07.004

Elsaesser, B., Coffin, M., Hood, J., & Starzmann, R. (2015). Field Testing a Full-Scale Tidal Turbine Part 3 : Acoustic Characteristics. *Proceedings of the 11th European Wave and Tidal Energy Conference*, (April 2016), 1–7.

Halvorsen, M. B., Carlson, T. J., & Copping, a E. (2011). Effects of Tidal Turbine Noise on Fish Hearing and Tissues (Draft Final Report). *U.S. Department of Energy*, (September).

Keenan, G., Sparling, C., Williams, H., & Fortune, F. (2011). SeaGen Environmental Monitoring Programme, (January), 1–81.

Matthews, J. (2012). Acoustic Monitoring in the Bay of Fundy.

Nistor, C. G., Scutaru, G., CâMpeanu, R., & Cernat, M. (2015). Noise and vibration monitoring for premium efficiency IE 3 Three-Phase induction motors. *Advances in Electrical and Computer Engineering*, *15*(3), 117–122. https://doi.org/10.4316/AECE.2015.03017

Jotspec

Technical specification

EPC:	DesignPro Ltd	**Name:**	Hydro power generation unit		
Cons/Eng:		**Version:**	1	**Date:**	06/12/2017
Project:	Hydro power generation unit				
Prepared by:	Carole Filar - Jotun Coatings				

Technical specification

Project	Hydro power generation unit	**Prepared by**	Carole Filar - Jotun Coatings
Customer	DesignPro Ltd		
		Date	06/12/2017

Position **Blades**

Substrate Aluminium **Area** 1 m² **No.** 1

Surface Prep. After pre-treatment of welds, sharp edges, removal of weld spatter and other surface contamination the surface shall be degreased using an alkaline detergent and cleaned by low-pressure Water Cleaning LPWC method to ISO 8501-4 Wa 1 with fresh water and then dry abrasive blast cleaned with an approved non-metallic abrasive media to create a sharp and angular surface profile. As a guide, a surface profile 25-55 microns, grade Fine G; RyS to ISO 8503 should be achieved.

Product	Type of coat	Area to paint %	Vol. solids %	Filmthickness (µm)		Recoating intervals						Thinner		Consumption (l)
						10°C		23°C		40°C				
				Dry spec.	Wet spec.	Min	Max	Min	Max	Min	Max	No.	Max %	Theor.
PENGUARD HB	FC	100	54	50	93	16 h	NR	8 h	NR	3.5 h	NR	17	0	0.09
JOTAMASTIC 90 WG	FC	100	80	100	125	6 h	14 d	2 h	7 d	*	5 d	17	0	0.13
SAFEGUARD UNIVERSAL ES	FC	100	62	75	121	18 h	8 d	10 h	7 d	6 h	7 d	17	0	0.12
SEAQUANTUM ULTRA S	FC	100	50	160	320	9 h	*	7 h	*	6 h	*	7	0	0.32
			Total	385										

Remarks

N.B. The blade system proposed is based on the a blade rotation speed equiverlent to 10Knot and as seawater temp of 10 Degrees C in salt water for 36 months.

If the system is to be used in Fresh water or alternative conditions then Jotun should be contacted and the system should be respecified

1.Theoretical Spread Rate does not allow for any wastage, this should be considered when calculating the Practical Spread Rate

2.If any of the above coatings are applied by brush and roller then multiple coats may be required in order to achieve the minimum thicknesses specified

3.For complex structures, stripe coating by brush/roller is recommended on uneven areas and those difficult to access by spray

4.One or two coats of finish maybe required dependent on colour

Technical specification

Project	Hydro power generation unit	**Prepared by**	Carole Filar - Jotun Coatings
Customer	DesignPro Ltd		
		Date	06/12/2017

Position External - under water with anti foul coating

Substrate Carbon Steel **Area** 1 m² **No.** 2

Surface Prep. Surfaces to be coated shall be degreased to ISO 12944-4, Part 6.1.4 Alkaline Cleaning, and abrasive blast cleaned to Sa 2½ (ISO 8501-1) with a minimum surface profile 75 µm, grade Fine to Medium G, Ry5 (ISO 8503-2).

Product	Type of coat	Area to paint %	Vol. solids %	Filmthickness (µm)		Recoating intervals						Thinner		Consumption (l)
						10°C		23°C		40°C				
				Dry spec.	Wet spec.	Min	Max	Min	Max	Min	Max	No.	Max %	Theor.
JOTAMASTIC 90 WG	FC	100	80	150	188	6 h	14 d	2 h	7 d	*	5 d	17	0	0.19
SAFEGUARD UNIVERSAL ES	FC	100	62	75	121	18 h	8 d	10 h	7 d	6 h	7 d	17	0	0.12
SEAQUANTUM ULTRA S	FC	100	50	110	220	9 h	*	7 h	*	6 h	*	7	0	0.22
			Total	335										

N.B. The underwater system proposed is based on the static condtions with a seawater temp of 10 Degrees C in salt water for 36 months.
If the system is to be used in Fresh water or alternative conditions then Jotun should be contacted and the system should be respecified

1.Theoretical Spread Rate does not allow for any wastage, this should be considered when calculating the Practical Spread Rate
2.If any of the above coatings are applied by brush and roller then multiple coats may be required in order to achieve the minimum thicknesses specified
3.For complex structures, stripe coating by brush/roller is recommended on uneven areas and those difficult to access by spray
4.One or two coats of finish maybe required dependent on colour

Technical specification

Project	Hydro power generation unit	**Prepared by**	Carole Filar - Jotun Coatings
Customer	DesignPro Ltd		
		Date	06/12/2017

Position	**Top sides**
Substrate	Carbon Steel **Area** 1 m² **No.** 3
Surface Prep.	Surfaces to be coated shall be degreased to ISO 12944-4, Part 6.1.4 Alkaline Cleaning, and abrasive blast cleaned to Sa 2½ (ISO 8501-1) with a minimum surface profile 75 µm, grade Fine to Medium G, Ry5 (ISO 8503-2).

Product	Type of coat	Area to paint %	Vol. solids %	Filmthickness (µm)		Recoating intervals 10°C Min	10°C Max	23°C Min	23°C Max	40°C Min	40°C Max	Thinner No.	Thinner Max %	Consumption (l) Theor.
				Dry spec.	Wet spec.									
JOTAMASTIC 90 WG	FC	100	80	150	188	6 h	3 mth	2 h	3 mth	*	2 mth	17	0	0.19
JOTAMASTIC 90 WG	FC	100	80	150	188	6 h	10 d	2 h	7 d	*	5 d	17	0	0.19
HARDTOP AX	FC	100	63	50	79	10 h	*	5 h	*	3 h	*	26	0	0.08
			Total	350										

Remarks

1.Theoretical Spread Rate does not allow for any wastage, this should be considered when calculating the Practical Spread Rate
2.If any of the above coatings are applied by brush and roller then multiple coats may be required in order to achieve the minimum thicknesses specified
3.For complex structures, stripe coating by brush/roller is recommended on uneven areas and those difficult to access by spray
4.One or two coats of finish maybe required dependent on colour

* please refer to the relevant technical datasheets and AG application guide for recoating and curing conditions